Design and development of a suitable model with supporting technologies for aiding a tourism information retrieval system

Thesis submitted to the Jadavpur University for the degree of Doctor of Philosophy in Library & Information Science

By

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Certificate

Certified that the thesis entitled ‘Design and development of a suitable model with supporting technologies for aiding a tourism information retrieval system’ submitted by me for the award of the degree of Doctor of Philosophy at Jadavpur University is based upon my work carried out under the supervision of Dr. Sunil Kumar Chatterjee, Professor, Department of Library & Information Science, Jadavpur University and that neither this thesis nor any part of it has been submitted before for any degree or diploma anywhere/elsewhere.

Countersigned by:

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Dated: Dated:

Abstract

Tourism is among those industries which are continuously expanding at fast rates. Such a huge sector will largely benefit if the amenities provided by the industry are accessible to all. Accessible tourism is an important stride towards building an egalitarian tourism industry. Complex interplays among various types of industries like transportation, hospitality, etc. can be witnessed in tourism. Thus, semantic domain knowledge organization systems can provide the means of structuring the tourism domain. Over the years, different domain models have been constructed for supporting different purposes related to tourism. Existing literature on the domain reveals that primarily there are two principal actors, namely, tourists and destination managers among the various stakeholders involved in tourism. The tourists require information about prospective destinations and related essentials for undertaking trips. On the other hand, destination managers are concerned about the opinions and requirements of the tourists. Considering these premises, two ontology based domain models have been demonstrated in this study. One is for facilitating information retrieval pertaining to accessible leisure tourism. The other demonstrates semantic organization of tourist reviews with the aim of catering to destination managers. These two models have provisions for mapping among themselves so that they can be used together in a tourism information retrieval system. A prototype model of a system for combined deployment of the domain models also has been discussed. It is envisioned that the demonstrated domain models will affect research on knowledge organization in the tourism domain.

Acknowledgement

Firstly, I express my heartfelt gratitude to my supervisor Prof. Sunil Kumar Chatterjee for his kind support and guidance. I sincerely thank all the teachers of the Department of Library & Information Science of Jadavpur University and the Documentation Research & Training Centre of Indian Statistical Institute. I express my gratitude to the members of the doctoral committees for their suggestions. I also express my gratitude to fellow research scholars and students from whom I have learnt a lot by interacting and have collected necessary inputs. My seniors and friends have always provided continuous support to me. Dr. Subhashis Das has encouraged and supported me like an elder brother and I cannot thank him enough. I thank all who are continuously striving to maintain the aura of freedom and functioning of Jadavpur University.

I do not know how much justice I have done to the help and support I have received. Still, I hope that this thesis will be a good read.

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List of Abbreviations

APA	American Psychological Association
CCO	Cataloging Cultural Objects
CEN	Comité Européen de Normalisation
CRM	Conceptual Reference Model
CSV	Comma-separated values
DUL	DOLCE+DnS Ultralite
eCHO	Cultural Heritage Objects Framework
ETCAATS	European Training Certificate Accessible for All in the Tourism Sector
GeoTIFF	Geographic Tagged Image File Format
GIS	Geographic Information System
GPS	Global Positioning System
JPEG	Joint Photographic Experts Group
KNN	K-Nearest Neighbour
LOD	Linked Open Data
NETEx	Network Timetable Exchange
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting
OSM	Open Street Map
PNG	Portable Network Graphics
POI	Point of Interest
RDF	Resource Description Framework
SHACL	Shapes Constraint Language
SIRI	Service Interface for Real Time Information
UN	United Nations
WTO	World Tourism Organization
XML	Extensible Markup Language

List of links for accessing the demonstrated ontologies

Section &Title	Link
5.2: Domain model of accessible leisure tourism	https://webprotege.stanford.edu/#projects/b6e6ff52-e5e9-4923-bf16-144ff5c0b3c5/edit/Classes
5.3: Domain model for organizing reviews	https://webprotege.stanford.edu/#projects/5801e3b3-52de-4a4e-9df3-29e7aa0665af/edit/Classes

Contents

Chapter 1: Introduction

The act of defining tourism is very complex since it requires multiple scientific approaches for comprehending its relation with the society. While explaining concepts related to tourism, the UNWTO notes that "A visitor is a traveller taking a trip to a main destination outside his/her usual environment, for less than a year, for any main purpose (business, leisure or other personal purpose) other than to be employed by a resident entity in the country or place visited. These trips taken by visitors qualify as tourism trips. Tourism refers to the activity of visitors" (UNWTO, 2010, p.10). This description clearly highlights the spatial and temporal aspects of tourism. Shaw and Williams (1994) have discussed about the relationship between recreation, leisure and tourism. Though tourism is usually considered to be a leisure activity, concepts like business tourism, medical tourism, etc. also have gained traction over time. With the evolution of different purposes for travel the act of defining tourism in a particular way is becoming more and more challenging. Tourism has evolved from being exclusively reserved for the upper class to the opening of the first travel agency in 1841 by Thomas Cook, and, is still evolving (Anderson & Westcott, 2021).

Many regions and countries rely on tourism as the main source of revenue that serves as a pillar to their national gross domestic product. The tourism domain is the hub of a lot of economic activities. The volume of business associated with tourism is comparable to that of businesses like automobiles, oil exports, etc. (https://www.unwto.org/why-tourism). The tourism domain has experienced continued expansion and diversification and has become one of the largest and fastest-growing economic sectors in the world that continues to grow (https://www.unwto.org/international-tourism-growth-continues-to-outpace-the-economy). It has grown so much that only an interdisciplinary approach can help in comprehending it. Only by making connections between different disciplines we can observe the different realities related to tourism. For example, the sociological approach can give insights on the interaction of tourism with the environment. A psychological approach can provide insights on behavior of different stakeholders of tourism. Similarly, disciplines like political sciences, geography and anthropology can provide insights based on their specialization and area of interest intersecting with the tourism domain. Duration of stay, tourists' intentions, local level planning, influence of society in shaping tourists' decisions, impact of tourists' opinions, spending by tourists etc. are important factors that are considered in tourism research.

Castells (2010) has named the present era as “the age of Informationalism”. With the increase in the ease of travel facilitated by technology different worlds are coming closer. Innovations in communication and transport have been able to compress the spatial and temporal distances according to geographer David Harvey (Harvey, 2003, p.20). Also now people are very much dependent on online sources for availing services (for example, booking transport, hotels etc.) Tourism has become a lot easier now. Due to globalization mobility of people has also increased significantly over time. To co-opt with this age some visible changes related to the tourism domain are e-versions of guidebooks supplementing hard copies, tour operators moving online, hotels and resorts investing to increase online visibility etc. To summarize, businesses are investing more to build up their online presence parallel to the increase in internet connectivity. Thus, there is a surge in data, information and knowledge handling in the tourism domain. With the increase in volume of online information, questions related to reliability are also popping up.

Tourism is a sector where information plays a vital role in decision making (Inkpen, 1998). It is crucial to accurately determine the context of a tourist’s information requirement or information seeking pattern. Tourists moving from one place to another need relevant information for enhancing their mobility. In this context, Tobler’s (1970) law which states that “Everything is related to everything else, but near things are more related than distant things” is very much relevant. It is evident that relationships are the core for understanding the interactions between different components of tourism (Merinero-Rodríguez, 2016). The concept of relatedness can be measured with sophistication using GIS technologies (Miller, 2004). Analysis of statistical data may also help in revealing specific kind of facts and relationships. But above all, a semantic organization of information in a way that the relationships between the concepts become explicit is required. Concepts and relationships can be effectively organized and expressed using knowledge organization systems (Biagetti, 2020). Knowledge organization systems like ontologies are important constituents that can help in realizing the ‘Semantic Web’. The concept of a semantic web has brought forward the idea of a web of data and information based on semantic underpinnings such that machines can interpret and manipulate it (Berners-Lee et al., 2001).

Semantic web technologies have been extensively used in the tourism domain. For example, Niemann et al. (2008) have proposed a framework based on semantic web technologies for enabling exploration of hotels. The framework models domain knowledge and integrates data from various sources. A RDF based mobile tourism application for finding tourism hotspots and venues have been developed by Palanca et al. (2009). Mahmood & Bin Abdul Salam (2013) have used semantic

web technologies in a proposed framework for building location based applications for tourism. Hendrik and Perdana (2014) have discussed the semantic web technology based design of a tourist guide application for mobiles using Android. From the abundance of such studies, it is evident that the multi-faceted, continuously expanding, economically important nature of tourism provides an interesting field for experimenting with semantic web technologies. This is also the primary motivation behind choosing this field for study.

1.1 Objectives, Research Questions & Statement of the Problem

In this thesis, knowledge organization of the tourism domain carried out using techniques from the field of Library & Information Science has been presented. The field of Library & Information Science is fundamentally concerned with organization of information (Bawden & Robinson, 2012). Many important theories stemming from the domain of Library & Information Science are relevant in dealing with the current demands of knowledge organization. Based on some of these theories, through the domain modeling presented in this thesis, the aim is to influence knowledge organization centering tourists and destination managers. The demonstrated domain models have been designed to facilitate information retrieval pertaining to accessible leisure tourism and the semantic organization of reviews by tourists. Due to the provisions for mapping within the domain models they can be used together in a tourism information retrieval system. The statement of the problem of the work presented in this thesis is as follows:

"Designing suitable domain models for touristic knowledge management using semantic web technologies"

The thesis has been organized into 6 chapters. In Chapter 2, a quantitative analysis and thorough review of existing literature on the use of semantic web technologies in the tourism domain have been presented. In Chapter 3, sources of data and information, existing standards and vocabularies that are relevant to tourism have been discussed. The objective behind Chapter 2 &3 is to study and present the research landscape surrounding the applications of semantic web technologies in the tourism domain. The corresponding research question that has driven the study is 'What are the semantic web compliant technologies, standards and methodologies that are relevant for the tourism domain?' Chapter 4 illustrates different concepts related to the tourism domain that have been encountered while going through the constituents of Chapter 3. The objective is to define the core concepts belonging to the tourism domain and their associated interrelations while delineating the scope. The research question corresponding to the objective that has driven the study is 'Who are the major actants (*see* Latour (1996, p.373)) in the

tourism domain?'Chapter 5 contains a discussion on domain models followed by discussion on two domain models (for tourists and destination managers) constructed for the purpose of this study. The research question 'What are the needs of the end users?' has stimulated the study presented in this chapter. Chapter 6 concludes the study by stating the limitations of the work and the prospective usage of the domain models in a tourism information system. The search for answers to the research question 'What are the prerequisites of touristic knowledge management systems?' has helped in organizing the content of this chapter. Each chapter contains a list of references. Also, the section titled Reference List, presents a compiled list of all the sources cited in this thesis. The references have been listed according to the APA (7th ed.) style of referencing. Appendices have been appended at the last which supplement the discussions presented in the preceding chapters.

References:

Anderson, W., & Westcott, M. (Eds.). (2021). *Introduction to tourism and hospitality in B.C* (2nd ed.). BCcampus. https://opentextbc.ca/introtourism2e/

Bawden, D., & Robinson, L. (2012). *Introduction to information science.* Neal-Schuman Publishers.

Berners-Lee, T., Hendler, J., & Lassila, O. (2001, May 17). The semantic web. *Scientific american, 284*(5), 34-43. https://www.scientificamerican.com/article/the-semantic-web/

Biagetti, M.T. (2020), Ontologies (as knowledge organization systems). In B. Hjørland, & C. Gnoli (Eds.), *ISKO Encyclopedia of Knowledge Organization.* https://www.isko.org/cyclo/ontologies

Castells, M. (2010). The new economy: informationalism, globalization, networking. In M. Castells (Ed.), *The rise of the Network Society* (pp. 77-162). https://doi.org/10.1002/9781444319514.ch2

Harvey, D. (2003). The fetish of technology: Causes and consequences. *Macalester International, 13,* Article 7. https://digitalcommons.macalester.edu/macintl/vol13/iss1/7

Hendrik, & Perdana, D. H. F. (2014). Trip guidance: A linked data based mobile tourists guide. *Advanced Science Letters, 20*(1), 75-79. https://doi.org/10.1166/asl.2014.5285

Inkpen, G. (1998). *Information technology for travel and tourism* (2nd ed.). Addison Wesley Longman.

Latour, B. (1996). On actor-network theory: A few clarifications. *Soziale Welt*, 47(4), 369-381. http://www.jstor.org/stable/40878163

Mahmood, F. M., & Bin Abdul Salam, Z. A. (2013). A conceptual framework for personalized location-based services (LBS) tourism mobile application leveraging semantic web to enhance tourism experience. *Proceedings of the 2013 3rd IEEE International Advance Computing Conference*, 287-291. https://doi.org/10.1109/IAdCC.2013.6514237

Merinero-Rodríguez, R., & Pulido-Fernández, J. I. (2016). Analysing relationships in tourism: A review. *Tourism Management*, 54, 122-135. https://doi.org/10.1016/j.tourman.2015.10.010

Miller, H. (2004). Tobler's First Law and Spatial Analysis. *Annals of the Association of American Geographers*, 94(2), 284-289. http://www.jstor.org/stable/3693985

Niemann, M., Mochol, M., & Tolksdorf, R. (2008). Enhancing hotel search with semantic web technologies. *Journal of Theoretical and Applied Electronic Commerce Research, 3*(2), 82-96. https://doi.org/10.4067/s0718-18762008000100008

Palanca, J., Aranda, G., & Fornes, A. G. (2009). Building service-based applications for the iphone using RDF: A tourismapplication. In Y. Demazeau, J. Pavón, J.M. Corchado, J. Bajo (Eds.), *Advances in Intelligent and Soft Computing: Vol. 55. 7th International Conference on Practical Applications of Agents and Multi-Agent Systems (PAAMS 2009).* Springer. https://doi.org/10.1007/978-3-642-00487-2_45https://doi.org/10.1007/978-3-642-00487-2_45

Shaw, G., & Williams, A. M. (1994). *Critical issues in tourism: A geographical perspective.* Blackwell Publishers.

Tobler, W. R. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography*, 46, 234-240. https://doi.org/10.2307/143141

UNWTO. (2010). *International Recommendations for Tourism Statistics 2008*. United Nations Publication. https://unstats.un.org/unsd/publication/seriesm/seriesm_83rev1e.pdf

Chapter 2: Literature Review

While a qualitative review demonstrates the understanding of a researcher, a quantitative study provides an overview at a macro level (Li et al., 2017). In this chapter, a quantitative analysis followed by a thorough qualitative review of existing literature on the applications of semantic web technologies in the tourism domain has been presented. A similar approach of combining quantitative methods and literature review for studying the research patterns and evolution of a domain can be seen in the study by Sharafuddin and Madhavan (2020) on blue tourism research. The methodology behind the analysis presented in this chapter has been discussed in section 2.1. The discussion on the quantitative analysis has been presented in section 2.2. And some of the studies belonging to selected themes identified from the quantitative analysis that are relevant to the scope and purpose of the thesis have been discussed in the section 2.3.

2.1 Methodology

Literature published after 2001 up to 2020 were considered for the study as the semantic web was introduced by Berners-Lee et al. (2001) in 2001. A query was formulated accordingly for searching the Scopus database. Though, Ding (2010) has suggested that the inclusion of terms denoting important semantic web technologies like OWL, OIL, DAML, RDF in the search query will increase noise, still some such terms were included in the search query due to their present popularity. Additional measure of restricting the search to areas of computer science and engineering was taken. Also, editorial materials and conference reviews were excluded from the corpus of study. The search was carried out on May 21, 2021. Manual checking of details of all the downloaded details of literature is a tedious task. Still, similar to Yu et al.'s (2019) approach documents were removed from the corpus if it was found that the words used in the search query appeared only in the Scopus assigned keywords associated with the documents. Also those studies where the abstract did not have any relationship with semantic web were excluded. Finally, 621 documents were considered for the quantitative analysis. The Bibliometrix package by Aria and Cuccurullo (2017) for R (R Core Team, 2020) was used for performing the computing and the obtained results were then analyzed. After this, literature on semantic techniques used in tourism, ontologies in tourism, methods of dealing with context, recommender systems, linked data in tourism and graph based modeling were selected based on the scope of the thesis and were reviewed.

2.2 Quantitative analysis

Quantitative methods used in scientometrics help in studying the development of science (Leydesdorff & Milojevic, 2015). Instances of application of quantitative methods for analysis are ample. For example, Ding (2010) has analyzed literature on Semantic Web using data collected from Scopus and Web of Science. Co-word analysis has been performed to study literature on Linked Data by Niknia and Mirtaheri (2015). Strategic analysis and keyword clustering have been used by Zhu et al. (2015) for studying research on ontology. Li et al. (2017) have presented an analysis of geo-ontology research with visualizations of research performance and collaborations in the domain while also analyzing the keywords, term words.

Keyword based analysis can help in identifying the trends of development in a research field (Li et al., 2017). Also keyword co-occurrence can help in visualizing emerging research topics in a field of study (Fang et al., 2017). Both the Authors' keywords and Scopus assigned keywords were considered for the presented analysis. The graph showing the growth of the Scopus assigned keywords has been presented in Figure 1. Figure 2 shows the Scopus assigned keywords' co-occurrence network where the bigger size of the nodes correspond to the top Scopus assigned keywords.

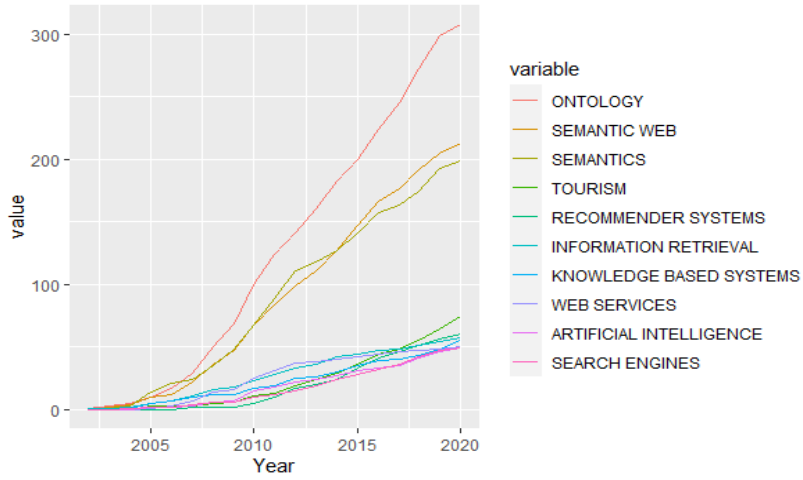

Figure 1: Graph demonstrating the growth of Scopus assigned keywords

Li et al. (2020) have proposed formulas for calculating the Popularity Index and Promising Index of entities. Within a specified period of time, the percentage of publications discussing an entity from among all publications within that time gives a measure of the Popularity Index (Li et al., 2020). Between two continuous periods the change in popularity of an entity is denoted by the Promising Index (Li et al., 2020). The formulas for calculating the value of the indices were applied for

studying the keywords during the period 2006-2020, divided into three sections viz., 2006-2010, 2011-2015 and 2016-2020. The obtained values have been presented in Table 1.The value of the indices for the period before 2006 was not calculated since significant growth in the usage of the keyword was noticed since

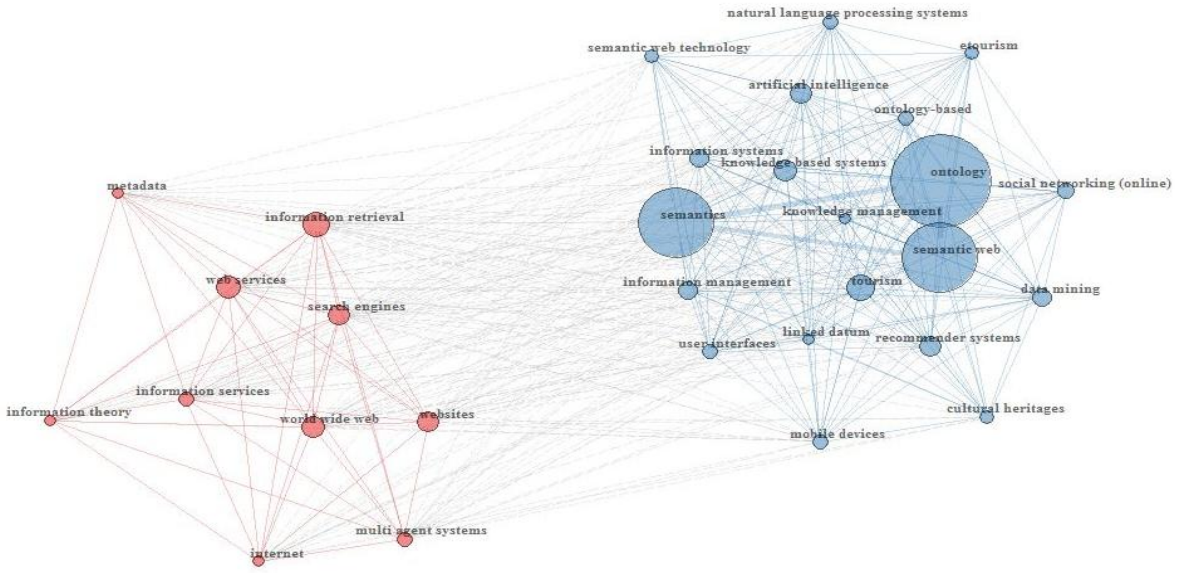

Figure 2: Network formed by Scopus assigned keywords co-occurrences

2005 onwards. Only in 2006, Linked Data came into the picture (Berners- Lee, 2006). So, the usage count of the keywords 'Linked Data' and 'Linked Open Data' in the documents was not found to be among that of the top keywords. Thus, the value of the Popularity index for Linked Data and Linked Open Data for the period 2006-2010 and consequently, the value of the Promising index for the period 2011-2015 could not be calculated. From Table 1, it can be seen that during each period

	2006-2010 (AC:143)		2011-2015 (AC: 221)			2016-2020 (AC: 229)		
Author keywords	AC	P1	AC	P1	P2	AC	P1	P2
Linked Data	Not in top 20	------	14	6.33	------	16	6.99	0.66
Linked Open Data	Not in top 20	------	6	2.71	------	12	5.24	2.53
E-tourism	10	6.99	6	2.71	-4.28	9	3.93	1.22
Scopus assigned keywords								
Ontology	90	62.94	100	45.25	-17.69	108	47.16	1.91
Semantic web	57	39.86	80	36.20	-3.66	67	29.26	-6.94
Knowledge based systems	12	83.92	18	8.14	-75.78	20	8.73	0.59

Table 1: Values of the indices of selected keywords corresponding to different periods (AC:Article count;P1:Popularity Index;P2:Promising Index)

‘Ontology’ has registered a high popularity index among the others. In 2016-2020, the value of promising index of ‘Linked Open Data’ is higher than the others followed by ‘Ontology’. A co-word analysis revealed the conceptual structure of the domain that has been obtained based on the word co-occurrences in the documents in the corpus and has been presented in Figure 3. The clusters display the pattern of word co-occurrences in the documents. The closeness of the words like ‘context’, ‘knowledge graph’ to the centre of the graph display that they are at the centre of the research domain under consideration.

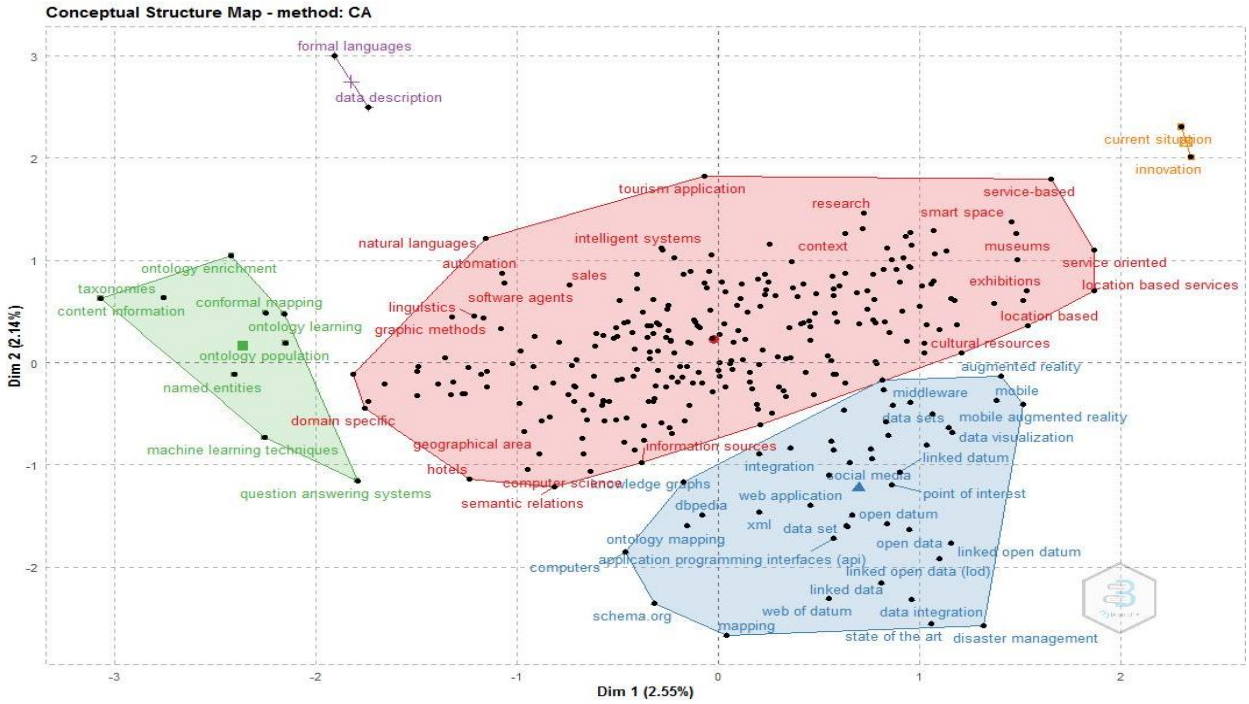

Figure 3: Conceptual structure map plotted from word co-occurrences

2.3 Review

There exist several studies that provide overview on the application of semantic web technologies in the tourism domain. Siricharoen (2008) has discussed about the probable uses of semantic web technologies in the tourism domain and about example ontologies in the e-tourism domain. Čech and Bureš (2009) have reviewed technologies related to semantic web, data mining and multi-agent technologies that are used in the e-tourism domain for the purpose of knowledge representation while discussing the drawbacks and pointing out important research areas. Eftekhari et al. (2011) have extensively reviewed the changes and developments in the tourism domain concurrent to the transition of the web from Web 1.0 to Web 3.0. Mouhim et al. (2011) have provided an extensive discussion on concepts related to semantic web and knowledge management in tourism. Ortega et al.

(2014) have discussed about tourism standards, ontologies and enterprise architectures that are important for business intelligence. Suganya and Porkodi (2018) have reviewed studies from different domains including tourism that discuss information extraction based on ontologies. Vert and Vasiu (2014) have reviewed projects that focus on Linked Open Data integration in mobile augmented reality applications in the tourism domain. Yochum et al. (2020) have presented a systematic review of studies on linked open data in location-based recommendation system in the tourism domain. In the following sections, literature related to graph based modeling, linked data, tourism recommender systems, context based modeling, ontologies and application of other semantic techniques on the tourism domain have been reviewed. These themes were selected based on the quantitative analysis and scope of the thesis.

2.3.1 Semantic techniques

Abrahams and Dai (2005) have demonstrated a mechanism for annotating web pages with RDF metadata that enables agents to carry out search and coordination activities. Becker and Bizer (2009) have discussed about DBpedia Mobile that uses GPS location and the DBpedia dataset to inform users about nearby locations using a map. Users can further explore additional information by following additional links on the map. The application has been conceived thinking of the exploration of a city by a tourist. In addition to this, the application enables publishing of reviews, pictures etc. which are further linked with nearby DBpedia resources. Cambria, E., et al. (2010) have described about a tool using artificial intelligence and semantic web techniques, named SenticNet that helps in semantic mining of opinions in expressed in natural language. Burzagli et al. (2010) have combined web 2.0 and semantic web techniques for developing architecture for information exchange. The system discussed in Blanco-Fernández et al. (2011) prepares tourist packages by capturing user preferences from the TV programs watched by the user and the activities of the user in social network. Semantic sensor data integration based on cloud computing has been demonstrated by Zhang et al. (2012). Martelli et al. (2012) have discussed the use of a semantic approach in the design of a statistical information system for supporting tourism governance, such that all involved actors can benefit. Tiwari and Kaushik (2012) have used semantic annotations attached to the location of the user for the purpose of searching related web content. The location of the user has been obtained using reverse geo-coding. Li et al.'s (2013) model aims to semantically convert user comments to ratings by using word matching. Next, the derived ratings and the ratings provided by users have been used for understanding the customers' satisfaction on the provided service. Matuszka (2013) has designed a framework that combines augmented

reality and semantic web for use in domains like tourism, navigation etc. Studies behind a prototype system for ride sharing service have been discussed by Smirnov et al. (2013). Also, algorithms for matching driver path and starting and destination points of tourists, path matching time reducing strategies have been discussed. Taking cognizance of user interest and by using semantic web technologies, Agarwal et al.'s (2013) system can combine different travel components for providing cost effective packages while also allowing route customization.

Refanidis et al. (2014) have presented an application that helps in planning tourism activities with due consideration of privacy. The application has a designated module for updating itself with new activities in the area. Panawong (2014) have demonstrated the use of a modified Naïve Bayes algorithm for classifying web pages related to Thailand tourism. Lisi and Esposito (2014a, 2014b) have discussed about the use of semantic web technologies for providing integrated tourism services in Apulia. Based on network ranking metrics developed from a network of tourist reviews, a keyword extraction method has been proposed by Becheru et al. (2015). Ikkala et al. (2015) have introduced TourRDF that extends the TourML schema. The study demonstrates the usage of TourRDF by using it on data about Suomenlinna fortress. Brasoveanu et al. (2017) have applied RDF Data Cube principles for integrating and visualizing statistical data sources and have exemplified the approach on the tourism and telecommunications domains. Jingxuan et al. (2017) have used a text clustering method using semantic similarity for analyzing satisfactions of dimensions of reviews of Chinese hotels. Khalil et al. (2017) have discussed the design of a system for providing a service of relating the products encountered by tourists to products in their own culture. For this purpose data about products and cultural attributes of tourists has been used. Ryu (2017) has presented a semantic system that helps in planning customized itineraries using Android smart phones by providing travel related information. The OnTraNetBD knowledge base by Islam (2018) relates different entities related to tourism. The knowledge base is extensible since the design contains provisions for mapping with related domain models. Holodnik and Perechuda (2019) have discussed the process of integration of the tourist points of interest and tourism services networks, and have also discussed the process of enhancement of tour planner. Rios-Alvarado et al. (2020) have proposed a process for extracting axiomatic relations from text by identifying entities, co-occurrences and patterns etc. Laddha and Jawandhiya (2020) have implemented a spelling correction module for accelerating the performance of semantic search interface to tackle misspelled words present in query. Che et al. (2021) have applied semantic network analysis on tourist comments to understand the perception of customers and have laid out important aspects.

2.3.2 Ontologies in the tourism domain

Navigli (2002) have demonstrated the construction of a 'is-a hierarchy' for a domain ontology using the WordNet hierarchy. Tryfona and Pfoser (2005) have modeled both spatial and temporal concepts in the demonstrated domain model that has been applied in the Athens Metropolitan Area for providing location-based services to tourists with mobile devices. Tomai et al. (2005) have used an user profile ontology and a tourism ontology for supporting trip planning. Choi et al. (2006) have used Activity (further classsified into Leisure Sports and Tourism Culture), Food, Accommodation and Transportation as the main classes in a travel ontology for use in a recommendation system. Schiel et al. (2007) have developed domain ontologies for tour components and used them for the discovering services and creation of trip plans. Zhao et al. (2007) have presented an ontology based image retrieval framework for the tourism domain, in which a ranking scheme has been used to rank content expressed in images. Gouveia and Cardoso (2007) have demonstrated data aggregation from various sources using ontologies. Lam and Liu (2008) have constructed a tourist information portal based on an ontology built using information from tourism websites. The tour planning system discussed by Castillo et al. (2008) uses an ontology based knowledge model for supporting its case-based module, user module and planning module. Damljanovic and Devedžic (2008) have discussed about a prototype ontology based system for e-tourism while delineating the efficacy of semantic web technologies. While experimenting on the e-tourism domain, Chifu and Letia (2008) have demonstrated the improvement of quality of ontology enrichment due to use of vector representations of newly added terms like document frequency - inverse term frequency (DF-ITF) weighting.

Lam et al. (2009) have demonstrated a system that uses ontology constructed using information from websites related to travel, global positioning system and agent technologies for providing information to tourists in a location-aware manner. The system was evaluated on novice users to test the efficacy. Boldrini et al. (2009) have labeled questions on the tourism domain in the languages Spanish and English with matching answer types using ontologies for the purpose of training question answering system. Bilbao and Herrero (2009) have presented an ontology based semantic platform where users can register and search for different tourism services. Park et al. (2009) have presented a tourist preference ontology and a tourist services ontology which have been used in a tourist information system. The study by Mínguez et al. (2009) demonstrates semantic matching between a user profile ontology and a RDF knowledge base of tourism for the purpose of selecting tourist resources corresponding to a user profile and using the selected

resources to create an optimal route. Tang and Cai (2010) have demonstrated a formal concept analysis based method for extracting concepts from unstructured text documents for construction of a tourism ontology. Tatsiopoulos and Boutsinas (2010) have proposed a system that allows tourists to share knowledge with others having similar interests. In the system, ontologies have been used to represent tourism services and user interests that have been compared using algorithms for providing suggestions.

Al-Hassan et al. (2011) have presented an ontology-based framework for e-government tourism services that would help tourists in finding preferable destinations and activities. Dumitrache and Lange (2011) have built a website of urban landmarks of historical importance with annotations for querying facility. Books on architectural landscape of touristic importance were subjected to text mining for creation of an ontology representing relevant information. The study also discusses about the relevance of Drupal7 and Semantic MediaWiki to the requirements of the project. Manna et al. (2011) have designed a system that has deployed an ontology of tourist offers that is populated with information extracted from leaflets provided by tour operators to the travel agencies. Ferrández et al. (2011) have designed the QALL-ME framework that provides an ontology-based architecture for building cross-lingual and multi-lingual question answering with due cognizance to space and time of the question. Based on the framework, an example application for events in the tourism has been discussed. An application of ontologies for semantic clustering has been demonstrated in Batet et al. (2011) by using data collected from visitors of a Natural Reserve. The study states that addition of conceptual meanings helps in better interpretation of clusters. Bordoni (2011) has proposed an outline of an information infrastructure based on an ontology of cultural objects using information from different cultural resources. Li et al. (2011) have introduced some principles for construction of ontology based travel knowledge database.

Nakatoh et al. (2012) have used a statistical method for constructing a set of tourists' behavior. An ontology construction process using resources gathered from web has been also discussed in the study. Palaniammal et al.'s (2012) semantic search model helps in retrieving information based on user's priority. A conditional probability is calculated from the model and a deployed ontology is queried for retrieving information. Cao and Nguyen (2012) have designed semantic search interfaces for a mobile travel guide application based on an ontological model representing tourists' profiles and resources. Based on the ant colony algorithm the study provides a travel itinerary planning algorithm. Ma and Zhou (2012) have also used the ant colony algorithm and have designed a web service modeling ontology for predicting consumption trend of travelers by analyzing

behavioral characteristics of travelers. The ontology can support tourism managers. Kitwatthanathawon et al. (2012) have discussed an ontology based system for extraction and knowledge base creation from tourists' hotel reviews. In addition to this the satisfaction level of tourists has been calculated using a fuzzy logic based method. Alonso et al (2012) have described an ontology based system that regularly updates the user profiles using feedbacks. The user profiles are used to query different information sources and ranked results are provided to the user. Vicient et al. (2013) have proposed a method for extraction of relevant named entities from textual resources and associating them with concepts represented in an ontology using a web-based co-occurrence analysis and linguistic support. Formica et al.'s (2013) system uses an ontology-based method for structuring services using representative concepts which are then used to match features from incoming user requests. Park (2013) has preferred task ontology based on activities of mobile users for constructing a tourist information service. The ontology represents travelers' needs and activities. Liu et al. (2013) have presented a fuzzy formal concept analysis based construction of ontology on the tourism domain that involves information analysis, conceptual clustering and mapping. Zhang et al. (2013) have designed an OWL ontology model for sensor data for dealing with tourism information collected from destinations. Lima and Moreira (2013) have presented a three tier framework for tourism information systems. The framework consists of a core layer that represents an ontological tourism model, a data layer that supports mapping of information from relational databases to RDF and an application layer that supports data integration from different data sources.

Nasingkun et al. (2014) have described the process of automatic ontology refinement using concepts induced from the users. Agarwal et al. (2014) also have constructed an e-tourism ontology that structures data integrated from reliable data sources. Prasath et al.'s (2015) proposed system retrieves document by matching user query type with document topic. An ontology has been deployed that represents topics in the tourism domain that have been identified using a document classifier. The user query type has been identified using a query classifier. Frikha et al. (2015) have developed a user interest ontology containing preferences and influences collected from social networks. The ontology has been deployed in a recommender system for the Tunisian tourism domain. Zhang et al. (2015) have proposed an automatic image annotation method using a tourism ontology. The proposal includes the use of image classification for acquiring names of scenic spots. Varfolomeyev et al. (2015) have developed a historical tourism recommendation service by employing the smart space approach of service design that uses ontological formats for representing and retrieving information. A mobile application that provides tourism information based on user preferences and

situation at the destination has been developed by Ponomarev and Parfenov (2015). The discussed application is supported by a tourism ontology and a formal model for stability. Pavkovic and Štajduhar (2015) have discussed a framework that guides the representation of data collected from different tourist services on the web using an ontology such that the different web services can be queried from a single end point.

Hu and Li (2016) have constructed an ontology based user interest model based on user's web access actions, sentiment, and demographic information. Martínez-García et al. (2016) have represented user preferences about tags using an ontology. The study provides an example application of the approach on the tourism domain. Chu et al. (2016) have proposed an ontology based tourism recommender system. The methodology involves segregating users into groups, namely, related and non-related by using association rules. In addition to collaborative filtering for incorporating time factors for dealing with both the segregated user categories, a tourism attraction ontology has been used for the unrelated users category. The approach of Kasri and Benchikha (2016) allows users to interact with the system based on their view of the domain. Ontology design patterns and relational concept analysis have been used to conceptualize the methodology. Rajapaksha et al. (2016) have devised an ontology based tour planner system. The system uses scores to map identified travelers' features with destinations' features for recommending destinations. Fang et al., (2016) have proposed a framework of tourism Linked Data that involves a metadata layer, an ontology layer, a Linked Data layer and a Data application layer. Chochiang et al's (2016) platform helps non-Thai speaking tourists in finding information on the web. An ontology on phuket tourism, a language ontology and a user profile ontology has been deployed for the platform. Frikha et al. (2017) have proposed a method for calculating trusted friends based on analysis of Facebook profile of user and have presented an ontological user model based on degree of trust and preferences of trusted friends. Akbar et al. (2017) have presented an ontological model for representing communication activities on multiple channels with uniformity. The usage of the model for the tourism industry has been discussed in the study. Data structuring using ontologies and interlinking with contextual data, exemplified using a tourism recommendation application has been presented in Gasmi et al. (2017). Nasingkun et al. (2017) have created an ontology based knowledge map by linking cultural heritage sites with aspects based on common properties. Getahun and Woldemariyam (2017) have demonstrated an approach based on statistical and neural network techniques (word2vec) for ontology learning using data from unstructured and semi structured sources.

Kularbphettong's (2018) methodology for ontology enrichment using information extracted from unstructured text of websites deploys data mining techniques and has been exemplified on the Thai tourism domain. Salaiwarkul and Khruakong (2018) have presented an hybrid approach for interpretation of queries in Thai language for retrieving information from a tourism ontology. Thai does not have space between words and thus requires special processing. Pandolfo et al. (2018) have proposed a user model ontology for describing the user interests, that could be deployed into cultural tourism applications. Salaiwarakul (2018) has presented a cultural tourism ontology that helps users to access tourism information using queries in Thai language. Virmani et al's (2018) Touringology can provide information about different kind of facilities so that tourists can make travel plans. Mili et al. (2018) have discussed the development of an e-tourism portal based on an ontological domain model. Wardhana et al. (2018) have used the semantic web rule language for construction of a tourism ontology. Mikhailov and Kashevnik (2018) have developed an ontology that coordinates a set of interacting services within a trip planning system and enhances interoperability.

The human-computer cloud discussed in Smirnov et al (2019) uses ontologies for resource discovery and composition of decision support workflow. Gunathilaka et al. (2019) have discussed a semantic feature-based approach for opinion mining that involves part-of-speech tagging and ontology. Blersch et al. (2019) have used ontologies for creation of virtual assistants and have tested them on the tourism domain among others. An emotion analysis model that utilizes a tourism domain ontology and helps in designing formulas to quantify tourists' emotions has been discussed in Pan et al. (2019). Mountasser et al. (2019) have discussed about an ontology-based centralized platform that uses different open data sources for supporting tourists in tour planning. By using DBpedia ontology as a tool for semantic annotation, Rosyiq et al. (2019) have demonstrated the process of semantic information extraction from Twitter. Ontology based tourist knowledge recommendation has been also demonstrated in Pai et al (2019) that uses a tourist knowledge structure constructed from online travel reviews. The addition of new concepts to the DWIPA ontology using the ontology enrichment methodology has been demonstrated in Kuntarto et al. (2019a&b). The architecture of the tourist guide presented in Stoyanova-Doycheva et al (2020) uses ontology network (for cultural and historical objects presented according the CCO standard) for generating the tourist routes. Tian et al. (2020) have used ontology for knowledge representation and description logic for drawing inferences between different constituents of a smart tourism system-of-systems. Doan et al. (2020) have demonstrated the construction of ontology by extracting concepts and relations from text corpus and using word sense disambiguation. Sengloiluean et al. (2020)

have demonstrated an ontology based semantic text extraction process validated through Recall, Precision and F-measure scores that has been exemplified on the tourism domain. Premananthan et al. (2020) have used Latent Dirichlet Allocation for building an ontology for visualizing relationships between keywords and model topics related to the wildlife sector. Laddha and Jawandhiya (2021) have discussed an ontology constructed for supporting information retrieval in the Indian tourism domain. Gala et al.'s (2021) work discusses about a three level architecture of an ontology representing cultural heritage knowledge for the urban tourism domain. Boudaa et al.'s (2021) mobile application DATAtourist uses a tourism ontology as knowledge source and provides personalized recommendation of tourist points of interest.

2.3.3 Dealing with context in tourism

Lam and Lee (2006) have used user location captured using GPS devices and a domain ontology on tourism for providing location-aware information service to the users while matching their interests. Paganelli et al. (2007) have combined object-oriented models with ontology-based models for improved context handling and reasoning and have demonstrated the approach on the tourism domain by integrating location-aware services with messaging services. Kanellopoulos and Kotsiantis (2007) have modeled destinations, user profiles and context using ontologies. The architecture uses the Semantic Web Rule Language for drawing contextual inferences with user profile descriptions. Viana et al. (2007; 2008) have demonstrated a system that provides service using contextual annotations to photos using an ontology that represents data from social networks. Barta et al's (2009) approach involves the usage of different ontologies for matching between user's context and tourist sites. Schenk et al. (2009) have demonstrated an infrastructure for exploring heterogeneous data which can be visualized using different contextual views. The data infrastructure is linked with WordNet, GeoNames, DBpedia etc. A human-centric approach for context modeling using ontologies has been demonstrated by Lamsfus et al. (2009). Adel and Abbdellah (2010) have demonstrated an ontology based system for discovering contextual web services with due consideration to quality. The construction of the ontology involves defining the service requirements and parameters for service quality followed by description of contextual metadata. Kim and Park (2011) have discussed about both user experience based context ontology and multiple sensor based context ontology. An augmented reality based tour application for Korea's National Palace Museum has been demonstrated.

Lamsfus et al. (2012) have discussed context focusing on the characteristics and requirements from the perspective of human mobility. The study describes a

framework that advocates the use of digital broadcasting for disseminating information to mobile devices which is then filtered using a network of ontologies for displaying to tourists. Wang et al. (2012) have constructed an ontology for modeling contextual information for use in mobile e-commerce related to tourism. Namahoot et al. (2015) have used the Naïve Bayes Model with boundary values, an ontology on Thailand tourism and a temporal ontology for building a context aware tourism recommender system for Thailand. Smirnov et al. (2016) have proposed an approach to construct a recommendation system consisting of multiple modules that coordinate using a coordination module for adapting to the tourist context. Based on existing context awareness research and context sensitive features of mobiles, Zhang et al.'s (2016) ontology based system recommends tourist attractions. Cheniki (2018) have developed a context-aware service discovery system. The system is based upon a model that describes properties of context-aware services and is enriched with instances from linked open data. Based on descriptions, matchmaking algorithms have been used to provide contextual services to users. Chantrapornchai et al. (2018) have demonstrated that image annotation using ontology improves search-ability and helps in retrieving results according to context. Wang (2018) has proposed a context-aware tour recommendation system that uses ontology for describing spatial, temporal and causality relationships. Khallouki et al. (2018) have developed a context aware mobile tourism recommendation system using a combination of Internet of Things technologies and semantic web services. A context-aware ontology-based algorithm for suggesting routes to tourists has been discussed in Barzegar et al. (2019). A drivers' experiences ontology and a tourist services ontology were deployed for the algorithm. Mikhailov et al (2020) presents an analysis of tourists' behavior using contextual information. The work demonstrates the usage of the digital pattern of life that helps in defining important components related to tourists.

2.3.4 Tourism recommender systems

García-Barriocanal and Sicilia (2008) have demonstrated the process of recommending itineraries in Alcalá de Henares by using an ontological model for cultural spaces. An ontolgy based recommendation system for Tainan City travel, that uses a fuzzy inference mechanism and ant colony optimization has been demonstrated in Lee et al. (2009). The workflow of the system involves an agent that first finds location distance and counts contextual relations and then based on tourist's requirements and a travel ontology infers contextual information. Next, a personalized tour route plotted on Google Map is found by a route recommendation agent. Choi et al. (2009) have constructed a recommendation

system that finds personalized destinations based on a Jeju travel ontology. Al-Hassan et al., (2010) have discussed an ontology based personalized e-government tourism service recommender system. User communities visiting similar place categories can be identified using the methodology demonstrated in Noulas et al. (2011). The study demonstrates the process of using place information in tourism recommender systems. Wang et al. (2011) have constructed an ontology-based knowledge base that integrates travel information from various sources. The travel behavior of the user accessing the system and other users is taken into consideration while providing recommendation service based on the Bayesian network technique. García-Crespo et al.'s (2011) recommender system uses ontologies for representing customer and hotel related concepts and characteristics. Feedback on recommendations provided by the system is used to update rules in the system.

Cardona and Garijo (2012) have discussed the process of aggregating data from different sources and using it for providing recommendation service based on social profile and context of user. Borràs et al.'s (2012) framework used in a tourism recommender system is based on the assumption that every user relates with a concept in the ontology to some degree. This leads to the calculation of a degree of confidence associated to the user. Next, spreading algorithms have been used to propagate information about the user's preferences and degree of confidence throughout the set of concepts. Kuntarto and Gunawan (2012) have discussed about the Bali tourism ontology based Dwipa search engine. Ciobanica et al. (2012) have used an ontology along with a map system for aggregating information from the web for using in a travel recommender system. Dînsoreanu et al. (2012) have used a combination of ontology-based domain model and case-based reasoning approach for designing a recommender system that has been tested in the tourism domain.

SigTur/E-Destination discussed by Moreno et al. (2013) is an ontology based system that gives consideration to motivation behind travel, demographic information, user ratings etc. for providing tourism recommendation service in Tarragona. The tourism information system designed by Smirnov et al. (2013) recommends tourist attractions based on user preferences and the situation at the location while also showing information on the attraction that has been evaluated by others. Taking cognizance of the fact that if late response is provided to tourists, the recommendation of points of interest may become redundant, Alhazbi et al. (2013a, 2013b) have designed an ontology based mobile tourism recommender system that uses user location and speed for recommending points of interest before the user reaches them. Ruotsalo et al. (2013) have devised a recommender system for contextually addressing the needs of tourists accessing cultural heritage

and have used ontologies to structure user profiles, data from sensors, content descriptions. The information system devised by Luz et al. (2013) exploits data from social networks for providing tourism related recommendation services. Shi et al. (2014) have developed an ontology based recommender system that links user's needs and context based preferences. Ferraro and Lo Re (2014) have devised an ontology based travel plan recommender system for aiding tourists by using situational information about the place. Borràs et al. (2014) have extensively examined smart e-tourism recommender systems with due consideration of factors like diversity of recommendation algorithms, functionalities of the systems. The study also shares guidelines for recommender system construction. Bahramian and Ali (2015) have proposed a tourism recommendation model that adapts user preferences using the spreading activation strategy. Al-Hassan et al. (2015) have proposed an ontology based semantic similarity measure based on relationships and attributes for evaluating semantic similarity between items. Using the semantic similarity measure and collaborative filtering approach a recommendation methodology has been proposed that has been exemplified on the Australian e-Government tourism services. Lu et al. (2015) have presented a destination recommender system based on semantic web technologies. The study aims to contribute to behavioral research in the e-tourism field. Devasanthiya et al.'s (2016) system recommends tourism options to customers. The system utilizes text mining techniques to analyze textual messages exchanged between a tourist and a travel agent and uses the results of the analysis for creating the recommendation. The findings of the study demonstrate that results retrieved by using ontological specifications have better relevancy than results yielded without using ontological specifications. Shi et al. (2016) have used semantic web and big data based techniques like structural equation method, path analysis etc. for modeling stakeholders of intangible cultural heritage tourism. Smirnov et al. (2016) recommends attractions to tourists based on their preferences, the situation at the attraction and tourists' ratings. Information about the attractions is extracted from the web sources. For building a tourism recommendation system for Thailand tourism, Namahoot et al. (2016) have used a tourism ontology for tourist attractions and a temporal ontology for important festivals. The Semantic Web Rule Language and the KNN algorithm have been deployed for retrieving information. Based on the user needs selected by the user, the system recommends appropriate destinations. Frikha et al. (2016) have calculated trust among social network friends with due consideration to temporal factors for using in the development of a tourism recommender system.

Smirnov et al.'s (2017) approach for construction of tourism recommender systems consists of multiple coupled models. Lee et al. (2017) have developed an ontology

based tourism recommendation system where the use of Fuseki server can be seen. Bahramian et al. (2017) have used the spreading activation method to provide context-aware tourism recommendations. Zhang and Sun (2018) have developed a system that provides recommendations to tourist groups and also has interactive features. Boulakbech et al. (2018) have discussed about a system that recommends tour itineraries by using data integrated from heterogeneous sources. Frikha et al. (2018) have used trusted friend's preferences extracted from social network and an ontology of user interests for developing a knowledge-based personalized recommender system. Subramaniyaswamy et al.'s (2019) ProTrip is a health-centric recommender system that can serve personalized food recommendations to travelers. Sittisaman and Panawong (2019) have discussed about a real-time tourism information recommendation system for smart phones that utilizes PHP and SPARQL for temporal and spatial ontology search. Aslam et al. (2020) have proposed an ontology based recommender system where queries can be made in natural language and answers are returned based on user demand and offer relevance. She et al. (2020) have developed a tourism recommender system that utilizes a property graph ontology that uses jaccard index for defining rules and relations between entities.

2.3.5 Linked Data in the tourism domain

Van et al. (2010) have aggregated generic information about geo-locations and specialized cultural heritage information while also using linked open data sources. Next, location aware mobile systems have been used to search the localized information. The study advocates clubbing linked open data sources with other data sources for creating better services. Cao and Tuan (2011) have discussed about a tourist information access and recommending system for the Android platform, that uses an ontology for describing travel information and supports data integration from Linked Data sources. The application also uses ontology manipulating web services for providing dynamic user interfaces that helps users in expressing queries with different complexity levels. Sabou et al. (2012) have pointed out challenges to reuse of data offered by organizations in the tourism domain and have demonstrated the use of linked data technologies for transforming the data obtained from TourMIS. Buján et al. (2012) have commented on context modeling in tourism applications while also demonstrating an approach based on publishing of open data as linked data for context modeling. LinkedQR has been discussed by Emaldi et al. (2012) for a combined usage of QR codes and linked data. Descamps-Vila et al. (2012) have created an ontology for representing user preferences, habits, POIs etc. and also aligned it with the Linked Geo Data ontology. The ontology serves a mobile application that recommends personalized

routes to users. Lapi et al. (2012) have discussed important constituents that are necessary for building a linked open data platform for storing and cataloging datasets. The use of the platform has been exemplified by demonstrating tour guide that consumes the published open data. Buján et al. (2013) have presented an approach for modeling context data that is based on publishing of data from Open data repository as Linked Data. Ou et al. (2013) have designed a linked data based framework for disaster management and have also demonstrated the application of this framework by discussing a disaster alert system for tourists. Sabou (2013) have exposed the tourism statistics data of Europe contained in TourMIS in a Linked Open data format. Keller et al. (2014) have devised a mobile application that uses contextual information about the user and tourism information sources for supporting tourists. Toma et al. (2014) have discussed the relevance of several Linked Data technologies to their work that focuses on annotation of tourism service providers in Innsbruck and its surroundings for greater visibility. Makiyama et al. (2014) have also used linked data to provide tourism service. The study notes the use of social experiments for evaluating the provided service. Fensel et al. (2015) have introduced TourPack, a linked data based system for providing information on tourist services by integrating from multiple sources. The study also proposes to make the service packages available for booking. Nguyen et al. (2015) have followed a Linked Data based approach for building a mobile application for aiding the tourists in rural settings. Cabrera Rivera et al.'s (2015) methodology for constructing a Linked Data based recommender system takes cognizance of user preferences and opinions. Lo Bue and Machì (2015) have demonstrated a methodology for data integration using SPARQL queries and SPIN rules. The study has discussed an application of the methodology on the tourism domain whereby integration, interlinking, enrichment and publication of data as Linked Open Data has been demonstrated. Fermoso et al. (2015) have discussed about a collaborative knowledge base that has been developed using open data of a regional government enriched using the Linked open data cloud. The system also allows knowledge collaboration by different tourism related user profiles. Sabou et al. (2016) have followed a Linked Data based approach for integrating data from Eurostat, World Bank, TourMIS and have thus discussed the suitability of Linked Data technologies in data integration. Wakahara et al.'s (2016) study describes converting of tourism data into RDF format and storing it in a Linked open data database for developing a local community system for tourism. Klein et al. (2016) have discussed experiences from the LOD project 'Fusepool P3' that is concerned with development of tourism related applications and software components for publishing legacy data in the linked data format.

Liu et al. (2017) have used a linked data method for studying Chinese tourists' behavior in Switzerland. The discussion surrounds profiles of Chinese travelers', keywords trends, etc. A semantic search engine based on linked data technologies for providing information to tourists and other stakeholders of tourism has been proposed. Nahari et al. (2017) have reviewed the measures for quality assessment of data and have presented a linked data fusion and quality assessment framework. Mekhabunchakij (2017) have presented a Linked Open Data modeling approach with example application on the domain of Thailand tourism. The discussion surrounds mapping between relational data and Linked Data, visualization of key tourism indicators and other Linked Open Data modeling related steps. Mihindukulasooriya et. al. (2018) have demonstrated the process of publishing statistical data of Srilankan tourism as 5-star linked open data by using the W3C RDF Data Cube vocabulary. Cheniki et al. (2019) have proposed a trip recommendation method involving linked open data. Dimitrakis et al. (2020) have presented a survey of works on question answering systems that have been applied in RDF or Linked Data or a combination of these. Yang and Chen (2020) have developed a tourism recommendation platform based on linked open data.

2.3.6 Graph based modeling and visualizations

Ling et al. (2007) have presented an ontology modeling tool that enables building of ontologies in a graphical mode. The use of the tool has been exemplified by demonstrating the construction of an ontology on the tourism domain. For tourism information, Nakatoh et al. (2011) have proposed an approach that uses WordNet for visualization of a document group as a conceptual graph thereby revealing trends and other features. Paramonov et al. (2016) have discussed about the generation of graphs using linked key phrases that have been automatically extracted from text. The demonstrated approach for key phrase extraction involves a combination of key phrase extraction algorithm and thesaurus-based procedure for better results. Lu et al. (2016) have constructed knowledge graph based on user profiling and using existing knowledge graphs like Geonames, DBpedia etc. Lu et al. (2017) have observed the comparative performance of knowledge graph and folksonomy and have designed a framework for assessment of users' affinity. Lully et al. (2018) have utilized knowledge graphs for providing content based explanations. The study discusses the problem of explaining recommendations using unstructured textual data and the described approach that has been exemplified on the tourism domain utilizes resources like DBpedia, schema.org and YAGO. Kärle (2018) have shown the process of developing a knowledge graph from Tyrolean tourism data which involves mapping data sources to schema.org. Alonso-Maturana et al. (2018) have discussed about a tourism

knowledge graph based upon existing vocabularies and ontologies like FRBR, Geonames, Harmonise, OnTour, Rout and rNews. The semantic enhancement of event data by linking with the DBpedia and Geonames has been discussed in Lo Bue (2019). Using Schema.org vocabulary the resulting RDF knowledge graph was exposed in the web and was also made accessible for providing an event searching service through an instant messaging application. Zhang et al. (2020) have presented a tourism knowledge graph using knowledge from encyclopedia and web pages.

References:

Abrahams, B., & Dai, W. (2005). Architecture for automated annotation and ontology based querying of Semantic Web Resources. *The 2005 IEEE/WIC/ACM International Conference on Web Intelligence (WI'05)*, 413-417. https://doi.org/10.1109/wi.2005.34

Adel, A., & Abbdellah, B. (2010). CxQWS: Context-aware quality semantic web service. *2010 International Conference on Machine and Web Intelligence, ICMWI 2010 - Proceedings,* 69-76. https://doi.org/10.1109/ICMWI.2010.5648032

Agarwal, J., Goudar, R. H., Sharma, N., Kumar, P., Parshav, V., Sharma, R., & Rao, S. (2013). Cost effective dynamic packaging systems in E-tourism using semantic web. *Proceedings of the 2013 InternationalConference on Advances in Computing, Communications and Informatics (ICACCI 2013),* 1196-1200. https://doi.org/10.1109/ICACCI.2013.6637347

Agarwal, J., Sharma, N., Kumar, P., Parshav, V., Srivastava, A., Rathore, R., & Goudar, R. H. (2014). Semantic search in E-tourism services: Making data compilation easier. *Proceedings of the Second International Conference on Soft Computing for Problem Solving (SocProS 2012),* 811-820. https://doi.org/10.1007/978-81-322-1602-5_86

Akbar, Z., Fensel, A., & Fensel, D. (2017). An ontology-based coordination and integration of multi-channel onlinecommunication. *International Journal of Metadata, Semantics and Ontologies, 12*(4), 219-231. https://doi.org/10.1504/IJMSO.2017.093646

Al-hassan M., Lu H., & Lu J. (2011). Personalized e-Government Services: Tourism Recommender System Framework. In Filipe J., & Cordeiro J. (Eds.), *Lecture notes in business information processing: Vol. 75. Web Information Systems and Technologies* (pp. 173-187). Springer. https://doi.org/10.1007/978-3-642-22810-0_13

Al-Hassan, M., Lu, H., & Lu, J. (2010). A framework for delivering personalized e-government tourism services. *Proceedings of the 6th International Conference on Web Information Systems and Technology (WEBIST 2010),* 263-270. https://doi.org/10.5220/0002803802630270

Al-Hassan, M., Lu, H., & Lu, J. (2015). A semantic enhanced hybrid recommendation approach: A case study of e-government tourism service recommendation system. *Decision Support Systems, 72*, 97-109. https://doi.org/10.1016/j.dss.2015.02.001

Alhazbi, S., Lotfi, L., Ali, R., & Suwailih, R. (2013a). *An ontology-based context-aware mobile system for on-the-move tourists.* In M. J. O'Grady, H. Vahdat-Nejad, K.-H. Wolf, M. Dragone, J. Ye, C. Röcker, G. O'Hare (Eds.), *Communications in Computer and Information Science: Vol. 413. Evolving Ambient Intelligence* (pp. 252-256). Springer. https://doi.org/10.1007/978-3-319-04406-4_25

Alhazbi, S., Lotfi, L., Ali, R., & Suwailih, R. (2013b). Ontology-based model in tourism context-aware systems. *International Conference on ICT Convergence (ICTC)*, 775-779. https://doi.org/10.1109/ICTC.2013.6675476

Alonso, K., Zorrilla, M., Iñan, H., Palau, M., Confalonieri, R., Vázquez-Salceda, J., Calle, J., Castro, E. (2012). Ontology-based tourism for all recommender and information retrieval system for interactive community displays. *2012 8th International Conference on Information Science and Digital Content Technology (ICIDT 2012),3,* 650-655.

Alonso-Maturana, R., Alvarado-Cortes, E., López-Sola, S., Martínez-Losa, M. O., & Hermoso-González, P. (2018). La riojaturismo: The construction and exploitation of a queryable tourism knowledge graph. In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.), *Lecture Notes in Computer Science: Vol. 11153.* Springer. https://doi.org/10.1007/978-3-030-03056-8_20

Aria, M., Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*. *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Aslam, T., Latif, M., Sehar, P., Shaheen, H., Kousar, T., & Nazir, N. (2020). *Ontological approach to analyze Traveler'sinterest towards adventures club.* In A. Khanna, D. Gupta, S. Bhattacharyya, V. Snasel, J. Platos, A. Hassanien (Eds.), *Advances in Intelligent Systems and Computing: Vol. 1087. International Conference on Innovative Computing and Communications* (pp. 147-159). Springer. https://doi.org/10.1007/978-981-15-1286-5_13

Bahramian, Z., Abbaspour, R. A., & Claramunt, C. (2017). A context-aware tourism recommender system based on a spreading activation method. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives, 42*-4/W4, 333-339. https://doi.org/10.5194/isprs-archives-XLII-4-W4-333-2017

Bahramian, Z., & Ali Abbaspoura, R. (2015). An ontology-based tourism recommender system based on spreading activation model. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives, 40*-1/W5. 83-90. https://doi.org/10.5194/isprsarchives-XL-1-W5-83-2015

Barta, R., Feilmayr, C., Pröll, B., Grün, C., & Werthner, H. (2009). Covering the semantic space of tourism: An approach based on modularized ontologies. *ACM International Conference Proceeding Series*, 1-8, Article 1. https://doi.org/10.1145/1552262.1552263

Barzegar, M., Sadeghi-Niaraki, A., Shakeri, M., & Choi, S.-M. (2019). A context-aware route finding algorithm for self-driving tourists using ontology. *Electronics, 8*(7), Article 808. https://doi.org/10.3390/electronics8070808

Batet, M., Valls, A., & Gibert, K. (2011). Semantic clustering based on ontologies: An application to the study of visitors in a natural reserve. *Proceedings of the 3rd International Conference on Agents and Artificial Intelligence*, 283-289. https://upcommons.upc.edu/handle/2117/18478

Becheru, A., Buşe, F., Colhon, M., & Bădicə, C. (2015). Tourist review analytics using complex networks. Proceedings of the 7th Balkan Conference on Informatics Conference, Article 25. https://doi.org/10.1145/2801081.2801088

Becker, C., & Bizer, C. (2009). Exploring the geospatial semantic web with DBpedia mobile. *Journal of Web Semantics, 7*(4), 278-286. https://doi.org/10.1016/j.websem.2009.09.004

Berners-Lee, T. (2006, July 27). Linked data-design issues. World Wide Web Consortium (W3C). https://www.w3.org/DesignIssues/LinkedData.html

Berners-Lee, T., Hendler, J., Lassila, O., (2001, May 17). The Semantic Web. *Scientific american*. 284(5), 34-43. https://www.scientificamerican.com/article/the-semantic-web/

Bilbao, S., & Herrero, J. (2009). Semantic platform for the composition of tourism products and services. *SMAP'09 - 4th International Workshop on Semantic Media Adaptation and Personalization*, 111-114. https://doi.org/10.1109/SMAP.2009.14

Blanco-Fernández, Y., López-Nores, M., Pazos-Arias, J. J., García-Duque, J., & Martín-Vicente, M. I. (2011). TripFromTV+:Targeting personalized tourism to interactive digital TV viewers by social networking and semantic reasoning. *IEEE Transactions on Consumer Electronics, 57*(2), 953-961. https://doi.org/10.1109/TCE.2011.5955245

Blersch, M., Weigelt, S., Tichy, W. F., & Angele, K. (2019). Automatic generation of virtual assistants from databases using active ontologies. *Proceedings of the International Conference on Software Engineering and Knowledge Engineering*. https://doi.org/10.18293/SEKE2019-077

Boldrini, E., Ferrández, S., Izquierdo, R., Tomás, D., & Vicedo, J. L. (2009). *A parallel corpus labeled using open andrestricted domain ontologies.* In A. Gelbukh (Eds.), *Lecture Notes in Computer Science, Vol. 5449. Computational Linguistics and Intelligent Text Processing* (pp. 346-356). Springer. https://doi.org/10.1007/978-3-642-00382-0_28

Bordoni, L. (2011). Technologies to support cultural tourism for latin latium. *Journal of Hospitality and Tourism Technology, 2*(2), 96-104. https://doi.org/10.1108/17579881111154218

Borràs, J., Moreno, A., & Valls, A. (2014). Intelligent tourism recommender systems: A survey. *Expert Systems with Applications, 41*(16), 7370-7389. https://doi.org/10.1016/j.eswa.2014.06.007

Borràs, J., Valls, A., Moreno, A., Isern, D. (2012). Ontology-based management of uncertain preferences in user profiles. In S. Greco, B. Bouchon-Meunier, G. Coletti, M. Fedrizzi, B. Matarazzo, R.R. Yager (Eds.), *Communications in Computer and Information Science, Vol. 298. Advances in Computational Intelligence* (pp. 127-136). Springer. https://doi.org/10.1007/978-3-642-31715-6_15

Boulakbech, M., Cheniki, N., Messai, N., Sam, Y., & Devogele, T. (2018). Linked data graphs for semantic data integration in the CART system. https://doi.org/10.1007/978-3-030-03056-8_21. In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.), *Lecture Notes in Computer Science, Vol. 11153. Current Trends in Web Engineering* (pp. 221-226). Springer. https://doi.org/10.1007/978-3-030-03056-8_21

Boudaa, B., Figuir, D., Hammoudi, S., & Benslimane, S. M. (2021). DATAtourist: A constraint-based recommender system using datatourisme ontology. International Journal of Decision Support System Technology, 13(2), 62-84. https://doi.org/10.4018/IJDSST.2021040104

Braşoveanu, A. M. P., Sabou, M., Scharl, A., Hubmann-Haidvogel, A., & Fischl, D. (2017). Visualizing statistical linked knowledge for decision support. *Semantic Web, 8*(1), 113-137. https://doi.org/10.3233/SW-160225

Buján, D., Martín, D., Torices, O., & Uriarte, A. (2012). New approaches in context modelling for tourism applications. In J. Bravo, D. López-de-Ipiña, F. Moya (Eds.), *Lecture Notes in Computer Science, Vol. 7656. Ubiquitous Computing and Ambient Intelligence* (pp. 379-386). Springer. https://doi.org/10.1007/978-3-642-35377-2_53

Buján, D., Martín, D., Torices, O., López-de-Ipiña, D., Lamsfus, C., Abaitua, J., & Alzua-Sorzabal, A. (2013). Context management platform for tourism applications. *Sensors, 13*(7), 8060-8078. https://doi.org/10.3390/s130708060

Burzagli, L., Como, A., & Gabbanini, F. (2010). Towards the convergence of web 2.0 and semantic web for E-inclusion. In K. Miesenberger, J. Klaus, W. Zagler, A. Karshmer (Eds.), *Lecture Notes in Computer Science, Vol. 6179. Computers Helping People with Special Needs* (pp. 343-350). Springer. https://doi.org/10.1007/978-3-642-14097-6_55

Cabrera Rivera L., Vilches-Blázquez L.M., Torres-Ruiz M., Moreno Ibarra M.A. (2015). Semantic Recommender System for Touristic Context Based on Linked Data. In V. Popovich, C. Claramunt, M. Schrenk, K. Korolenko, J. Gensel (Eds.), *Lecture Notes in Geoinformation and Cartography*. Information Fusion and Geographic Information

Systems (IF&GIS' 2015) (pp. 77-89). Springer. https://doi.org/10.1007/978-3-319-16667-4_5

Cambria, E., Speer, R., Havasi, C., & Hussain, A. (2010). SenticNet: A publicly available semantic resource for opinion mining. *Commonsense Knowledge: Papers from the AAAI Fall Symposium (FS-10-02)*, 14-18. https://www.aaai.org/ocs/index.php/FSS/FSS10/paper/viewFile/2216/2617

Cao, T., & Nguyen, Q. (2012). Semantic approach to travel information search and itinerary recommendation. *International Journal of Web Information Systems, 8*(3), 256-277. https://doi.org/10.1108/17440081211258169

Cao, T., & Tuan, N. (2011). Improving travel information access with semantic search application on mobile environment. *Proceedings of the 9th International Conference on Advances in Mobile Computing and Multimedia*, 95-102. https://doi.org/10.1145/2095697.2095716

Cardona, G. P., & Garijo, M. (2012). A conceptual architecture for semantic mash up recommender framework. *8th International Conference on Signal Image Technology and Internet Based Systems,* 1002-1009. https://doi.org/10.1109/SITIS.2012.148

Castillo, L., Armengol, E., Onaindía, E., Sebastiá, L., González-Boticario, J., Rodríguez, A., Fernández, S., Arias, J. D., & Borrajo, D. (2008). Samap:An user-oriented adaptive system for planning tourist visits. *Expert Systems with Applications, 34*(2), 1318-1332. https://doi.org/10.1016/j.eswa.2006.12.029

Čech, P., & Bureš, V. (2009). Advanced technologies in e-tourism. *Proceedings of the 9th WSEAS International Conference on Applied Computer Science*, 85-92.http://www.wseas.us/e-library/conferences/2009/genova/ACS/ACS-12.pdf

Chantrapornchai, C., Bunlaw, N., & Choksuchat, C. (2018). Semantic image search: Case study for western region tourism in thailand. *Journal of Information Processing Systems, 14*(5), 1195-1214. https://doi.org/10.3745/JIPS.04.0088

Che, S., Nan, D., Kamphuis, P., Jin, X., & Kim, J. H. (2021). A Cluster Analysis of Lotte Young Plaza Using Semantic Network Analysis Method. *15th International Conference on Ubiquitous Information Management and Communication (IMCOM)*, 1-6. IEEE. https://doi.org/10.1109/IMCOM51814.2021.9377390.

Cheniki, N., Boulakbech, M., Labbaci, H., Messai, N., Sam, Y., & Devogele, T. (2019). A linked open data based approachfor trip recommendation. *Proceedings - 2019 IEEE 28th International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE)*, 192-195. IEEE. https://doi.org/10.1109/WETICE.2019.00048

Cheniki, N., Sam, Y., Messai, N., & Belkhir, A. (2018). Context-aware and linked open data based service discovery. In T. Mikkonen, R. Klamma, J. Hernández, (Eds.), *Lecture Notes*

in Computer Science: Vol. 10845. Web Engineering (pp. 448-462). Springer. https://doi.org/10.1007/978-3-319-91662-0_36

Chifu, E. S., & Leţia, I. A. (2008). Text-based ontology enrichment using hierarchical self-organizing maps. *Proceedings of the First International Conference on Nature Inspired Reasoning for the Semantic Web, 419,* 36-50. https://dl.acm.org/doi/10.5555/2889615.2889619

Chochiang, K., Hanna, F., Betbeder, M., & Lapayre, J. (2016). A new web-services based platform for semantic transliterated words searching to facilitate tourist strips in thailand. *Proceedings of the 2016 IEEE 20th International Conference on Computer Supported Cooperative Work in Design,* 310-315. https://doi.org/10.1109/CSCWD.2016.7566006

Choi, C., Cho, M., Choi, J., Hwang, M., Park, J., & Kim, P. (2009). Travel ontology for intelligent recommendation system. *Proceedings - 2009 3rd Asia International Conference on Modelling and Simulation,* 637-642. https://doi.org/10.1109/AMS.2009.75

Choi, C., Cho, M., Kang, E.-y., & Kim, P. (2006). Travel ontology for recommendation system based on semantic web. *8th International Conference Advanced Communication Technology, ICACT 2006 –Proceedings,* 624-627. https://doi.org/10.1109/ICACT.2006.206046.

Chu, Y., Wang, H., Zheng, L., Wang, Z., & Tan, K.-L. (2016). *TRSO: A tourism recommender system based on ontology.* In F. Lehner, N. Fteimi (Eds.), *Lecture Notes in Computer Science, Vol. 9983. Knowledge Science, Engineering and Management* (pp. 567-579). Springer. https://doi.org/10.1007/978-3-319-47650-6_45

Ciobanica, C., Tudic, F., & Slavescu, R. R. (2012). Designing an information gathering application for a personalized travel recommender system. *Proceedings of the 2012 IEEE/WIC/ACM International Conference onWeb Intelligence and Intelligent Agent Technology Workshops,* 102-106. https://doi.org/10.1109/WI-IAT.2012.101

Damljanović, D., & Devedžić, V. (2009). Applying semantic web to E-tourism. In Z. Ma, & H. Wang (Eds.), *The semantic web for knowledge and data management: Technologies and practices* (pp. 243-265). IGI Global. https://doi.org/10.4018/978-1-60566-028-8.ch010

Descamps-Vila, L., Conesa, J., & Péarro, A. (2012). Itiner@: Ontology for personalizing tourist routes in mobile devices. *Proceedings of the 2012 4th International Conference on Intelligent Networking and Collaborative Systems,* 420-427. https://doi.org/10.1109/iNCoS.2012.47

Devasanthiya, C., Vigneshwari, S., & Vivek, J. (2016). An enhanced tourism recommendation system with relevancy feedback mechanism and ontological specifications. In L. Suresh & B. Panigrahi (Eds.) *Advances in Intelligent Systems and Computing: Vol. 398. Proceedings of the International Conference on Soft Computing Systems* (pp. 281-289). Springer. https://doi.org/10.1007/978-81-322-2674-1_28

Dimitrakis, E., Sgontzos, K., & Tzitzikas, Y. (2020). A survey on question answering systems over linked data and documents. *Journal of Intelligent Information Systems, 55*(2), 233-259. https://doi.org/10.1007/s10844-019-00584-7

Ding, Y. (2010). Semantic Web: Who is who in the field — a bibliometric analysis. *Journal of Information Science,* 36(3), 335–356. https://doi.org/10.1177/0165551510365295

Dînşoreanu, M., Dobrin, M., Florea, M., & Fodor, A. (2012). An integrated case-based reasoning and ontology-drivenapproach for designing recommendation systems. *Proceedings - 2012 IEEE 8th International Conference on Intelligent Computer Communication and Processing,* 301-304. https://doi.org/10.1109/ICCP.2012.6356203

Doan, P. H., Arch-Int, N., & Arch-Int, S. (2020). A semantic framework for extracting taxonomic relations from text corpus. *International Arab Journal of Information Technology, 17*(3), 325-337. https://doi.org/10.34028/iajit/17/3/6

Dumitrache, A., & Lange, C. (2011). Baudenkmalnetz - creating a semantically annotated web resource of historicalbuildings. *CEUR Workshop Proceedings, 721,* 30-41. http://ceur-ws.org/Vol-721/paper-04.pdf

Eftekhari, M. H., Barzegar, Z., & Isaai, M. T. (2011). Web 1.0 to web 3.0 evolution: Reviewing the impacts on tourism development and opportunities In F.V. Cipolla Ficarra, C. de Castro Lozano, E. Nicol, A. Kratky, M. Cipolla-Ficarra (Eds.), *Lecture Notes in Computer Science, Vol. 6529.* Springer. https://doi.org/10.1007/978-3-642-18348-5_17

Emaldi, M., Lázaro, J., Laiseca, X., & López-De-Ipiña, D. (2012). LinkedQR: Improving tourism experience through linked data and QR codes. In J. Bravo, D. López-de-Ipiña, F. Moya (Eds.), *Lecture Notes in Computer Science: Vol. 7656. Ubiquitous Computing and Ambient Intelligence* (pp. 371-378). Springer. https://doi.org/10.1007/978-3-642-35377-2_52

Fang, Y., Jiaming, Z., Yaohui, L., & Mei, G. (2016). Semantic description and link construction of smart tourism linked databased on big data. *Proceedings of 2016 IEEE International Conference on Cloud Computingand Big Data Analysis,* 32-36. https://doi.org/10.1109/ICCCBDA.2016.7529530

Fang, Y., Yin, J., & Wu, B. (2017). Climate change and tourism: a scientometric analysis using CiteSpace. *Journal of Sustainable Tourism,* 26(1), 108–26. https://doi.org/10.1080/09669582.2017.1329310

Fensel, A., Kärle, E., & Toma, I. (2015). TourPack: Packaging and disseminating touristic services with linked data andsemantics. *CEUR Workshop Proceedings, 1339,* 43-54.

Fermoso, A. M., Mateos, M., Beato, M. E., & Berjón, R. (2015). Open linked data and mobile devices as e-tourism tools Apractical approach to collaborative e-learning. *Computers in Human Behavior, 51,* 618-626. https://doi.org/10.1016/j.chb.2015.02.032

Ferrández, O., Spurk, C., Kouylekov, M., Dornescu, I., Ferrández, S., Negri, M., Izquierdo, R., Tomás, D., Orasan, C., Neumann, G., Magnini, B. & Vicedo, J. L. (2011). The QALL-MEframework: A specifiable-domain multilingual question answering architecture. *Journal of Web Semantics, 9*(2), 137-145. https://doi.org/10.1016/j.websem.2011.01.002

Ferraro P., Lo Re G. (2014) Designing Ontology-Driven Recommender Systems for Tourism. In S. Gaglio, G. Lo Re (Eds.), *Advances in Intelligent Systems and Computing: Vol. 260.* Springer. https://doi.org/10.1007/978-3-319-03992-3_24

Formica, A., Missikoff, M., Pourabbas, E., & Taglino, F. (2013). Semantic search for matching user requests with profiled enterprises. *Computers in Industry, 64*(3), 191-202. https://doi.org/10.1016/j.compind.2012.09.007

Frikha M., Mhiri M., Gargouri F. (2015) Designing a User Interest Ontology-Driven Social Recommender System: Application for Tunisian Tourism. In J. Bajo, J. Z. Hernández, P. Mathieu, A. Campbell, A Fernández-Caballero, M. N. Moreno, V. Julián, A. Alonso-Betanzos, M. D. Jiménez-López, V. Botti (Eds.) *Advances in Intelligent Systems and Computing: Vol. 372. Trends in Practical Applications of Agents, Multi-Agent Systems and Sustainability (pp. 159-166). Springer.* https://doi.org/10.1007/978-3-319-19629-9_18

Frikha, M., Mhiri, M., & Gargouri, F. (2015). *Designing a user interest ontology-driven social recommender system: Application for tunisian tourism* https://doi.org/10.1007/978-3-319-19629-9_18

Frikha, M., Mhiri, M., & Gargouri, F. (2017). An user interest ontology based on trusted friends preferences for personalized recommendation. In M. Themistocleous, V. Morabito, (Eds.), *Lecture Notes in Business Information Processing: Vol. 299. Information Systems* (pp. 54-67). Springer. https://doi.org/10.1007/978-3-319-65930-5_5

Frikha, M., Mhiri, M., & Gargouri, F. (2018). Using social interaction between friends in knowledge-based personalized recommendation. *Proceedings of IEEE/ACS International Conference on Computer Systems and Applications,* 1454-1461. https://doi.org/10.1109/AICCSA.2017.206

Frikha, M., Mhiri, M., Zarai, M., & Gargouri, F. (2016). Time-sensitive trust calculation between social network friends for personalized recommendation. *Proceedings of the 18th Annual International Conference on Electronic Commerce: e-Commerce in Smart connected World,* Article 36, https://doi.org/10.1145/2971603.2971639

Gala, A. P.-D. L., Cardinale, Y., Dongo, I., & Ticona-Herrera, R. (2021). Towards an ontology for urban tourism. *Proceedings of the 36th Annual ACM Symposium on Applied Computing,* 1887–1890. https://doi.org/10.1145/3412841.3442142

García-Barriocanal E., Sicilia MA. (2008). On Linking Cultural Spaces and e-Tourism: An Ontology-Based Approach. In L. Miltiadis D., C. John M., D. Ernesto, T. Robert D., A. David, G. Vossen, P. Patricia Ordonez De (Eds.), *Communications in Computer and*

Information Science: Vol. 19. The Open Knowlege Society: A Computer Science and Information Systems Manifesto (pp. 694-701) Springer. https://doi.org/10.1007/978-3-540-87783-7_88

García-Crespo, A., López-Cuadrado, J. L., Colomo-Palacios, R., González-Carrasco, I., & Ruiz-Mezcua, B. (2011). Sem-fit:A semantic based expert system to provide recommendations in the tourism domain. *Expert Systems with Applications*, *38*(10), 13310-13319. https://doi.org/10.1016/j.eswa.2011.04.152

Gasmi, A., Tamani, N., Faucher, C., & Ghamri-Doudane, Y. (2017). OAISIS: An ontological-based approach for interlinking Crowd Sensing information systems. *IEEE International Conference on Systems, Man, and Cybernetics - Conference Proceedings*, 3995-4000. IEEE. https://doi.org/10.1109/SMC.2016.7844858

Getahun, F., & Woldemariyam, K. (2017). Integrated ontology learner: Towards generic semantic annotation framework. *Proceedings of the 9th International Conference on Management of Digital EcoSystems*, 142-149. https://doi.org/10.1145/3167020.3167042

Gouveia, M., & Cardoso, J. (2007). Tourism information aggregation using an ontology based approach. *Proceedings of the 9th International Conference on Enterprise Information Systems - DISI*, 569-572. https://doi.org/*10.5220/0002371705690572*

Gunathilaka D., Pathirana S., Senarathne S., Weerasekara J., Silva T. (2019). Feature Based Opinion Mining for Hotel Profiling. In J. Hemanth, T. Silva, A. Karunananda (Eds.), *Communications in Computer and Information Science: Vol. 890. Artificial Intelligence* (pp. 219-231). Springer. https://doi.org/10.1007/978-981-13-9129-3_16

Hołodnik, D., & Perechuda, K. (2019). Route ontology in value recognition of self-tour planning application. In N. Nguyen, R. Chbeir, E. Exposito, P. Aniorté, B. Trawiński, (Eds.), *Lecture Notes in Computer Science: Vol. 11684. Computational Collective Intelligence* (pp. 346-356). Springer. https://doi.org/10.1007/978-3-030-28374-2_30

Hu, J. -T., & Li, S. (2016). An information recommendation method based on user interest model. *Frontiers in Artificial Intelligence and Applications: Vol. 281. Fuzzy System and Data Mining* (pp.284-292). IOS Press. https://doi.org/10.3233/978-1-61499-619-4-284

Ikkala, E., Mäkelä, E., & Hyvönen, E. (2015). TourRDF: Representing, enriching, and publishing curated tours based on linked data. In L. Patrick, H. Eero, B. Eva, P. Valentina, Q. Guilin, S. Uli, D. Ying, G. Chiara. (Eds.), *Lecture Notes in Computer Science: Vol. 8982. Knowledge Engineering and Knowledge Management* (pp. 145-149). Springer. https://doi.org/10.1007/978-3-319-17966-7_19

Islam, M. R., Hossain, B. A., Imteaj, M. N., Akhter, S., Jogesh, H. S., & Mostafa, M. B. (2018). OnTraNetBD: A knowledge base for the travel network in bangladesh. *5th IEEE Region 10 HumanitarianTechnology Conference 2017*, 170-174. IEEE. https://doi.org/10.1109/R10-HTC.2017.8288931

Jingxuan, Z., Bing, L., Fei, T., Can, C., & Yikai, D. (2017). Analysis of Evaluating Dimensions of Chinese Express Hotels Based on User Generated Content. *Proceedings of the International Conference on Business and Information Management,* 62-67. https://doi.org/10.1145/3134271.3134276

Kanellopoulos, D., & Kotsiantis, S. (2007). A semantic-based architecture for intelligent destination managementsystems. *International Journal of Soft Computing, 2*(1), 61-68. https://www.medwelljournals.com/abstract/?doi=ijscomp.2007.61.68

Kärle, E., Şimşek, U., Panasiuk, O., & Fensel, D. (2018). *Building an ecosystem for the tyrolean tourism knowledge graph.* In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.) *Lecture Notes in Computer Science: Vol. 11153. Current Trends in Web Engineering* (pp. 260-267). Springer. https://doi.org/10.1007/978-3-030-03056-8_25

Kasri, S., & Benchikha, F. (2016). Refactoring ontologies using design patterns and relational concepts analysis tointegrate views: The case of tourism. *International Journal of Metadata, Semantics and Ontologies, 11*(4), 243-263. https://doi.org/10.1504/IJMSO.2016.083519

Keller, C., Brunk, S., & Schlegel, T. (2014). Introducing the public transport domain to the web of data. In B. Benatallah, A. Bestavros, Y. Manolopoulos, A. Vakali, Y. Zhang (Eds.), *Lecture Notes in Computer Science: Vol. 8787. Web Information Systems Engineering – WISE 2014* (pp. 521-530). Springer. https://doi.org/10.1007/978-3-319-11746-1_38

Khalil, V. A., Ishida, T., Otani, M., & Lin, D. (2017). A culturally-situated agent to support intercultural collaboration. In T. Yoshino, T. Yuizono, G. Zurita, Vassileva J. (Eds.), *Lecture Notes in Computer Science: Vol. 10397. Collaboration Technologies and Social Computing* (pp. 130-144). Springer. Cham. https://doi.org/10.1007/978-3-319-63088-5_12

Khallouki, H., Abatal, A., & Bahaj, M. (2018). An ontology-based context awareness for smart tourism recommendation system. *Proceedings of the International Conference on Learning and Optimization Algorithms: Theory and Applications.* Article 43. https://doi.org/10.1145/3230905.3230935

Kim, J. -B., & Park, C. (2011). Development of mobile AR tour application for the national palace museum of korea. In Shumaker R. (Ed.), *Lecture Notes in Computer Science: Vol. 6773. Virtual and Mixed Reality - New Trends* (pp. 55-60). Springer. https://doi.org/10.1007/978-3-642-22021-0_7

Kitwatthanathawon, P., Angskun, T., & Angskun, J. (2012). A knowledge extraction system from online reviews usingfuzzy logic. *Proceedings of 9th International Joint Conference on Computer Science andSoftware Engineering,* 189-196. https://doi.org/10.1109/JCSSE.2012.6261950

Klein, E., Gschwend, A., & Neuroni, A. C. (2016). Towards a linked data publishing methodology. *Proceedings of the 6th International Conference for E-Democracy and Open Government, CeDEM 2016,* 188-196. https://doi.org/10.1109/CeDEM.2016.12

Kularbphettong, K. (2018). Enrichment ontology instance by using data mining techniques: A case of thai tourist interest in culture tourism. In R. Silhavy, P. Silhavy, Z. Prokopova (Eds.), *Advances in Intelligent Systems and Computing, Vol. 662. Applied Computational Intelligence and Mathematical Methods* (pp. 150-155). Springer. https://doi.org/10.1007/978-3-319-67621-0_13

Kuntarto, G. P., & Gunawan, D. (2012). Dwipa search engine: When E-tourism meets the semantic web. *2012 International Conference on Advanced Computer Science and Information Systems, ICACSIS 2012 -Proceedings,* 155-160. IEEE. https://ieeexplore.ieee.org/abstract/document/6468741

Kuntarto, G. P., Alrin, Y., & Gunawan, I. P. (2019a). The key role of ontology alignment and enrichment methodologies for aligning and enriching dwipa ontology with the weather concept on the tourism domain. *Proceedings of 3rd International Conference on Informatics and Computational Sciences (ICICOS),* 1-6. IEEE. https://doi.org/10.1109/ICICoS48119.2019.8982437

Kuntarto, G. P., Isyahrani, S., & Gunawan, I. P. (2019b). Performance of K-means clustering algorithm in enriching a newconcept of amenities into dwipa ontology III within the indonesia tourism domain. Proceedings of *2nd International Seminar on Research of Information Technology and Intelligent Systems,* 334-339. IEEE. https://doi.org/10.1109/ISRITI48646.2019.9034563

Laddha, S. S., & Jawandhiya, P. M. (2021). Onto-semantic indian tourism information retrieval system. In A. Khanna, A.K. Singh, A. Swaroop (Eds.) *Studies in Computational Intelligence: Vol. 921. Recent Studies on Computational Intelligence* (pp. 1-18). Springer. https://doi.org/10.1007/978-981-15-8469-5_1

Laddha, S., & Jawandhiya, P. M. (2020). Novel concept of spelling correction for semantic tourism search interface. In M. Tuba, S. Akashe, A. Joshi (Eds.) *Advances in Intelligent Systems and Computing: Vol. 933. Information and Communication Technology for Sustainable Development* (pp. 13-21). Springer. https://doi.org/10.1007/978-981-13-7166-0_2

Lam, T. H. W., & Lee, R. S. T. (2006). iJADE FreeWalker: An ontology-based tourist guiding system. In B. Gabrys, R.J. Howlett, L.C. Jain (Eds.) *Lecture Notes in Computer Science: Vol. 4252. Knowledge-Based Intelligent Information and Engineering Systems* (pp.644-651). Springer. https://doi.org/10.1007/11893004_83

Lam, T. H. W., & Liu, J. N. K. (2008). SemTour: HK - a tourist information system. In M.-C. Chan, R. Cheung, J. N. K. Liu (Eds.), *Challenges in information technology management* (pp. 137-144). https://doi.org/10.1142/9789812819079_0021

Lam, T. H. W., Liu, J. N. K., & Lee, R. S. T. (2009). Master: An intelligent ontology-based multi-agent system for sightseer. *International Journal of Software Engineering and Knowledge Engineering, 19*(2), 137-147. https://doi.org/10.1142/S021819400900412X

Lamsfus, C., Martín, D., Alzua-Sorzabal, A., López-de-Ipiña, D., & Torres-Manzanera, E. (2012). Context-based tourism information filtering with a semantic rule engine. *Sensors, 12*(5), 5273-5289. https://doi.org/10.3390/s120505273

Lamsfus, C., Martin, D., Salvador, Z., Usandizaga, A., & Alzua-Sorzabal, A., (2009). Human-centric ontology-based context modelling in tourism. *MCIS 2009 Proceedings.* Article 64. http://aisel.aisnet.org/mcis2009/64

Lapi, E., Tcholtchev, N., Bassbouss, L., Marienfeld, F., & Schieferdecker, I. (2012). Identification and utilization ofcomponents for a linked open data platform. *Proceedings - International Computer Software and Applications Conference,* 112-115. IEEE. https://doi.org/10.1109/COMPSACW.2012.30

Lee, C. -I., Hsia, T. -C., Hsu, H. -C., & Lin, J. -Y. (2017). Ontology-based tourism recommendation system. *Proceedings of 4th International Conference on Industrial Engineering and Applications,* 376-379. https://doi.org/10.1109/IEA.2017.7939242

Lee, C. -S., Chang, Y. -C., & Wang, M. -H. (2009). Ontological recommendation multi-agent for tainan city travel. *Expert Systems with Applications, 36*(3), 6740-6753. https://doi.org/10.1016/j.eswa.2008.08.016

Leydesdorff, L., & Milojevic, S. (2015). Scientometrics. In J.D. Wright (Ed.), *International Encyclopedia of Social and Behavioral Sciences* (2nd ed., pp. 322-327), Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.85030-8

Li, L., Liu, Y., Zhu, H., Ying, S., Luo, Q., Luo, H., Kuai, X., Xia, H., & Shen, H. (2017). A bibliometric and visual analysis of global geo-ontology research. *Computers & Geosciences, 99*, 1–8. https://doi.org/10.1016/j.cageo.2016.10.006

Li, L.-H., Hsu, R. -W., Lee, F. -M., & Chen, M. -C. (2013). A study on automated semantic analysis of customer satisfactioncomments-a case study on service quality of hotels on a chinese tourism website. *Research Journal of AppliedSciences, Engineering and Technology, 6*(8), 1366-1381. https://doi.org/10.19026/rjaset.6.3958

Li, X., Chen, M., & Wang, X. (2011). Construction method of travel knowledge database based on ontology. *Proceedings - 2011 3rd International Conference on Intelligent Human-Machine Systems andCybernetics,* 182-185. https://doi.org/10.1109/IHMSC.2011.115

Li, X., Rousseau, J.F., Ding, Y., Song, M., & Lu, W. (2020). Understanding drug repurposing from the perspective of biomedical entities and their evolution: bibliographic research using aspirin. *JMIR medical informatics*, 8(6), Article e16739. https://doi.org/10.2196/16739

Lima, S., & Moreira, J. (2013). A semantic framework for touristic information systems. In P. Ordóñez de Pablos, M. Lytras, R. Tennyson, & J. Gayo (Eds.), *Cases on Open-Linked Data and Semantic Web Applications* (pp. 132-155). IGI Global. http://doi:10.4018/978-1-4666-2827-4.ch007

Ling, L., Shengqun, T., Lina, F., Ruliang, X., Xinguo, D., Youwei, X., & Yang, X. (2007). VOEditor: A visual environment forontology construction and collaborative querying of semantic web resources. *Proceedings -International Computer Software and Applications Conference,* 591-597. https://doi.org/10.1109/COMPSAC.2007.237

Lisi, F. A., & Esposito, F. (2014). Semantic web services for integrated tourism in the apulia region. *CEUR Workshop Proceedings,1195,* 178-193. http://ceur-ws.org/Vol-1195/long12.pdf

Lisi, F. A., & Esposito, F. (2014). Supporting integrated tourism services with semantic technologies and machine learning. *CEUR Workshop Proceedings, 1272,* 361-364. http://ceur-ws.org/Vol-1272/paper_98.pdf

Liu, Y., Liu, S. Q., & Li, P. (2013). Tourism domain ontology construction method based on fuzzy formal concept analysis. *Applied Mechanics and Materials, 347–350,* 2809–2813.https://doi.org/10.4028/www.scientific.net/amm.347-350.2809

Liu, Z., Shan, J., Glassey Balet, N., & Fang, G. (2017). Semantic social media analysis of chinese tourists in switzerland. *Information Technology and Tourism, 17*(2), 183-202. https://doi.org/10.1007/s40558-016-0066-z

Lo Bue, A., Machì, A., & Taibi, D. (2019). PCC2018-bot: A telegram bot for "Palermo capitale della cultura 2018" events powered by linked open data and schema.org annotations. *CEUR Workshop Proceedings, 2418,* 125-131. http://ceur-ws.org/Vol-2418/paper13.pdf

Lo Bue. A., Machì, A. (2015) Open Data Integration Using SPARQL and SPIN: A Case Study for the Tourism Domain. In M. Gavanelli, E. Lamma, F. Riguzzi (Eds.), *Lecture Notes in Computer Science: Vol. 9336. AI*IA 2015 Advances in Artificial Intelligence* (pp. 316-326). Springer. https://doi.org/10.1007/978-3-319-24309-2_24

Lu C., Laublet P., Stankovic M. (2016) Travel Attractions Recommendation with Knowledge Graphs. In E. Blomqvist, P. Ciancarini, F. Poggi, F. Vitali (Eds.), *Lecture Notes in Computer Science: Vol. 10024. Knowledge Engineering and Knowledge Management* (pp. 416-431). Springer. https://doi.org/10.1007/978-3-319-49004-5_27

Lu C., Stankovic M., Radulovic F., Laublet P. (2017). Crowdsourced Affinity: A Matter of Fact or Experience. In E. Blomqvist, D. Maynard, A. Gangemi, R. Hoekstra, P. Hitzler, O. Hartig (Eds.), *Lecture Notes in Computer Science: Vol. 10249. The Semantic Web.* Springer. https://doi.org/10.1007/978-3-319-58068-5_34

Lu, C., Stankovic, M., & Laublet, P. (2015). Leveraging semantic web technologies for more relevant e-tourism behavioralretargeting. *Proceedings of the 24th International Conference on World Wide Web,* 1287-1292. https://doi.org/10.1145/2740908.2742001

Lully, V., Laublet, P., Stankovic, M., & Radulovic, F. (2018). Enhancing explanations in recommender systems withknowledge graphs. *Procedia Computer Science, 137,* 211-222. https://doi.org/10.1016/j.procs.2018.09.020

Luz, N., Almeida, A., Anacleto, R., & Silva, N. (2013). Collective intelligence in toursplan: An online tourism social networkwith planning and recommendation services. *Proceedings of the International C* Conference on Computer Science and Software Engineering,* 42-48. https://doi.org/10.1145/2494444.2494449

Ma, C., & Zhou, X. (2012). Affection behavior approach for WSMO based on ant colony algorithm. *International Review on Computers and Software, 7*(5), 2673-2678.

Makiyama, T., Ono, Y., Sugiyama, T., Morita, T., Kogusuri, H., Tejima, H., & Yamaguchi, T. (2014). Implementing tourism service based on linked data with social experiments. *CEUR Workshop Proceedings, 1312,* 120-123. http://ceur-ws.org/Vol-1312/jist2014pd_paper3.pdf

Manna M., Ricca F., Saccà L. (2011) Logic-Based Technologies for e-Tourism: The iTravel System. In A. D'Atri, M. Ferrara, J. George, P. Spagnoletti (Eds.) *Information Technology and Innovation Trends in Organizations* (311-318). Physica-Verlag HD. https://doi.org/10.1007/978-3-7908-2632-6_35

Martelli, C., & Bellini, E. (2012). The role of a semantic approach of complex statistical information system planning andmanagement. *Proceedings of the 8th International Conference on Signal Image Technology and Internet Based Systems,* 876-883. https://doi.org/10.1109/SITIS.2012.152

Martínez-García M., Valls A., Moreno A. (2016). Construction of an Outranking Relation Based on Semantic Criteria with ELECTRE-III. In J. Carvalho, M. J. Lesot, U. Kaymak, S. Vieira, B. Bouchon-Meunier, R. Yager (Eds.), *Communications in Computer and Information Science: Vol. 611. Information Processing and Management of Uncertainty in Knowledge-Based Systems.* Springer. https://doi.org/10.1007/978-3-319-40581-0_20

Matuszka, T. (2013). Augmented Reality Supported by Semantic Web Technologies. In P. Cimiano, O. Corcho, V. Presutti, L. Hollink, S. Rudolph (Eds.), *Lecture Notes in Computer Science: Vol. 7882. The Semantic Web: Semantics and Big Data.* Springer. https://doi.org/10.1007/978-3-642-38288-8_51

Mekhabunchakij, K. (2017). Towards modeling linked open data for decision support: An example application of Thailand tourism linked data visualization. Proceedings of the *2016 Management and Innovation Technology International Conference,* MIT88-MIT92. IEEE. https://doi.org/10.1109/MITICON.2016.8025240

Mihindukulasooriya, N., Priyatna, F., & Rico, M. (2018). Publishing tourism statistics as linked data a case study of srilanka. In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.), *Lecture Notes in Computer Science, Vol. 11153. Current Trends in Web Engineering.* Springer. https://doi.org/10.1007/978-3-030-03056-8_17

Mikhailov, S., & Kashevnik, A. (2018). An ontology for service semantic interoperability in the smart phone-based touristtrip planning system. *Proceedings of 23rd Conference of Open Innovations Association,* 240-245. IEEE. https://doi.org/10.23919/FRUCT.2018.8588027

Mikhailov, S., Kashevnik, A., & Smirnov, A. (2020). Tourist behaviour analysis based on digital pattern of life. *Proceedings of the 7th International Conference on Control, Decision and Information Technologies*, 622-627. https://doi.org/10.1109/CoDIT49905.2020.9263945

Mili, H., Valtchev, P., Szathmary, L., Boubaker, A., Leshob, A., Charif, Y., & Martin, L. (2018). Ontology-based model-driven development of a destination management portal: Experience and lessons learned. *Software: Practice and Experience, 48*(8), 1438-1460. https://doi.org/10.1002/spe.2581

Mínguez, I., Berrueta, D., & Polo, L. (2009). CRUZAR: An application of semantic matchmaking to e-tourism. In Y. Kalfoglou (Ed.), *Cases on semantic interoperability for information systems integration: Practices and applications* (pp. 255-271). IGI Global. https://doi.org/10.4018/978-1-60566-894-9.ch012

Moreno, A., Valls, A., Isern, D., Marin, L., & Borràs, J. (2013). SigTur/E-destination: Ontology-based personalized recommendation of tourism and leisure activities. *Engineering Applications of Artificial Intelligence, 26*(1), 633-651. https://doi.org/10.1016/j.engappai.2012.02.014

Mouhim, S., El Aoufi, A., Cherkaoui, C., Megder, E., & Mammass, D. (2011). Towards a knowledge management systemfor tourism based on the semantic web technology. *Proceedings of the International Conference on Multimedia Computing and Systems,* https://doi.org/10.1109/ICMCS.2011.5945640

Mountasser, I., Ouhbi, B., Hdioud, F., & Frikh, B. (2019). Ontology-based open tourism data integration framework: Trip planning platform. In M. Strydom, & S. Buckley (Ed.), *AI and Big Data's Potential for Disruptive Innovation (pp. 44-70).* IGI Global. http://doi:10.4018/978-1-5225-9687-5.ch002

Nahari, M. K., Ghadiri, N., Jafarifard, Z., Dastjerdi, A. B., & Sack, J. R. (2017). A framework for linked data fusion and quality assessment. *Proceedings of the 2017 3rd International Conference on Web Research,* 67-72. IEEE. https://doi.org/10.1109/ICWR.2017.7959307

Nakatoh, T., Yin, C., & Hirokawa, S. (2012). Characteristic grammatical context of tourism information. *ICIC Express Letters, 6*(3), 753-758. https://kyushu-u.pure.elsevier.com/en/publications/characteristic-grammatical-context-of-tourism-information

Nakatoh, T., Yin, C., Matsuura, H., & Hirokawa, S. (2011). Visualization of tourism information using WordNet. *Proceedings of the 2011 3rd International Conference on Awareness Science and Technology,* 412-417. https://doi.org/10.1109/ICAwST.2011.6163110

Namahoot, C. S., Brückner, M., & Panawong, N. (2015). Context-aware tourism recommender system using temporal ontology and naïve bayes. In H. Unger, P. Meesad, S. Boonkrong (Eds.), *Advances in Intelligent Systems and Computing: Vol. 361. Recent Advances in Information and Communication Technology 2015* (pp.183-194). Springer. https://doi.org/10.1007/978-3-319-19024-2_19

Namahoot, C. S., Panawong, N., & Brückner, M. (2016). A tourism recommendation system for thailand using semanticweb rule language and K-NN algorithm. *Information, 19*(7B), 3017-3023. http://www.nsru.ac.th/tung/papers/I2BM_Paper2_2016.pdf

Nasingkun, K., Ikeda, M., Suntisrivaraporn, B., & Supnithi, T. (2014). Ontology refinement using implicit user preferences: A case study in cultural tourism domain. *CEUR Workshop Proceedings,1312,* 92-101. http://ceur-ws.org/Vol-1312/ldop2014_paper4.pdf

Nasingkun, K., Srijuntongsiri, G., Supnithi, T., & Ikeda, M. (2017). An ontology based tour design support to extendtourist's cultural interest. *International Journal of Knowledge and Systems Science, 8*(4), 1-16. https://doi.org/10.4018/IJKSS.2017100101

Navigli, R. (2002). Automatically extending, pruning and trimming general purpose ontologies. *Proceedings of the IEEE International Conference on Systems, Man and Cybernetics,* 631-635. IEEE. https://doi.org/10.1109/ICSMC.2002.1168049.

Nguyen, H. H., Beel, D., Webster, G., Mellish, C., Pan, J. Z., & Wallace, C. (2015). CURIOS mobile: Linked dataexploitation for tourist mobile apps in rural area. In T. Supnithi, T. Yamaguchi, J. Z. Pan, V. Wuwongse, M. Buranarach (Eds.), *Lecture Notes in Computer Science. Semantic Technology.* Springer. https://doi.org/10.1007/978-3-319-15615-6_10

Niknia, M., & Mirtaheri, S.L. (2015). Mapping a decade of linked data progress through co-word analysis. *Webology,* 12(2), 1-14. https://www.webology.org/abstract.php?id=276

Noulas, A., Scellato, S., Mascolo, C., & Pontil, M. (2011). Exploiting semantic annotations for clustering geographic areas and users in location-based social networks. *Proceedings of the International AAAI Conference on Web and Social Media*, 5(3), 32-35. https://ojs.aaai.org/index.php/ICWSM/article/view/14212

Ortega P.M.M., Ávila L.G., Gómez J.M. (2014) Business Intelligence Taxonomy. In R. Espin, R. Pérez, A. Cobo, J. Marx, A. Valdés (Eds.), *Studies in Computational Intelligence: Vol. 537. Soft Computing for Business Intelligence.* Springer. https://doi.org/10.1007/978-3-642-53737-0_10

Ou, Y. Z., Tsai, S. H., Lai, Y. A., Su, J., Yu, C. W., Hsiao, C. T., Chu, E. T.-H., Lin, K. J., Ho, J. M., & Liu, J. W. S. (2013). A linked-data based virtual repository for disaster management

tools and applications. *Proceedings of the WIT Transactions on the Built Environment, 133,* 185-196. WIT Press. https://doi.org/10.2495/DMAN130171

Paganelli, F., Bianchi, G., & Giuli, D. (2007). A context model for context-aware system design towards the ambientintelligence vision: Experiences in the eTourism domain. In C. Stephanidis, M. Pieper (Eds.), *Lecture Notes in Computer Science, Vol. 4397. Universal Access in Ambient Intelligence Environments.* Springer. https://doi.org/10.1007/978-3-540-71025-7_12

Pai, M. -Y., Wang, D. -C., Hsu, T. -H., Lin, G. -Y., & Chen, C. -C. (2019). On ontology-based tourist knowledge representationand recommendation. *Applied Sciences, 9*(23), Article 5097. https://doi.org/10.3390/app9235097

Palaniammal, K., Indra Devi, M., & Vijayalakshmi, S. (2012). An unfangled approach to semantic search for E-tourism domain. *Proceedings of the 2012 International Conference on Recent Trends in Information Technology,* 130-135. https://doi.org/10.1109/ICRTIT.2012.6206758

Pan, J., Mou, N., & Liu, W. (2019). Emotion analysis of tourists based on domain ontology. *Proceedings of the 2019 International Conference on Data Mining and Machine Learning,* 146-150. https://doi.org/10.1145/3335656.3335701

Panawong, N., Snae Namahoot, C., & Brückner, M. (2014). Classification of tourism web with modified naïve bayes algorithm. *Advanced Materials Research,* 931–932, 1360–1364. https://doi.org/10.4028/www.scientific.net/amr.931-932.1360

Pandolfo, L., Pulina, L., & Grosso, E. (2018). A user model ontology for adaptive systems in cultural tourism domain. *Frontiers in Artificial Intelligence and Applications: Vol. 310. Applications of Intelligent Systems* (pp.212-219). IOS Press. https://doi.org/10.3233/978-1-61499-929-4-212

Paramonov, I., Lagutina, K., Mamedov, E., & Lagutina, N. (2016). Thesaurus-based method of increasing text-via-keyphrase graph connectivity during keyphrase extraction for e-tourism applications. In A. C. Ngonga Ngomo, P. Křemen (Eds.). *Communications in Computer and Information Science, Vol. 649. Knowledge Engineering and Semantic Web* (pp 129-141). Springer. https://doi.org/10.1007/978-3-319-45880-9_11

Park, H. (2013). Task model and task ontology based on mobile users' generic activities for task-oriented tourist information service. *International Journal of Smart Home, 7*(3), 33-44. https://gvpress.com/journals/IJSH/vol7_no3/3.pdf

Park, H., Kwon, S., & Kwon, H. -C. (2009). Ontology-based approach to intelligent ubiquitous tourist information system. *Proceedings of the 4th International Conference on Ubiquitous Information Technologies and Applications,* 1-6. IEEE. https://doi.org/10.1109/ICUT.2009.5405697

Pavković, I., & Štajduhar, I. (2015). Semantic approach to accommodation & booking related web services. *38th International Convention on Information and Communication Technology, Electronicsand Microelectronics (MIPRO) - Proceedings,* 419-424. https://doi.org/10.1109/MIPRO.2015.7160307

Ponomarev, A., & Parfenov, V. (2015). Verification-enabling interaction model for services in smart space: A TAIS case. Proceedings of the *17th Conference of Open Innovation Association (FRUCT),* 163-172. IEEE. https://doi.org/10.1109/FRUCT.2015.7117988

Prasath, R., Kumar, V., & Sarkar, S. (2015). Assisting web document retrieval with topic identification in tourism domain. *Web Intelligence and Agent Systems, 13*(1), 31-41. https://doi.org/10.3233/WEB-150308

Premananthan, P., Btgs, K., Kudavidanage, E. P., & Kuhaneswaran, B. (2020). A data mining and ontology-based approach for predicting the research ideas in the wildlife sector of sri lanka. Proceedings of the *2020 IEEE 15th International Conference on Industrial and Information Systems (ICIIS),* 606-610. https://doi.org/10.1109/ICIIS51140.2020.9342637

R Core Team. (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing. https://www.R-project.org/

Rajapaksha, L. H. S. U., Jayasena, L. I., Wijerathna, G. G. C., Samarakoon, P. G. K. B., & Bandara, K. Y. (2016). Web-based intelligent tour planner and advisor. *Proceedings of the 15th International Conference on Advances in ICT for Emerging Regions,* 277-277. https://doi.org/10.1109/ICTER.2015.7377710

Refanidis, I., Emmanouilidis, C., Sakellariou, I., Alexiadis, A., Koutsiamanis, R. -A., Agnantis, K., Tasidou, A., Kokkoras, F., & Efraimidis, P. S. (2014). myVisitPlanner^{GR}: Personalized itinerary planning system for tourism. In A. Likas, K. Blekas, D. Kalles (Eds.), *Lecture Notes in Computer Science, Vol. 8445. Artificial Intelligence: Methods and Applications.* Springer. https://doi.org/10.1007/978-3-319-07064-3_53

Rios-Alvarado, A. B., Martinez-Rodriguez, J. L., Guerrero-Melendez, T. Y., Rodriguez-Rodriguez, A. J., & Vargas-Requena, D. T. (2020). Axiomatic relation extraction from text in the domain of tourism. In B. Villazón-Terrazas, F. Ortiz-Rodríguez, S.M. Tiwari, S.K. Shandilya (Eds.). *Communications in Computer and Information Science, Vol. 1232. Knowledge Graphs and Semantic Web* (pp. 14-28). Springer. https://doi.org/10.1007/978-3-030-65384-2_2

Rosyiq, A., Hayah, A. R., Hidayanto, A. N., Naisuty, M., Suhanto, A., & Avuning Budi, N. F. (2019). Information extraction from twitter using DBpedia ontology: Indonesia tourism places. *Proceedings of International Conference on Informatics, Multimedia, Cyber and Information System (ICIMCIS),* 91-96. https://doi.org/10.1109/ICIMCIS48181.2019.8985194

Ruotsalo, T., Haav, K., Stoyanov, A., Roche, S., Fani, E., Deliai, R., Mäkelä, E., Kauppinen, T., & Hyvönen, E. (2013). SMARTMUSEUM: A mobilerecommender system for the web of data. *Journal of Web Semantics, 20,* 50-67. https://doi.org/10.1016/j.websem.2013.03.001

Ryu, K. -. (2017). Research on semantic web-based custom travel model. *International Journal of Applied EngineeringResearch, 12*(20), 9794-9798. https://www.ripublication.com/ijaer17/ijaerv12n20_73.pdf

Sabou, M., Arsal, I., & Braşoveanu, A. M. P. (2013). TourMISLOD: A tourism linked data set. *Semantic Web, 4*(3), 271-276. https://doi.org/10.3233/SW-2012-0087

Sabou, M., Braşoveanu, A. M. P., & Arsal, I. (2012). Supporting tourism decision making with linked data. *Proceedings of the 8th International Conference on Semantic Systems,* 201–204. https://doi.org/10.1145/2362499.2362533https://doi.org/10.1145/2362499.2362533

Sabou, M., Onder, I., Brasoveanu, A. M. P., & Scharl, A. (2016). Towards cross-domain data analytics in tourism: A linked data based approach. *Information Technology and Tourism, 16*(1), 71-101. https://doi.org/10.1007/s40558-015-0049-5

Salaiwarakul, A. (2018). Thai natural language based cultural tourism ontology. *ICIC Express Letters, 12*(2), 159-165. https://doi.org/10.24507/icicel.12.02.159

Salaiwarkul, A., & Khruakong, S. (2018). A hybrid approach for natural language querying segmentation for tourism ontology. *Journal of Telecommunication, Electronic and Computer Engineering, 10*(1-5), 109-113. https://jtec.utem.edu.my/jtec/article/view/3640

Schenk, S., Saathoff, C., Staab, S., & Scherp, A. (2009). SemaPlorer-interactive semantic exploration of data and media based on a federated cloud infrastructure. *Journal of Web Semantics, 7*(4), 298-304. https://doi.org/10.1016/j.websem.2009.09.006

Schiel, U., Souza Baptista, C., De Jesus Maia, A., & De Andrade, F. (2007). SEI-tur: A system based on composed web-service discovery to support the creation of trip plans. Proceedings of the *1st International Conference on the Digital Society,* 28-28. https://doi.org/10.1109/ICDS.2007.36

Sengloiluean, K., Arch-Int, N., & Arch-Int, S. (2020). An ontology-based semantic extraction approach from text corpus. *Journal of Theoretical and Applied Information Technology, 98*(14), 2721-2731.

Sharafuddin, M. A., & Madhavan, M. (2020). Thematic Evolution of Blue Tourism: A Scientometric Analysis and Systematic Review. *Global Business Review*. https://doi.org/10.1177/0972150920966885

She, K. -S., Haw, S. -C., & Chew, L. -J. (2020). Tourism recommender system utilising property graph ontology as knowledge base. *Proceedings of the 12th International Conference on Computer Modeling and Simulation,* 14-18. https://doi.org/10.1145/3408066.3408102

Shi, L., Lin, F., Yang, T., Qi, J., Ma, W., & Xu, S. (2014). Context-based ontology-driven recommendation strategies for tourism in ubiquitous computing. *Wireless Personal Communications, 76*(4), 731-745. https://doi.org/10.1007/s11277-013-1550-9

Shi, M., Zhu, W., Yang, H., & Li, C. (2016). Applying semantic web and big data techniques to construct a balance model referring to stakeholders of tourism intangible cultural heritage. *International Journal of Computer Applications in Technology, 54*(3), 192-200. https://doi.org/10.1504/IJCAT.2016.079873

Siricharoen, W. V. (2008). Learning semantic web from E-tourism. In N.T. Nguyen, G.S. Jo, R. J. Howlett, L.C. Jain (Eds.) *Lecture Notes in Computer Science: Vol. 4953. Agent and Multi-Agent Systems: Technologies and Applications* (pp.516-525). Springer. https://doi.org/10.1007/978-3-540-78582-8_52

Sittisaman, A., & Panawong, N. (2019). A development of real-time tourism information recommendation system for smart phone using responsive web design, spatial and temporal ontology. *International Journal of Engineering and Advanced Technology, 8*(5), 994-999. https://www.ijeat.org/wp-content/uploads/papers/v8i5/E7066068519.pdf

Smirnov, A., Kashevnik, A., Ponomarev, A., Shchekotov, M., & Kulakov, K. (2016). Application for e-tourism: Intelligent mobile tourist guide. *Proceedings of the 4th International Congress on Advanced Applied Informatics,* 40-45. IEEE. https://doi.org/10.1109/IIAI-AAI.2015.190

Smirnov, A., Kashevnik, A., Ponomarev, A., Shilov, N., Schekotov, M., & Teslya, N. (2013). Recommendation system for tourist attraction information service. *Proceedings of the Conference of Open Innovation Association,* 148-155. https://doi.org/10.1109/FRUCT.2013.6737957

Smirnov, A., Levashova, T., Shilov, N., & Ponomarev, A. (2019). Human-computer cloud for decision support: Main ontological models and dynamic resource network configuration. In A. Abraham, S. Kovalev, V. Tarassov, V. Snasel, A. Sukhanov (Eds.), Advances in Intelligent Systems and Computing: Vol. 874. Proceedings of the Third International Scientific Conference "Intelligent Information Technologies for Industry" (IITI'18) (pp.16-25). Springer. https://doi.org/10.1007/978-3-030-01818-4_2

Smirnov, A., Ponomarev, A., & Kashevnik, A. (2016). Tourist attraction recommendation service: An approach,architecture and case study. *Proceedings of the 18th International Conferenceon Enterprise Information Systems, 2,* 251-261. https://doi.org/10.5220/0005870202510261

Smirnov, A., Ponomarev, A., & Kashevnik, A. (2017). Multi-model service for recommending tourist attractions. In S. Hammoudi, L. Maciaszek, M. Missikoff, O. Camp, J. Cordeiro (Eds.), *Lecture Notes in Business Information Processing, Vol. 291. Enterprise Information Systems* (pp. 364-386). Springer. https://doi.org/10.1007/978-3-319-62386-3_17

Smirnov, A., Shilov, N., Kashevnik, A., Teslya, N., & Laizane, S. (2013). Smart space-based ride sharing service in e-tourism application for Karelia region accessibility: Ontology-based approach and implementation. *Proceedings of the 8th International Joint Conference on Software Technologies*, 591-598. https://www.scitepress.org/papers/2013/44190/44190.pdf

Stoyanova-Doycheva, A., Ivanova, V., Glushkova, T., Stoyanov, S., & Radeva, I. (2020). Dynamic generation of cultural routes in a tourist guide. *International Journal of Computing, 19*(1), 39-48. https://doi.org/10.47839/ijc.19.1.1691

Subramaniyaswamy, V., Manogaran, G., Logesh, R., Vijayakumar, V., Chilamkurti, N., Malathi, D., & Senthilselvan, N.(2019). An ontology-driven personalized food recommendation in IoT-based healthcare system. *Journal of Supercomputing, 75*(6), 3184-3216. https://doi.org/10.1007/s11227-018-2331-8

Suganya, G., & Porkodi, R. (2018). Ontology based information extraction -A review. *Proceedings of the 2018 International Conference on Current Trends Towards Converging Technologies*, 1-7, https://doi.org/10.1109/ICCTCT.2018.8551071

Tang, S., & Cai, Z. (2010). Using the format concept analysis to construct the tourism information ontology. *Proceedings of the 2010 7th International Conference on Fuzzy Systems and Knowledge Discovery,* 2941-2944. https://doi.org/10.1109/FSKD.2010.5569075

Tatsiopoulos, C., & Boutsinas, B. (2010). Automatic knowledge exchanging between tourists via mobile devices. *Journal of Hospitality and Tourism Technology, 1*(2), 163-173. https://doi.org/10.1108/17579881011065056

Tian, Y., Jing, D., Yang, C., Chen, Y., & Yang, H. (2020). An ontological approach for architecture design of a smarttourism system-of-systems. *International Journal of Performability Engineering, 16*(4), 587-598. https://doi.org/10.23940/ijpe.20.04.p10.587598

Tiwari, S., & Kaushik, S. (2012). Extracting region of interest (ROI) details using LBS infrastructure and web-databases. *Proceedings of the 2012 IEEE 13th International Conference on Mobile Data Management,* 376-379. IEEE. https://doi.org/10.1109/MDM.2012.29

Toma, I., Stanciu, C., Fensel, A., Stavrakantonakis, I., & Fensel, D. (2014). Improving the online visibility of touristic service providers by using semantic annotations. In V. Presutti, E. Blomqvist, R. Troncy, H. Sack, I. Papadakis, A. Tordai (Eds.), *Lecture Notes in Computer Science, Vol. 8798. The Semantic Web: ESWC 2014 Satellite Events.* Springer. https://doi.org/10.1007/978-3-319-11955-7_31

Tomai, E., Spanaki, M., Prastacos, P., & Kavouras, M. (2005). Ontology assisted decision making - A case study in trip planning for tourism. In R. Meersman, Z. Tari, P. Herrero

(Eds.), *Lecture Notes in Computer Science: Vol. 3762. On the Move to Meaningful Internet Systems 2005: OTM 2005 Workshops.* Springer (pp.1137-1146). https://doi.org/10.1007/11575863_136

Tryfona, N., & Pfoser, D. (2005). Data semantics in location-based services. In S. Spaccapietra & E. Zimányi (Eds.), *Lecture Notes in Computer Science: Vol. 3534. Journal on Data Semantics III.* Springer. https://doi.org/10.1007/11496168_8

Van Aart, C., Wielinga, B., & Van Hage, W. R. (2010). Mobile cultural heritage guide: Location-aware semantic search. In P. Cimiano & H.S. Pinto (Eds.), *Lecture Notes in Computer Science, Vol. 6317. Knowledge Engineering and Management by the Masses.* Springer. https://doi.org/10.1007/978-3-642-16438-5_18

Varfolomeyev, A., Korzun, D., Ivanovs, A., Soms, H., & Petrina, O. (2015). Smart space based recommendation servicefor historical tourism. *Procedia Computer Science, 77*, 85-91. https://doi.org/10.1016/j.procs.2015.12.363

Vert, S., & Vasiu, R. (2014). Relevant aspects for the integration of linked data in mobile augmented reality applications for tourism. In G. Dregvaite & R. Damasevicius (Eds.), *Communications in Computer and Information Science: Vol. 465. Information and Software Technologies* (pp.334-345). Springer. https://doi.org/10.1007/978-3-319-11958-8_27

Viana, W., Bringel Filho, J., Gensel, J., Villanova-Oliver, M., & Martin, H. (2008). PhotoMap: From location and time tocontext-aware photo annotations. *Journal of Location Based Services, 2*(3), 211-235. https://doi.org/10.1080/17489720802487956

Viana, W., Filho, J. B., Gensel, J., Oliver, M. V., & Martin, H. (2007). PhotoMap - automatic spatio temporal annotation for mobile photos. *In J.M. Ware & G. E. Taylor (Eds.), Lecture Notes in Computer Science: Vol. 4857. Web and Wireless Geographical Information Systems* (pp. 187-201). Springer. https://doi.org/10.1007/978-3-540-76925-5_14

Vicient, C., Sánchez, D., & Moreno, A. (2013). An automatic approach for ontology-based feature extraction from heterogeneous textual resources. *Engineering Applications of Artificial Intelligence, 26*(3), 1092-1106. https://doi.org/10.1016/j.engappai.2012.08.002

Virmani, C., Sinha, S., & Khatri, S. K. (2018). Unified ontology for data integration for tourism sector. Proceedings of the *2017 International Conference on Infocom Technologies and Unmanned Systems: Trends and Future Directions,* 152-156. IEEE. https://doi.org/10.1109/ICTUS.2017.8285995

Wakahara, T., Maki, T., Takahashi, K., Yamaguchi, A., Kimoto, S., Takagi, A., Ichifuji, Y., & Sonehara, N. (2016). Tourism local community system using LOD. *Proceedings of the 2016 10th International Conference on Complex, Intelligent, and Software Intensive Systems,* 332-336. IEEE. https://doi.org/10.1109/CISIS.2016.105

Wang, B., Liu, D., & Wong, S. (2012). A context information ontology hierarchy model for tourism-oriented mobile E-commerce. *Journal of Software, 7*(8), 1751-1758. https://doi.org/10.4304/jsw.7.8.1751-1758

Wang, C. (2018). An intelligent and context-aware touring system based on ontology. In C. Stephanidis (Eds.), *Communications in Computer and Information Science: Vol. 850. HCI International 2018 – Posters' Extended Abstracts.* Springer. https://doi.org/10.1007/978-3-319-92270-6_65

Wang, W., Zeng, G., & Tang, D. (2011). Bayesian intelligent semantic mashup for tourism. *Concurrency Computation Practice and Experience, 23*(8), 850-862. https://doi.org/10.1002/cpe.1676

Wardhana, H., Mustofa, K., & Sari, A. K. (2018). Utilization of semantic web rule language for tourism ontology. *Proceedings of the 3rd International Conference on Informatics and Computing,* 1-5. IEEE. https://doi.org/10.1109/IAC.2018.8780474

Yang, S. -Y., & Chen, K. -Y. (2020). Development of a cloud tourism supported platform with friendly interfaces based onlinked open data and big data analysis techniques. *Proceedings of the 2020 International Symposium on Computer, Consumer and Control,* 372-375. IEEE. https://doi.org/10.1109/IS3C50286.2020.00102

Yochum, P., Chang, L., Gu, T., & Zhu, M. (2020). Linked open data in location-based recommendation system on tourism domain: A survey. *IEEE Access, 8*, 16409-16439. https://doi.org/10.1109/aCCESS.2020.2967120

Yu, L., Wang, G., & Marcouiller, D. W. (2019). A scientometric review of pro-poor tourism research: Visualization and analysis. *Tourism Management Perspectives,* 30, 75–88. https://doi.org/10.1016/j.tmp.2019.02.005

Zhang, L., & Sun, X. (2018). *An interactive recommender system for group holiday decision-making.* In A. Marcus, & W. Wang (Eds.), *Lecture Notes in Computer Science, Vol. 10919. Design, User Experience, and Usability: Designing Interactions* (pp. 673-683). Springer. https://doi.org/10.1007/978-3-319-91803-7_50

Zhang, P., Du, J., Fan, D., & Zhou, Y. (2015). Automatic image semantic annotation based on the tourism domain ontological knowledge base.In H. Zha, X. Chen, L. Wang, & Q. Miao (Eds.), *Communications in Computer and Information Science, Vol. 547. Computer Vision* (pp. 61-69). Springer. https://doi.org/10.1007/978-3-662-48570-5_7

Zhang, W., Cao, H., Hao, F., Yang, L., Ahmad, M., & Li, Y. (2020). The chinese knowledge graph on domain-tourism. In J. Park, L. Yang, Y. S. Jeong, & F. Hao (Eds.), Lecture Notes in Electrical Engineering, vol 590. Advanced Multimedia and Ubiquitous Engineering (pp. 20-27). Springer, Singapore. https://doi.org/10.1007/978-981-32-9244-4_3

Zhang, X., Zhou, W., & Zhang, Y. (2012). Semantic sensor data integration based on cloud computing. *Advanced Science Letters, 7*, 103-106. https://doi.org/10.1166/asl.2012.2112

Zhang, X., Zhou, W., & Zhang, Y. (2013). Intelligent information management of tourist attractions based on semanticsensor web. In A. Ghose, H. Zhu, Q. Yu, A. Delis, Q. Z. Sheng, O. Perrin, J. Wang, Y. Wang (Eds.), *Lecture Notes in Computer Science: Vol. 7759. Service-Oriented Computing - ICSOC 2012 Workshops* (pp. 119-126). Springer. https://doi.org/10.1007/978-3-642-37804-1_13

Zhang, Z., Xu, G., Zhang, P., & Wang, Y. (2016). Personalized recommendation system based on WSN. *International Journal of Online Engineering, 12*(10), 91-96. https://doi.org/10.3991/ijoe.v12i10.6207

Zhao, S., Potdar, V., & Chang, E. (2007). A practical image retrieval framework for tourism industry. *Proceedings of the IEEE International Symposium on Industrial Electronics*, 2928-2932. IEEE. https://doi.org/10.1109/ISIE.2007.4375079

Zhu, Q., Kong, X., Hong, S., Li, J., & He, Z. (2015). Global ontology research progress: a bibliometric analysis. *Aslib Journal of Information Management*, 67(1), 27–54. https://doi.org/ 10.1108/ajim-05-2014-0061

Chapter 3: Data & Information Sources

The review of existing literature presented in Chapter 2 reveals that information about tourists' behavior, motivating factors, income patterns, opinions about destination image, service quality, comparative experience etc. are usually used to construct tourist profiles for use in tourism recommender systems. On the other hand, tourists use information about destination resources, accommodations, infrastructure, rental facilities, currency exchange, rules and regulations etc. for making tour plans. Organizations like World Travel & Tourism Council, United Nations World Tourism Organization provide specific information on tourism. Organizations like airline groups, marketing associations etc. that include private players, also provide specified information related to the components of tourism that they deal with. According to Fodness and Murray (1999) as cited in Hernández-Méndez et al. (2013), sources of tourism information have been mainly classified into the following: "Commercial Impersonal sources (for example, Brochures, Travel guides, Local tourist offices), Commercial Personal sources (for example, Clubs, Travel agencies), Non-commercial Impersonal sources (for example, Magazines, Newspapers) and Non-commercial Personal sources (for example, Friends and family, Personal experience)." In this chapter, data and information sources, vocabularies and standards that are relevant to tourism have been discussed.

3.1 Generic sources on tourism

Guide books have been serving as tourism information source since long. They are used by both tourists and service providers. Nowadays, people refer to travel blogs (for example, https://www.travelblog.org/) which are usually sources for learning about tour experiences. Word-of-mouth is also an important information source for tourists (Hernández-Méndez et al., 2013). Tour related information is available in social media networks (for example, travel related groups or state tourism pages in Facebook), where experiences, recommendations, packages, comparative evaluation etc. are available. Also, there are websites dedicated to tourism (for example, https://www.indianholiday.com/, https://www.tourmyindia.com/, http://india-tour.com/ etc.) that disseminate information on travel destinations. Online sources providing map based visualizations of the world (for example, https://www.citypopulation.de/en/world/bymap/, https://www.atlapedia.com/ etc.) or generic or comprehensive information like population, culture, flags, languages etc. about different locations of the world (for example, http://countrystudies.us/, http://geography-site.co.uk/, https://nationsonline.org/ etc.) or gazetteers (for

example, http://www.fallingrain.com/world/, https://gazetteer.org.uk/etc.) also can impart information to tourists. Examples of some of the sources have been discussed in this section.

World Travel Guide: Its print version has been in existence for a long time. It covers many popular travel destinations with details about ports, resorts, events. It is available in a lot of languages. The online portal is updated daily with tourism related news and interesting features. The brand is associated with Columbus Travel Media portfolio (https://www.worldtravelguide.net/about-us/).

Columbia Gazetteer of the World Online: It is an encyclopedia of geographical places and features (http://www.columbiagazetteer.org/static/about_gazetteer). The gazetteer is updated regularly and contains information on population, landscape alteration due to natural and man-made activities. Countries have been covered extensively irrespective of their size. The coverage can be typically grouped into the physical world (includes major geographical regions), the political world (includes oceans, mountains, deserts, volcanoes etc.) and special places (theme parks, natural reserves, ports, historic sites etc.).

TripAdvisor: Before becoming one of the most popular sources of reviews, TripAdvisor (https://www.tripadvisor.in/) used to provide information aggregated from different sources (Keates, 2007). At TripAdvisor visitors rate (using click buttons) and review (using free text) destinations which can be viewed publicly. Reviews in languages other than English can be read using translation. A lot of people study TripAdvisor reviews for learning about travel experiences of others (Keates, 2007).

3.2 Sources on accessible tourism

Information sources on accessible tourism are a little different from generic tourism information sources by virtue of their focus on accessibility features. Ideally, online sources on accessible tourism should adhere to the Web Content Accessibility Guidelines (https://www.w3.org/WAI/standards-guidelines/wcag/). The World Tourism Organization has recognized some of the organizations that are putting forward exceptional efforts to support accessible tourism. Some such sources have been listed here.

scandichotels.com: In addition to the options for exploring and booking the services offered by the Scandic hotel chain (https://www.scandichotels.com/), the website has travel guides and provides information on accessible destinations. The organization adheres to a common standard of accessibility measures followed across the chain of hotels (Scandic, 2012).

accesstraining.eu: It is a website for registering for e-learning course on accessible tourism that has been designed for destination managers. The course touches on important topics that can make staff capable of supporting disabled persons in overcoming barriers. The course is an outcome of research that identifies requirements of tourists with disabilities and the professional skills required for providing service. The research database of the ETCAATS project contains a variety of information and pedagogical materials on accessible tourism and can be accessed at https://www.etcaats.eu/?i=etcaats.en.etcaatslibrary.

quebecforall.com: This platform provides information on accessible destinations, activities, itineraries and supporting services in Quebec. It is a product of Kéroul (https://www.keroul.qc.ca/en/home.html), an organization that specializes in providing services to people with disabilities. Keroul is also behind the travel guide 'The Accessible Road' that provides information on tourist destinations, services and information offices in a way to support accessible tourism in Quebec (World Tourism Organization, 2016c).

Take Charge of Your Travel – A Guide for Persons with Disabilities: The Canadian Transportation Agency aims to support disabled persons with this guide by providing crucial accessibility related information required for different stages of tour planning and describing different types of accessible services (Canadian Transportation Agency, 2009 as cited in World Tourism Organization, 2016c).

sydneyforall.com: This website belonging to Destination New South Wales is a result of efforts made to understand the needs of disabled persons and develop accessible information systems. It enlightens visitors about accessibility conditions in Sydney on the basis of expert recommendations (https://sydneyforall.com/).

visitflanders.com/en/accessibility/index.jsp: This website contains information on accessible tours that can be undertaken in the Flanders region of Belgium. Designation labels have been used to distinguish destinations based on their support for accessibility. The website also contains brochures and other supporting materials (https://www.visitflanders.com/en/accessibility/index.jsp).

3.3 Data Standards and Vocabularies

Due to the complexity of the tourism domain because of the underlying linguistic and cultural differences, formulation of standard tourism definitions is very hard (Jentsch, 2005). The TourInFrance standard (TIF) standard for data exchange, a widely used standard in France stopped evolving and thus its users have transformed it in their own way suiting their own purpose and thereby data sharing using TIF has become non-interoperable (Soualah-Alila, 2015). The Open Travel

Alliance specification helps in defining XML Schema documents for the purpose of facilitating information exchange in the travel sector (OpenTravel Alliance, 2019). The Harmonise ontology was built to map different ontologies into a single ontology for supporting tourism but the Harmonise platform has been focusing only on the European standards and information systems (Dell'Erba, 2003). Though, Schema.org (schema.org/docs/full.html) contains various semantic tags but only tags related to Trips, Events, Place of Interest and other tourism concepts are relevant as is evident from existing literature on the domain. Chaves et al. (2012) have reused classes from DBpedia and Schema.org in an multilingual ontology, named Hontology for the accommodation sector. Şimşek et al. (2020) have proposed an approach for generating domain-specific patterns from the schema.org vocabulary by using operators implemented in SHACL syntax. Kärle et al. (2015) have studied the usage and application process of schema.org in the domain of hotels. For supporting sustainable travel and tourism, the Global Sustainable Tourism Council (https://www.gstcouncil.org/), registered in the USA has put forward standards and sets of criteria (one for policy-makers and destination managers and another for hotels and tour operators) that can be adapted locally. In this section, standards and vocabularies that are used in the tourism and geo-spatial domain have been discussed.

ISO 18513:2003: This standard by the International Organization for Standardization, defines terms related to accommodation related services in the tourism domain with the aim of establishing a common vocabulary between service providers and tourists (https://www.iso.org/standard/31812.html). The standard does not define complex terms or those terms which cannot be translated into all the languages used in the standard (Jentsch, 2005).

Thesaurus on Tourism & Leisure activities: The WTO's multilingual (Spanish, English and French) thesaurus (UNWTO, 2001) provides terminology for enabling standardization and interoperability at a global level. De Vita et al. (2017) have converted this thesaurus by following the Simple Knowledge Organization System.

European Union's INSPIRE Directive: The INSPIRE Directive provides a spatial data infrastructure for the environmental policies or activities of the European Union for facilitating policy-making, allowing public access and sharing of environmental spatial information. It is based on the infrastructures used by the member states of the European Union and contains 34 spatial data themes. The Directive was published in 2007 and is set to be fully implemented by 2021. The Directive is extensible so that it can support domain specific needs (Directive 2007/2/EC, 2007).

GeoSPARQL: The Open Geospatial Consortium has developed the GeoSPARQL standard for the purpose of representing and querying geospatial data on the Semantic Web (https://www.ogc.org/standards/geosparql). GeoSPARQL can support spatial reasoning and computations. The GeoSPARQL standard consists of modules that define RDFS/OWL classes, RDF properties, RDFS data types, topological query functions, RDF triple matching mechanism and rules for query rewriting (Open Geospatial Consortium, 2012).

General Transit Feed Specification: Public transit agencies can publish data by following this data specification so that different applications can consume it. The specification has a static and a real-time component. The static component is composed of routes, stops, fares, pathways etc. The real-time component is composed of prediction of arrivals, position of vehicles etc. The specification is very popular among public transport providers. Data publishers have to follow very specific instructions like saving files in comma-delimited format, taking care of case-sensitiveness etc. while publishing data using this specification (https://gtfs.org/).

GeoWordnet: GeoWordNet is a resource that has integrated WordNet and geo-spatial resources like GeoNames. It has used WordNet for adding semantics to the GeoNames feature classes. Other geospatial resources were also consulted and new concepts were introduced to the integrated knowledge base. The methodology was largely automatic with manual checking and involved evaluation by experts from the field of library science (Giunchiglia et al., 2010)

Getty Thesaurus of Geographic Names: It is a vocabulary that contains place names, alternative names, geographic coordinates and feature types. Different administrative features, physical features, archeological sites, lost settlements, etc. have been covered including entities from the historic period and also from the present time. The coverage is focused on places relevant to art, architecture and relevant disciplines (https://getty.edu/research/tools/vocabularies/index.html).

YAGO: The YAGO ontology was built using facts from Wikipedia that were unified with WordNet by performing automatic extraction and using rule-based and heuristic methods. YAGO uses individuals present in Wikipedia and the taxonomy of WordNet. Initially, YAGO contained 1 million entities and 5 million facts. In addition to the Is-A hierarchy other non-taxonomic relations also have been used (Suchanek et al., 2007). The YAGO knowledge base was extended to YAGO2 containing about 9.8 million entities and 447 million facts, with the addition of spatial and temporal dimension and the use of GeoNames (Hoffart et

al., 2013). YAGO3 extended YAGO by 1m new entities and 7m new facts by combining multilingual information from Wikipedia (Mahdisoltani et al., 2015).

Service Interface for Real time Information: SIRI is a CEN (Comité Européen de Normalisation) standard format based on Transmodel. 'Public Transport Reference Data Model' (EN 12896) or 'Transmodel' aims to help in establishing interoperability between the transport information processing systems (http://www.transmodel-cen.eu/). SIRI supports two types of information exchange. The first type consists of client's request message and producer's response message and the second type involves the scenario where the client subscribes to information by sending request and sensitivity criteria which is used to select messages for sending to the user until the subscription lasts (http://www.transmodel-cen.eu/standards/siri/). The SIRI XML Schemas contain specifications on the content of the XML documents that are the constituents of the messages. SIRI supports different services like vehicle monitoring, facility monitoring, timetable service etc. SIRI complements NETEx. NeTEx is also based on 'Transmodel' which facilitates the exchange of transport schedules and related data (http://netex-cen.eu/). SIRI is focused on supporting exchange of real time information while NetEx supports exchange of scheduled information (CEN TC278 WG3, 2006).

3.3 Data sources

It has been widely recognized that transparent and innovative approaches to data help in building trust and providing services in a cost effective manner. There are various sources that provide open data for example; https://www.data.gouv.fr/fr/ is a platform for French public data, https://www.tra.gov.au/ provides data on tourism in Australia. Some providers of data services like https://data.gov.uk/ were found to be taking special measures for accessibility. There are many studies that discuss aggregation of data from different sources for use in interdisciplinary domains like tourism. The SDI4Apps project aims to provide a cloud based infrastructure for data integration into applications and provide support for linking of spatial and non-spatial data according to the Linked Open Data principles, dealing with multilingualism of spatial data etc. (https://sdi4apps.eu/project-information/objectives/). Zanker et al. (2012) have integrated resources from geo-tagged resources for providing semantic recommendation services. Cimmino et al. (2018) have integrated data from different datasets like DBpedia, Wikidata and from datasets outside the Web of Data community for the purpose of disseminating information about festivals and events from not so popular regions in Spain. Patroumpas et al. (2019) have discussed about an ontology that helps in processing POI data from diverse sources and have also discussed about the open-source

software TripleGeo that helps in transforming POI data from heterogeneous sources and formats to RDF. Dorobăț and Posea (2021) have consolidated Romanian data sets while following the eCHO framework for cultural heritage and have developed a web application for viewing and creating tourist routes. A conceptual framework for integrating data from open government datasets of Thailand using geo-location data has been proposed by Budsapawanich (2018). Some of the popular and widely used data sources for building tourism applications have been discussed in this section.

India Tourism Statistics: It is published regularly by the Tourism Ministry of the Government of India. Based on a methodology developed by the Market Research Division, it provides statistical data on foreign tourist arrivals, foreign exchange earnings through tourism etc. using information aggregated from the World Tourism Organization, different divisions of the Tourism Ministry and different departments of the Government of India like the Bureau of Immigration, Archaeological Survey of India etc (Ministry of Tourism, 2020).

OpenStreetMap: The OpenStreetMap provides open data about roads, terminals, stations, buidling etc. which are demarcated using tags. A taxonomy of classes and objects representing real-world features is maintained to arrange the tags. The data is contributed and maintained by mappers, GIS professionals etc. and is entered as key-value pairs for the attributes of the features for the nodes and ways (Haklay & Weber, 2008). The data is verified using GPS devices, aerial imagery etc. for accuracy and keeping it updated. The data can be used by any application by giving due credit to the OpenStreetMap contributors (openstreetmap.org/about). Codescu et al. (2011) have created OSMOnto, an ontology of the OpenStreetMap tags.

INSPIRE Geoportal: Data provided by the European Union member states and members of the European Free Trade Association is centrally accessible through the INSPIRE Geoportal. The INSPIRE data sets can be searched and discovered using metadata and downloaded. The metadata is harvested from the European Union member states and members of the European Free Trade Association (https://inspire-geoportal.ec.europa.eu/).

LinkedGeoData: The information available in OpenStreetMap has been presented by LinkedGeoData as an RDF knowledge base of spatial data developed according to the Linked Data principles and linked with knowledge bases like DBpedia and GeoNames (Stadler et al., 2012). More than 3 billion nodes and 300 million ways have been reprsented resulting into approximately 20 billion triples (http://linkedgeodata.org/). The data is made available under the license used by

OpenStreetMap. The mapping information is stored in a relational database along with the OpenStreetMap and Ontology-based Data Access has been used to generate the RDF (http://linkedgeodata.org/docs/rdf-mapping.html).

GeoNames: It is a database of geo-spatial entities with huge coverage that includes geographical names, unique features, populated places and alternate names that can be freely downloaded under a creative commons attribution license (https://www.geonames.org/about.html). It integrates data from various sources like US Geological Survey (https://www.usgs.gov/), Pleiades (https://pleiades.stoa.org/), Census of India (https://www.censusindia.gov.in/), Natural Earth Data (https://www.naturalearthdata.com/), etc. The WGS84 (World Geodetic System 1984) system is followed for the lat/long coordinates. The features have been classified into feature classes which have been further classified into feature codes. GeoNames has been criticised for inconsistencies (Ahlers, D. 2013). Also, temporal information is not provided by GeoNames.

TourPedia: It provides information about attractions, points of interest etc. of Europe and currently covers places from London, Barcelona, Amsterdam, Dubai, Rome, Paris, Tuscany and Berlin (http://tour-pedia.org/about/). The RDF knowledge base of TourPedia has been built by extracting data from Booking.com, Facebook, Foursquare and Google Places, and is available as Places and Reviews datasets that can be accessed through a SPARQL endpoint or by using WebAPI. Gazzè et al. (2015) have provided an extensive discussion on TourPedia and have touched upon discovery of new relations among places using Named Entity Recognition tools.

data.culturaitalia.it: The platform makes the resources managed by the Italian culture portal ‘CulturaItalia’ mapped using the CIDOC-CRM ontology available as Linked Open Data that can be accessed through OAI-PMH, SPARQL, Fulltext (http://dati.culturaitalia.it/?language=it). CulturaItalia serves as an aggregator of Italian content for Europeana and plays a huge role in its development (Di Giorgio, 2014).

Pleiades: Pleiades provides a community-built map based gazetteer and graph of historical geographic information. The data is available in semantic web compliant formats like RDF, Turtle etc. The coverage includes authoritative information about ancient places from early medieval geography, the Greek and Roman world etc. The information can be reused under open license by applications focusing on humanities research. It does not provide terminological support (https://pleiades.stoa.org/).

Natural Earth Data: It provides map data sets containing integrated raster and vector data. The presented data contains embedded feature names ranked according to importance. The database is supported by the North American Cartographic Information Society (https://www.naturalearthdata.com/).

data.europa.eu: It is the official portal for European data on transport, regions and cities, environment etc. A SPARQL endpoint (https://data.europa.eu/sparql) also has been provided.

NASA's Socioeconomic Data and Applications Center: It is operated by Center for International Earth Science Information Network of Columbia University (sedac.ciesin.columbia.edu). It provides socioeconomic data and information on sustainability indicators, population distribution (on lat/long grid), infrastructure (roads, reservoirs, dams etc.), poverty, pollution etc. in different formats like vector, raster, tabular etc. (https://earthdata.nasa.gov/eosdis/daacs/sedac).

NASA Earth Observations: Image data captured by NASA's satellites available in formats like GeoTIFF, JPEG, PNG etc. have been made available for public use with the aim of enabling the visualizations of climate and environmental changes. The data has been categorized into atmosphere, energy, land, life and ocean and can be downloaded in CSV format and as floating point GEOTiff files. But the data provided is an approximation of original source data and is useful for basic analysis. Applications can use the datasets without the need of further permission by using the credit statements attached to the datasets or by giving credit to NASA Earth Observations (https://neo.sci.gsfc.nasa.gov/about/).

While consulting different data and information sources for this work, various barriers regarding their use in research were revealed that have been also mentioned in existing literature on the domain under consideration. The impediments were primarily encountered during data integration and during identification of concepts and representative terms with universal acceptance. For example, in India pin code is used whereas in foreign countries zip code is used. Around the world different currencies, different units of time are used. The classification of data may further vary depending on the categories used by the data providers. Most of the tourism websites do not present data in a semantic web compliant format. Lohvynenko and Nedbal (2019) have also noted similar findings where it has been displayed that just over half of the websites included in the corpus for the study use semantic web markup and only few websites use proper touristic annotation. Resources in the linked open data cloud present a different kind of inconsistencies in the data collection processes that are created due to

unrestrained evolution of knowledge bases in the linked open data cloud (Rashid et al. 2018).

Many information systems use schema developed for their own purpose and thereby ignore fundamental ontological principles (Das, 2018). While plenty of data providers are using the geographic coordinate system, projected coordinate systems were also found to be in use. Also different data formats are in use. For example, in India Tourism Statistics, data has been provided in tabular format which has to be processed before using. Trip Advisor ratings are represented using bubbles while the reviews are present in free-text. While accessing data about different countries, challenges due to multilingualism were encountered. For example, while gathering information and identifying concepts related to accessible tourism, the UNWTO's manuals on accessibility were opted for. But, it was found that Module II, III, IV of the manual (Organización Mundial del Turismo, 2015a, 2015b, 2015c) were available only in Español.

References:

Ahlers, D. (2013). Assessment of the accuracy of GeoNames gazetteer data. *Proceedings of the 7th workshop on geographic information retrieval.* 74-81. https://doi.org/10.1145/2533888.2533938

Budsapawanich, P., Anutariya, C., & Haruechaiyasak, C. (2018). A conceptual framework for linking open governmentdata based-on geolocation: A case of Thailand. In R. Ichise, F. Lecue, T. Kawamura, D. Zhao, S. Muggleton, K. Kozaki (Eds.), *Lecture Notes in Computer Science: Vol. 11341. Semantic Technology* (pp.352-366). Springer. https://doi.org/10.1007/978-3-030-04284-4_24

Canadian Transportation Agency (2009). *Take Charge of Your Travel – A Guide for Persons with Disabilities.* Minister of Public Works and Government Services Canada.

CEN TC278 WG3. (2006). SIRI-Service interface for Real-time Information CEN TS 15531 1-5 (SG7). http://www.transmodel-cen.eu/standards/siri/

Chaves, M. S., Freitas, L., & Vieira, R. (2012). Hontology: A multilingual ontology for the accommodation sector in thetourism industry. *Proceedings of the International Conference on KnowledgeEngineering and Ontology Development,* 149-154. https://doi.org/10.5220/0004107401490154

Cimmino, A., Mihindukulasooriya, N., Priyatna, F., & Rico, M. (2018). Linked-fiestas: A knowledge graph to promote cultural tourism in spain. In C. Pautasso, F. Sánchez-Figueroa, K. Systä & J. Murillo Rodríguez (Eds.), *Lecture Notes in Computer Science: Vol. 11153.* Current Trends in Web Engineering (pp. 202-205). Springer. https://doi.org/10.1007/978-3-030-03056-8_18

Codescu, M., Horsinka, G., Kutz, O., Mossakowski, T., & Rau, R. (2011). Osmonto-an ontology of openstreetmap tags. *State of the map Europe (SOTM-EU 2011)*. http://www.inf.unibz.it/~okutz/resources/osmonto.pdf

Cresci, S., D'Errico, A., Gazzé, D., Lo Duca, A., Marchetti, A., & Tesconi, M. (2014). Towards a DBpedia of tourism: The case of tourpedia. Paper presented at the *CEUR Workshop Proceedings, 1272*, 129-132. http://ceur-ws.org/Vol-1272/paper_106.pdf

Das, S. (2018). *Domain Modeling: Theory and Practice* [Doctoral dissertation, University of Trento]. http://eprints-phd.biblio.unitn.it/2877/

De Vita, E., Marcialis, I., Fadda, S. S., Farci, A., & Malagnini, G. L. (2017). Instrumenting the UNWTO's Thesaurus on Tourism & Leisure Activities for seamless adoption in the Web of Data. In J. Fernández, S. Hellmann (Eds.), *Proceedings of the Posters and Demos Track of the 13th International Conference on Semantic Systems - SEMANTiCS2017*. http://ceur-ws.org/Vol-2044/paper15

Dell'Erba, M., Fodor, O., Ricci, F., & Werthner, H. (2003). Harmonise: a solution for data interoperability. In J. L. Monteiro, P. M. C. Swatman, L.V. Tavares (Eds.), *IFIP — The International Federation for Information Processing: Vol. 105. Towards the Knowledge Society* (pp. 433-445). Springer. https://doi.org/10.1007/978-0-387-35617-4_28

Di Giorgio, S. (2014). Culturaitalia, the italian national content aggregator in europeana. *Procedia Computer Science, 38*, 40-43. https://doi.org/10.1016/j.procs.2014.10.008

Directive 2007/2/EC. *Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)*. European Parliament, Council of the European Union. https://eur-lex.europa.eu/eli/dir/2007/2/oj

Dorobăț, I. C., & Posea, V. (2021). The usability of romanian open data in the development of tourist applications. In M. Ioannides, E. Fink, L. Cantoni, E. Champion (Eds.), *Lecture Notes in Computer Science: Vol. 12642. Digital Heritage: Progress in Cultural Heritage: Documentation, Preservation, and Protection* (pp. 596-602). Springer. https://doi.org/10.1007/978-3-030-73043-7_51

Fodness, D., & Murray, B. (1999). A model of tourist information search behavior. *Journal of Travel Research*, 37(3), 220–230. https://doi.org/10.1177/004728759903700302

Gazzè, D., Duca, A. L., Marchetti, A., & Tesconi, M. (2015). An overview of the tourpedia linked dataset with a focus on relations discovery among places. *Proceedings of the 11th International Conference on Semantic Systems*, 157-160. https://doi.org/10.1145/2814864.2814876

Giunchiglia, F., Maltese, V., Farazi, F., & Dutta, B. (2010). GeoWordNet: A Resource for Geo-spatial Applications. In L. Aroyo, G. Antoniou, E. Hyvönen, A. t. Teije, H.

Stuckenschmidt, L. Cabral & T. Tudorache (Eds.), *Lecture Notes in Computer Science: Vol. 6088. The Semantic Web: Research and Applications* (pp. 121-136). Springer. https://doi.org/10.1007/978-3-642-13486-9_9

Haklay, M., & Weber, P. (2008). Openstreetmap: User-generated street maps. *IEEE Pervasive computing, 7*(4), 12-18. https://doi.org/10.1109/MPRV.2008.80

Hernández-Méndez, J., Muñoz-Leiva, F., & Sánchez-Fernández, J. (2013). The influence of e-word-of-mouth on travel decision-making: Consumer profiles. *Current Issues in Tourism, 18*(11), 1001–1021. https://doi.org/10.1080/13683500.2013.802764

Hoffart, J., Suchanek, F. M., Berberich, K., & Weikum, G. (2013). YAGO2: A spatially and temporally enhanced knowledge base from Wikipedia. *Artificial Intelligence, 194*, 28–61. https://doi.org/10.1016/j.artint.2012.06.001

Jentsch, A. (2005). *Tourism Standards*. XML Clearinghouse. http://195.130.87.21:8080/dspace/bitstream/123456789/632/1/Tourism%20standards.pdf

Kärle, E., Fensel, A., Toma, I., & Fensel, D. (2015). Schema.org usage for hotels: An analysis based on the web datacommons data set. *CEUR Workshop Proceedings, 1481,* 75-78. http://ceur-ws.org/Vol-1481/paper24.pdf

Keates, N. (2007). Deconstructing TripAdvisor. *Wall Street Journal*, https://www.wsj.com/articles/SB118065569116920710.

Lohvynenko, C., & Nedbal, D. (2019). Usage of semantic web in austrian regional tourism organizations. In M. Acosta, P. Cudré-Mauroux, M. Maleshkova, T. Pellegrini, H. Sack, Y. Sure-Vetter (Eds.), *Lecture Notes in Computer Science, Vol. 11702. Semantic Systems: The Power of AI and Knowledge Graphs* (pp. 3-18). Springer. https://doi.org/10.1007/978-3-030-33220-4_1

Mahdisoltani, F., Biega, J., & Suchanek, F. (2015). Yago3: A knowledge base from multilingual wikipedias. *Proceedings of 7th biennial conference on innovative data systems research* (*CIDR 2015).*

Ministry of Tourism (2020). *India Tourism Statistics 2020*. Government of India. https://tourism.gov.in/market-research-and-statistics

Open Geospatial Consortium. (2012). *OGC GeoSPARQL - A Geographic Query Language for RDF Data* (Project reference no. OGC 11-052r4). http://www.opengis.net/doc/IS/geosparql/1.0

OpenTravel Alliance. (2019). *OpenTravel Alliance message specifications* (2019A-2.0Version). http://www.opentravelmodel.net/pubs/specifications/Specifications.html

Organización Mundial del Turismo (2015a), *Manual sobre Turismo Accesible para Todos:Principios, herramientas y buenas prácticas – Módulo II: Cadena de accesibilidad y recomendaciones*, OMT. https://www.e-unwto.org/doi/pdf/10.18111/9789284416509

Organización Mundial del Turismo (2015b), *Manual sobre Turismo Accesible para Todos:Principios, herramientas y buenas prácticas – Módulo III: Principales áreas de intervención*, OMT. https://www.e-unwto.org/doi/pdf/10.18111/9789284416523

Organización Mundial del Turismo (2015c), *Manual sobre Turismo Accesible para Todos: Principios, herramientas y buenas prácticas – Módulo IV: Indicadores para el estudio de la accesibilidad en el turismo*, OMT. https://www.e-unwto.org/doi/pdf/10.18111/9789284416547

Patroumpas, K., Skoutas, D., Mandilaras, G., Giannopoulos, G., & Athanasiou, S. (2019). Exposing points of interest as linked geospatial data. *Proceedings of the 16th International Symposium on Spatial and Temporal Databases*, 21-30. https://doi.org/10.1145/3340964.3340976

Rashid, M., Rizzo, G., Torchiano, M., Mihindukulasooriya, N., & Corcho, O. (2018). Knowledge base evolution analysis: Acase study in the tourism domain. In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.) *Lecture Notes in Computer Science, Vol. 11153. Current Trends in Web Engineering* (pp.268-278). Springer. https://doi.org/10.1007/978-3-030-03056-8_26

Scandic (2012). Scandic's Accessibility Standard. Scandic. https://www.accessibletourism.org/resources/scandics-accessibility-standard_2012_en.pdf.

Şimşek, U., Angele, K., Kärle, E., Panasiuk, O., & Fensel, D. (2020). Domain-specific customization of schema.org basedon SHACL. In J. Z. Pan, V. Tamma, C. d'Amato, K. Janowicz, B. Fu, A. Polleres, O, Seneviratne & L. Kagal (Eds.), *Lecture Notes in Computer Science, Vol. 12507. The Semantic Web – ISWC 2020* (pp.585-600). Springer. https://doi.org/10.1007/978-3-030-62466-8_36

Soualah-Alila, F., Faucher, C., Bertrand, F., Coustaty, M., & Doucet, A. (2015). Applying semantic web technologies forimproving the visibility of tourism data. *Proceedings of the 2015 Workshop on Exploiting Semantic Annotations in Information Retrieval*, 5-10. https://doi.org/10.1145/2810133.2810137

Stadler, C., Lehmann, J., Höffner, K., & Auer, S. (2012). Linkedgeodata: A core for a web of spatial open data. *Semantic Web, 3*(4), 333-354. https://dl.acm.org/doi/10.5555/2590208.2590210

Suchanek, F. M., Kasneci, G., & Weikum, G. (2007). Yago: a core of semantic knowledge. *Proceedings of the 16th international conference on World Wide Web*, 697-706. https://doi.org/10.1145/1242572.1242667

UNWTO. (2001). *Thesaurus on Tourism & Leisure Activities (Trilingual: English, French, Spanish)*. World Tourism Organization. https://www.e-unwto.org/doi/book/10.18111/9789284404551

World Tourism Organization (2016c). *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module V: Best Practices in Accessible Tourism*. UNWTO.

Zanker, M., Jessenitschnig, M., & Stromberger, M. (2012). Harnessing geo-tagged resources for web personalization. *Proceedings of the 27th Annual ACM Symposium on Applied Computing*, 332-339. https://doi.org/10.1145/2245276.2245342

Chapter 4: Domain Study

For the purpose of constructing domain models (like those discussed in Chapter 5), a thorough study of the concepts belonging to the domain is required so that information required for structuring the domain model is at hand. Concepts and their interrelationships in totality represent a domain. The contextual definition and usage of the terms representing the concepts can be obtained from authoritative resources relevant to the domain. Domain knowledge is stored along different levels viz. lexical level (representation in natural language), lexico-semantic level (relations), conceptual and representational level (abstract representation), ontology level and raw data level (Das, 2018). In this chapter, a discussion on some of the basic concepts belonging to tourism and allied domains has been presented. The discussion has been supplemented by definitions that have been taken from different sources (discussed in detail in Chapter 3), that are relevant to the tourism domain.

4.1 Accessible Tourism Domain

Accessible tourism refers to the tailoring of tourism services and environment for enabling access and enjoyment by all tourists (World Tourism Organization, 2016a). One of the earliest definitions of 'Accessible Tourism' that covers different dimensions of access has been provided by Darcy (2006) who has described it as "A process of enabling people with disabilities and seniors to function independently and with equity and dignity through the delivery of Universal Tourism products, services and environments". The Economic and Social Commission for Asia and the Pacific (2009) in the Takamaya Declaration has provided a more comprehensive and inclusive definition that states that "Accessible Tourism is tourism and travel that is accessible to all people, with disabilities or not, including those with mobility, hearing, sight, cognitive, or intellectual and psychosocial disabilities, older persons and those with temporary disabilities." Disabled people or those with special needs for example, seniors and children constitute a big proportion of travelers and so accessible measures are very important. This has been advocated by the Article 7 of the UNWTO Global Code of Ethics for Tourism that states that the right to enjoy tourism should be available to all persons (World Tourism Organization, 2016a). Regarding accessible tourist destinations, the UNWTO gives importance to those destinations where the destination managers make special efforts so that the destinations can be enjoyed regardless of tourists' abilities. Spain, Portugal, Japan have been making exemplary progress in making destinations accessible. From India, Thrissur has got

recognition among the accessible tourism destination by UNWTO and the ONCE Foundation (World Tourism Organization, 2020). Meanings and definitions of some of the concepts belonging to tourism in general and accessible tourism in particular have been provided below.

Forms of tourism: Tourism is usually classified into three forms, namely, outbound tourism, inbound tourism and domestic tourism that are further combined into different forms, for example, international tourism, national tourism and internal tourism (https://www.unwto.org/glossary-tourism-terms).

Destination: The main destination of a tourism trip has been defined by the UNWTO (2010), "as the place visited that is central to the decision to take the trip. However, if no such place can be identified by the visitor, the main destination is defined as the place where he/she spent most of his/her time during the trip. Again, if no such place can be identified by the visitor, then the main destination is defined as the place that is the farthest from the place of usual residence." (p.13)

Visitor: A visitor can be classified as a type of traveller. A visitor has been defined by the UNWTO (2010) as "a traveller taking a trip to a main destination outside his/her usual environment, for less than a year, for any main purpose (business, leisure or other personal purpose) other than to be employed by a resident entity in the country or place visited." (p.10)

Tourist: If a trip by a visitor includes an overnight stay, then the visitor can be classified as a tourist and otherwise the visitor is to be classified as an excursionist (UNWTO, 2010, p.10).

Traveller: One moving between geographical locations for any duration and for any purpose may be classified as a traveller (UNWTO, 2010, p.9). Thus, tourism can be said to be a subset of travel (UNWTO, 2010, p.10).

Activity/activities: The term 'activities' has been used to "represent the actions and behaviors of people in preparation for and during a trip in their capacity as consumers" (UNWTO, 2010, p.1). Travel is an activity that is undertaken by travelers.

Disabled person: A disabled person is "Any person whose full and effective participation in society on an equal basis with others in travel, accommodation and other tourism services is hindered by the barriers in the environment they are in and by attitudinal barriers" (World Tourism Organization, 2013).

Universal Design: For achieving accessibility, the World Tourism Organization (2016b) has advocated the usage of "Universal Design", a term coined by Ronald

L. Mace, that has been defined by the United Nations Organization (2006) as "The design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal Design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed."

Interpreter: An interpreter is "a person who interprets, especially one who translates speech orally or into sign language" (Oxford University Press, 2010, p.915). The task of interpretation in tourism is to reveal the significances and meanings associated with destinations to impart learning and encourage sustainable behavior (https://www.gdrc.org/uem/eco-tour/t-glossary.html).

4.2 Geospatial Domain

The subject 'Geography' is the core of the geospatial domain. Terrestrial and/or aquatic region separated by administrative purpose (e.g. Country, State) or classified based on the earth's vegetation pattern (e.g. Alpine region, savanna region, tundra region) or region filled with water (e.g. sea region) can be classified as a geographical region. Discussions on global issues like population surge, greenhouse gas emission, climate change, urban planning, disaster management etc. include geographical parameters. Spatial data has a lot of economic importance. It helps in modeling and visualization of real world systems and their interactions. Increased dependence on map based services speaks about the importance of the geospatial domain. In addition to tourism, the geospatial domain has applications in many other domains like traffic management, goods delivery management, urban planning and development, waste management, real estate management etc. The conceptualization of geospatial entity depends on the context, scenario, purpose and intended use in an application. Meanings and definitions of some of the concepts belonging to the geospatial domain have been discussed in this section in the context of tourism.

Spatial object or Geographical feature (ISO 19100): A spatial object has been defined as "an abstract representation of a real-world phenomenon related to a specific location or geographical area" (Directive 2007/2/EC, 2007).

Coordinate reference systems: They have been defined as "Systems for uniquely referencing spatial information in space as a set of coordinates (x, y, z) and/or latitude and longitude and height, based on a geodetic horizontal and vertical datum" (Directive 2007/2/EC, 2007).

Administrative unit: Administrative or territorial division refers to set of districts defined for administrative purposes. It can be defined as "Units of administration,

dividing areas where Member States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries" (Directive 2007/2/EC, 2007). For example, Country (e.g. India), District (e.g. Hooghly), City (e.g. Serampore) are administrative units. Administrative data supports the implementation of administrative regulations (https://www.unwto.org/glossary-tourism-terms).

Protected site: It is described as an "Area designated or managed within a framework of international, Community and the Member States' legislation to achieve specific conservation objectives" (Directive 2007/2/EC, 2007). International Union for Conservation of Nature (IUCN) is an international body that has devised categories for classifying protected sites from all over the world (https://www.iucn.org/).

Bio-geographical region: Bio-geographical regions are "areas of relatively homogeneous ecological conditions with common characteristics" (Directive 2007/2/EC, 2007).

Habitats and Biotopes: Habitats and biotopes have been defined as "Geographical areas characterized by specific ecological conditions, processes, and (life support) functions that physically support the organisms that live there. Includes terrestrial, freshwater and marine areas distinguished by geographical, biotic and abiotic features, whether entirely natural or semi-natural" (Directive 2007/2/EC, 2007). Examples include savannah (terrestrial habitat), reefs (marine habitat) etc.

Natural Risk Zone: Natural Risk Zones are "Vulnerable areas characterized according to natural hazards (all atmospheric, hydrologic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society) e.g. floods, landslides and subsidence, avalanches, forest fires, earthquakes, volcanic eruptions" (Directive 2007/2/EC, 2007). For example, India's north-east includes several earthquake prone-areas (https://www.mapsofindia.com/maps/india/natural-hazard.htm).

4.3 Transportation

Transportation is the movement of beings and things from one location to other using vehicles such as bus, tram etc. that aid the process of transportation. Transportation network includes spatial network that supports the movement of vehicles or commodity. Transportation operations like passenger exchange, service booking etc., transportation infrastructure like roadways, railways, waterways, terminals, stations etc. are important constituents of transportation network. Public transportation data that includes frequency and availability of services, timetable,

travel pattern etc. is very important in this domain. Domain modeling approaches aim to help people choose from various types of transportation services according to their purpose and also aim to link transportation services with information on allied services. Various transport recommender applications exist in this domain. Some applications recommend travel options from a mix of transport while some provide recommendations based on a specific mode of transport. Public and private transport that can be used for the purpose of tourism fall within the scope of this work barring other modes of transport which are solely used for transporting goods. Some concepts related to transportation that are relevant to tourism have been discussed in this section.

Point: The most basic entity of a transport network is a point that denotes the location of stop points (http://www.transmodel-cen.eu/tutorials/common-concepts/).

Link: Links connect points (start point and end point set limits to a link) and contain spatial information (http://www.transmodel-cen.eu/tutorials/common-concepts/). A set of points and links form a sequence of links that help in the modeling of a transport network.

Airport/Heliport: According to the INSPIRE glossary an airport is "A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft/helicopters" (https://inspire.ec.europa.eu/glossary/Airport_Heliport).

Bridge: A bridge has been defined in the INSPIRE glossary as "A man-made structure spanning and providing passage over a body of water, depression, or other obstacles" (https://inspire.ec.europa.eu/glossary/Bridge).

4.4 Place-making

'Place' is mostly referred based on a sense of place and social attributes of place identity rather than on geometry. Place-making refers to the creation of livable and enjoyable places (Wyckoff, 2014). The concept originates from sources that describe parks, squares, water-fronts as contributors to quality of urban life (Sofield et al., 2017). The spelling 'place-making' (from among other variants like placemaking/ place making) has been mostly used to refer to this concept (Lew, 2017). Researchers from geography, planning, social anthropology etc. are contributors to discussions on place-making (Friedmann, 2010). Links between people and places can be solidified through place-making (https://www.pps.org/article/what-is-placemaking) thereby, helping in re-imagination of public spaces. Place-making can be seen as socio-spatial

relationships forming a network with a common frame of place (Pierce et al., 2011). Through people centered place-making, old places can be extensively reimagined (Friedmann, 2010). Tourism can drive urban development while contributing to place-making but there is a considerable gap in research in this area (Dupre, 2019).

In addition to the domains discussed above in this chapter, the tourism domain intersects with the domain of food. Tourists are usually interested in different types of cuisines that are often referred as a particular way of cooking food and are associated with different geographical regions of the world. Tourism also intersects with the accommodation sector. For providing accessible accommodation, special features such as designated parking spots, electrical sockets for charging electric wheelchairs, appropriate signage, wheelchair accessible cloakrooms etc. are required to be incorporated (Scandic, 2012).

References:

Darcy, S. (2006). *Setting a Research Agenda for Accessible Tourism*. Cooperative Research Centre for Sustainable Tourism.

Das, S. (2018). *Domain Modeling: Theory and Practice* [Doctoral dissertation, University of Trento]. http://eprints-phd.biblio.unitn.it/2877/

Directive 2007/2/EC. *Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)*. European Parliament, Council of the European Union. https://eur-lex.europa.eu/eli/dir/2007/2/oj

Dupre, K. (2019). Trends and gaps in place-making in the context of urban development and tourism: 25 years of literature review. *Journal of Place Management and Development*, 12(1), 102-120. https://doi.org/10.1108/JPMD-07-2017-0072.

Economic and Social Commission for Asia and the Pacific. (2009). *Takayama Declaration on the Development of Communities-for-All in Asia and the Pacific.* https://www.accessibletourism.org/resources/takayama_declaration_top-e-fin_171209.pdf

Friedmann, J. (2010). Place and place-making in cities: a global perspective. *Planning Theory and Practice*, 11(2), 149-165. https://doi.org/10.1080/14649351003759573.

Lew, A.A. (2017). Tourism planning and place making: place-making or placemaking? Tourism Geographies, 19(3), 448-466, https://doi.org/10.1080/14616688.2017.1282007.

Oxford University Press. (2010). Interpreter. In *Oxford Dictionary of English*. (3rd ed., p. 915)

Pierce, J., Martin, D.G., & Murphy, J.T. (2011). Relational place-making: the networked politics of place. *Transactions of the Institute of British Geographers*, 36(1), 54-70. https://doi.org/10.1111/j.1475-5661.2010.00411.x.

Scandic. (2012). Scandic's Accessibility Standard. Scandic. https://www.accessibletourism.org/resources/scandics-accessibility-standard_2012_en.pdf.

Sofield, T., Guia, J., & Specht, J. (2017). Organic 'folkloric' community driven place-making and tourism. *Tourism Management*, 61, 1-22. https://doi.org/10.1016/j.tourman.2017.01.002.

United Nations Organization. (2006). *Convention on the Rights of Persons with Disabilities.* https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html

UNWTO. (2010). *International Recommendations for Tourism Statistics 2008.* United Nations Publication. https://unstats.un.org/unsd/publication/Seriesm/SeriesM_83rev1e.pdf

World Tourism Organization. (2016a). *Accessible Tourism for All: An Opportunity within Our Reach*. UNWTO.

World Tourism Organization. (2016b). *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module I: Accessible Tourism – Definition and Context*. UNWTO.

World Tourism Organization (2020, January 24). *UNWTO and fundación once deliver international recognition of 'accessible tourist destinations' at fitur* [Press Release]. https://www.unwto.org/unwto-and-fundacion-once-deliver-international-recognition-of-accessible-tourist-destinations-at-fitur

World Tourism Organization. (2013). *UNWTO Recommendations on Accessible Tourism for All.* UNWTO.

Wyckoff, M.A. (2014). Definition of placemaking: four different types. *Planning and Zoning News*, 32(3), 1-10. https://www.canr.msu.edu/uploads/375/65814/4typesplacemaking_pzn_wyckoff_january2014.pdf.

Chapter 5: Domain Models

Among all types of Knowledge Organization Systems, ontologies by virtue of semantic richness are the most evolved (Biagetti, 2020). Ontology based models are highly suitable for systems where multiple agents are involved and are required to cooperate (Biagetti, 2020). This is because ontology based models are highly efficient in supporting machine-to-machine communication and data exchange (Zeng, 2019). Chakraborty et al. (2010) have demonstrated that ontology based knowledge management systems perform better than data based knowledge management systems. If the size of data is huge and there are huge numbers of joined variables, the complexity of queries increases in case of relation databases and decreases in case of ontologies (Choksuchat and Chantrapornchai 2010). So after consideration of these factors, ontology has been chosen as the preferred tool for constructing the domain models for this study. The decision also stems from the findings of Chapter 2 that show that ontology has been the most preferred technology for construction of domain models in tourism.

McCarthy (1980) was probably one of the first to use the term 'ontology' in the field of Artificial intelligence. The potential relevance of ontology in the field of knowledge engineering has been observed by Guarino (1995). Principles of ontology construction have been discussed by (Gruber 1995) and also during this time the uses of ontology for purposes like knowledge representation (Guarino 1995), knowledge management (Kietz et al. 2000) was observed. Since then research on ontology has continued. Berners-Lee, et al. (2001) had introduced the Semantic web in 2001 and as has been observed by Zhu et al. (2015) articles on ontology research have registered a huge count since then.

In Neches et al. (1991) it has been stated that "An ontology defines the basic terms and relations comprising the vocabulary of a topic area as well as the rules for combining terms and relations to define extensions to the vocabulary." Gruber (1993) had observed that "An ontology is an explicit specification of a conceptualization." Uschold and Gruninger (1996) have observed that "An ontology necessarily entails or embodies some sort of world view with respect to a given domain. The world view is often conceived as a set of concepts (e.g. entities, attributes, processes), their definitions and their inter-relationships; this is is referred to as a conceptualisation." Guarino (1998) has defined ontology as "a logical theory accounting for the intended meaning of a formal vocabulary, i.e. its ontological commitment to a particular conceptualization of the world." Studer et

al. (1998) has added to Gruber's (1993) definition stating that "An ontology is a formal, explicit specification of a shared conceptualisation."

According to Noy and McGuinness (2001), there is no single correct ontology development methodology. There exist different methodologies for construction of ontologies. The methodology of the TOVE (TOronto Virtual Enterprise) project ontology discussed in Gruninger and Fox (1995) involves describing scenarios, competency question formulation, specification of axioms, stating conditions such that solutions to the questions can be provided. Guidelines for developing and managing ontologies have been provided by the IDEF5 project (Benjamin et al., 1994). The SENSUS-based methodology involves collection of terms (referred as seed) and linking them to SENSUS, inclusion of concepts found in the path from seed to root, checking of nodes with large number of paths for adding entire sub-tree (Knight et al., 1995). The METHONTOLOGY methodology involves specification, acquisition of knowledge, conceptualization, integration, implementation, evaluation, documentation (Fernandez-Lopez et al., 1997).The steps in Uschold and Gruninger's (1996) methodology for ontology construction involves the identification of purpose and scope, defining the key concepts and relationships, coding of the ontology using a representation language, integration of existing ontologies, evaluation, preparation of documentation and guidelines for each phase. Grüninger & Fox's (1995) methodology demonstrates the use of competency questions for the design and evaluation of ontologies. Noy and McGuinness's (2001) step by step methodology for ontology construction emphasizes on ontology reuse and delineates important steps starting from determination of the scope of an ontology to creation of classes, properties and instances in the ontology. Chaware and Rao's (2010) methodology involves defining scenarios, questions and answer module formulation, term extraction, ontology construction using top-down approach. For the purpose of this study, primarily facet based domain modeling methodologies (see section 5.1 below) were followed, while also taking inspiration from the above mentioned methodologies.

5.1 Facet based domain modeling

A set of isolates ideas that have been identified using a single train of characteristics is called a facet (Ranganathan, 1957). A facet has been defined in various ways based on how it has been interpreted (Hudon, 2020).The identification of homogeneous, mutually exclusive facets from a given field of knowledge by using a single division characteristic is called Facet analysis (Vickery, 1960). According to the ALA Glossary of Library and Information Science, it is the analysis done for determining a subject's fundamental

characteristic (Levine-Clark & Carter, 2013). Hjørland (2013) has termed it as a logical approach to organize knowledge. Ranganathan's approach to faceted classification has been found suitable for organization and retrieval of online content (Hudon 2020, p.329). Ranagnathan's (1987) analytico-synthetic approach consists of the analysis step that consists of fragmenting compound and complex ideas into fundamental ideas. The characteristics of these fundamental ideas are analyzed and then they are grouped or clustered according to similarity. The second step, known as the synthesis phase consists of establishing semantic relationships between the concepts belonging to the domain. From Colon Classification's 4th edition the description of facets provided by Ranganathan became generic (Kashyap, 2003; Satija, 2017). DeGrolier (1962) has extensively discussed about different facet categories used in classification and coding. The efficacy of Ranganathan's methods centering facets for dealing with digital content has been recognized by contemporary researchers (Hudon, 2020, p. 329). Subsequently, different facet categories have been proposed based on modern day requirements that are inspired from Ranganathan's facet categories. Ranganathan's facet categories and categories proposed by other researchers which have been used for knowledge organization has been presented in Table 2.

Facet categories	Proposed by
Personality, Matter, Energy, Space, Time	Ranganathan (1952)
Substance (product), Organ, Constituent, Structure, Shape, Property, Object of action (patient, raw material), Action, Operation, Process, Agent, Space, Time	Vickery (1960)
Field of study, System, Environment, Specials, Object of study, Kinds/Parts of object, Properties of object, Action on the object, Kind of action, Method of action, Agent of action, Instrument of action, Space, Space qualifier, Time, Time qualifier	Ranganathan (1987, pp. 49–51) as cited in Satija (2017)
Domain, Entity, Property, Action and modifier	Bhattacharyya (1975)
Domain, Entity, Relation, Attribute	Giunchiglia and Dutta (2011), Giunchiglia et al. (2014)
set of classes, entities, binary relations, attributes	Giunchiglia et al. (2012)
Domain, Concept, Hierarchical relation, Property	Madalli et al. (2017)
thing/entity, kind, part, property, material, process, operation, patient, product, by-product, agent, space, time	Classification Research Group as cited in (Hudon, 2020, p. 327; Giunchiglia and Dutta, 2011)

Table 2: Facet categories

Broughton (2006) has commented on the efficacy of faceted classification in information retrieval. Faceted classification has been widely used for the purpose of constructing ontologies. An ontology for the identification and categorization of concepts has been built based on faceted classification by Prieto-Díaz (2003). The ontologies discussed in Giunchiglia (2009), Dutta et al. (2011), Giunchiglia et al. (2012) have been constructed on the geo-spatial domain with reference to Ranganathan's approach to faceted classification. An ontology for earthquake engineering research projects and experiments has been developed by Hasan et al. (2015) using the faceted approach to classification. A domain ontology for the field of library and information science has been developed by Ghosh and Panigrahi (2015) primarily based on the 7th edition of the Colon Classification (Ranganathan, 1987) while also using the Dewey Decimal Classification (23rd edition) (Dewey, 2011) and the standard edition of Universal Decimal Classification (Universal Decimal Classification, 2005). The YAMO methodology discussed in Dutta et al. (2015) also demonstrates the use of Ranganathan's vision of the faceted approach to classification and has been exemplified by constructing an ontology on the food domain. The methodology delineates steps for ontology construction that include knowledge acquisition, knowledge formulation, knowledge production, knowledge ordering, knowledge modeling, knowledge formalization, evaluation etc. among others. With reference to Ranganathan's approach to faceted classification, Das and Roy (2016) have presented an ontological model on the domain of brain tumor and Naskar and Das (2019) have developed an ontology on the human nervous system disorders using the standard vocabularies of the medical domain. Ghosh et al. (2020) have demonstrated the construction of a tourism ontology using a combination of Ranaganathan's faceted approach to classification and the theory of Selective Dissemination of Information for dealing with context.

For the purpose of classifying the entities belonging to the respective domains, most of the ontology construction methodologies (for example, Dutta et al. (2011), Ghosh and Panigrahi (2015), Dutta et al. (2015), Ghosh et al. (2020)) based on Ranganathan's vision of faceted classification have referred to the Canons of Characteristics which contains four canons as has been described in Ranganathan (1957) as, the Canon of Differentiation stating that "A characteristic used as the basis for the classification of a universe should differentiate some of its entities-that is, it should give rise at least to two classes or ranked isolates", the Canon of Relevance stating that "A characteristic used as the basis for the classification of a universe should be relevant to the purpose of the classification", the Canon of Ascertainability stating that "A characteristic used as the basis for the classification of a universe should be definite and ascertainable" and the Canon of Permanence

stating that “A characteristic used as the basis for the classification of a universe should continue to be unchanged so long as there is no change in the purpose of classification.”

In the next two sections of this chapter, an ontology based model of the accessible leisure tourism domain has been discussed in section 5.2 and the domain model discussed in section 5. 3 is for organizing reviews. In addition to the varied types of ontology development strategies discussed in the thesis, the ontology construction methodologies of the domain models discussed in the sections 5.2 and 5.3 have been primarily influenced by facet based domain modeling discussed in this section. Further, in case of both the domain models, the process of ontology construction has been guided by Gangemi et al.’s (2002) discussion on DOLCE and the ontologies have been mapped with the DOLCE+DnS Ultralite (DUL) ontology (http://www.ontologydesignpatterns.org/ont/dul/DUL.owl).

5.2 Domain model of accessible leisure tourism

Starting in 1980 with the Manila declaration, the vision of UNWTO for providing accessible tourism has developed with time and specific recommendations related to it has been documented in the document ‘Accessible Tourism for All’ (World Tourism Organization and Fundación ACS, 2015). Not only disabled people but any kind of tourists going through difficulty in availing tourism services, for example children, pregnant women, old people etc. are a potential target to whom ‘Accessible Tourism’ initiatives intend to lend support (World Tourism Organization, 2016b). The barriers to Accessible Tourism that have been summarized by World Tourism Organization (2016b) are inaccessible websites, environment, terminals, transportation boarding, buildings and facilities, tourism resources and activities, inept staff, lack of signage, information systems etc.

Several domain models and frameworks for supporting accessible tourism exist. Kehagias et al. (2008) have demonstrated an ontology based architecture that annotates web services for discovery and retrieval with the aim of aiding mobility impaired users. An ontology based system for providing information service to people with special needs has been designed by Alonso et al. (2012). Batouche et al.’s (2012) system provides travel plan recommendation based upon an user profile ontology and a tourism ontology, where both the ontologies contain provisions for elderly people. Scarinci and Myers (2014) have proposed a semantic web framework that aggregates different sustainable lodging management practices in the USA. In the framework, the relationship between management practices and accreditation criteria of the tourism standards have been made explicit using a combination of ontologies. Liu et al. (2016) have used linked data

technologies for providing tourism information to disabled people. Brodeala's (2020) work discusses a system for recommending accessible tourism destinations for supporting trip planning by people with disabilities. Taking inspiration from these studies, an ontology based domain model for the purpose of supporting accessible leisure tourism has been constructed. The methodology of ontology construction is primarily inspired from the facet based domain modeling methodologies discussed in section 5.1.

5.2.1 Methodology

Data collection about accessible tourism usually surrounds study of behavior of tourists, impact on economy due to accessibility and status of tourism services and infrastructure regarding accessibility (World Tourism Organization, 2016c). Disability in people has been mainly identified by the World Health Organization (2001) based on capacities (Physical, Sensory and Intellectual) and illnesses (Physical and Mental). In the Real Patronato sobre Discapacidad (2011) several aspects related to accessibility to cultural heritage, best practices and legislations has been identified and enlisted. Backed by the knowledge of the ONCE (Spanish National Organization of the Blind) foundation, the UNWTO has put forward its vision and references in 'The Handbook on Accessible Tourism for All: Principles, Tools and Good Practices' for making destinations accessible in the best possible manner at a global level so that diverse kind of people can participate in tourism (World Tourism Organization, 2016a). Tourism and non-tourism practices do not have clearly discerned boundaries. The definition of tourism is commanded by temporal and spatial factors (de Souza, 2016). Also, the tourism domain intersects with a lot of other domain of studies like geography, transportation etc. Information sources on these domains along with the above mentioned sources have been studied for understanding concepts and features that have relevance to accessible tourism. The tourism ontologies and studies that have been discussed in the Chapter 2 also provided a basic understanding about requirements of tourists. In most of the existing ontology construction methodologies guidelines on term extraction and use of standards are not clear (Chaware & Rao, 2010).

To have exhaustive information about the user preference on each concept in the case of large ontologies may not be feasible (Martínez-García, et al., 2019). Still, the aim of the information collection for construction of the demonstrated ontology was to gather information with due consideration to the tourist preferences. The UNWTO's (2001) Thesaurus on Tourism & Leisure Activities was followed to get a grasp over the concepts and extract terms related to the tourism domain. From Scandic (2012) information about the accessible features that are necessary at accommodations were obtained. The elements for denoting accessible provisions

in heritage sites that have been mentioned in Hooi and Yaacob (2019) were also useful for learning about potential accessible tourism related requirements. The study by Rodríguez-Rodríguez (2013) was also helpful, where a classification standard for tourist facilities based on the provided technological services has been discussed such that the offered services can be subjected to a quantitative and qualitative evaluation system. In addition to these studies, the information sources discussed in Chapter 3 also helped in gathering information on the domain under study and also guided the process of ontology construction. Any kind of ambiguity regarding the use of a concept was resolved during this phase. For example, Figure 4 depicts the use and classification of the term 'flora'. The sense of the term appropriate to the constructed ontology was selected. Definitions and general discussions on other concepts that have been represented in the ontology have been discussed in the Chapter 4.

Figure 4: Selection of appropriate usage according to sense (Source: https://wordnet.princeton.edu/perl/webwn)

The extracted information was analyzed and representative terms for the identified concepts were identified. Some of the terms are trip, eatery, hotel, lodge, terminal, transport, beach, campsite, park etc. The terms obtained for representing the concepts were studied for identifying similarities and differences. Terms denoting simple ideas were retained and a decision was taken regarding the prospective use of a term as a property or class with due consideration to the purpose of the ontology. Appropriate terms were chosen from among different synonymous terms by consulting the already discussed standard vocabularies (*see* Chapter 3) on the domain for enabling interoperability. Terms denoting concepts with similar properties were grouped together and were labelled. In this way, facets were synthesized. For identification of facets, a combination of top-down and bottom-up approach was followed.

In most of the facet based domain modeling methodologies discussed in section 5.1, the top-down or/and bottom-up approach has been followed for robust and exhaustive identification of facets. The top-down and the bottom-up approach are methods of reading into concepts from abstractness to concreteness and vice-versa respectively. Use of the top-down approach for discovering and structuring the domain concepts, accompanying relations, properties, axioms and thereby building a resource model can be also seen in other types of methodologies like Zhang et al.(2010) where the demonstrated ontology has been coded using Jena and has been tested on the domain of Yunnan tourism. Chuenta (2014) have used the top-down, bottom-up and a combination approach for identifying concepts for constructing an ontology for using it in a tourism website of Northeast Thailand. Palau et al. (2011) have also used both the top-down and bottom-up approach for building context-aware tourist information services. A pictorial overview of the methodology has been presented in Figure 5.

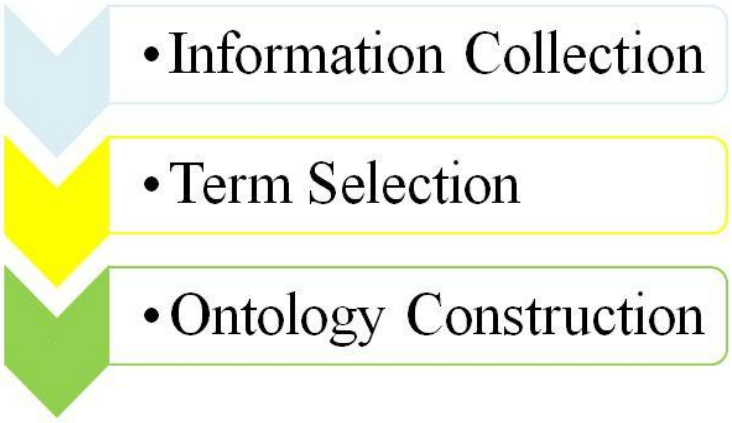

Figure 5: Pictorial overview of the methodology

5.2.2 Ontological Domain model

The Protégé-5.5.0 ontology editor was used for building the ontology which is a freely available open-source ontology editor that has been developed by Stanford Center for Biomedical Informatics Research (https://protege.stanford.edu). In a Protégé ontology, there are OWL classes and two types of properties namely object properties and data properties. Object properties relate classes. So, next relationships were established using the features of the concepts. Also, as has been shown in Figure 8, the ontology was mapped with the DOLCE+DnS Ultralite (DUL) ontology (http://www.ontologydesignpatterns.org/ont/dul/DUL.owl). The demonstrated ontology was tested for consistency and syntactic correctness using the HermiT reasoner (http://www.hermit-reasoner.com) in Protégé. The datatype of

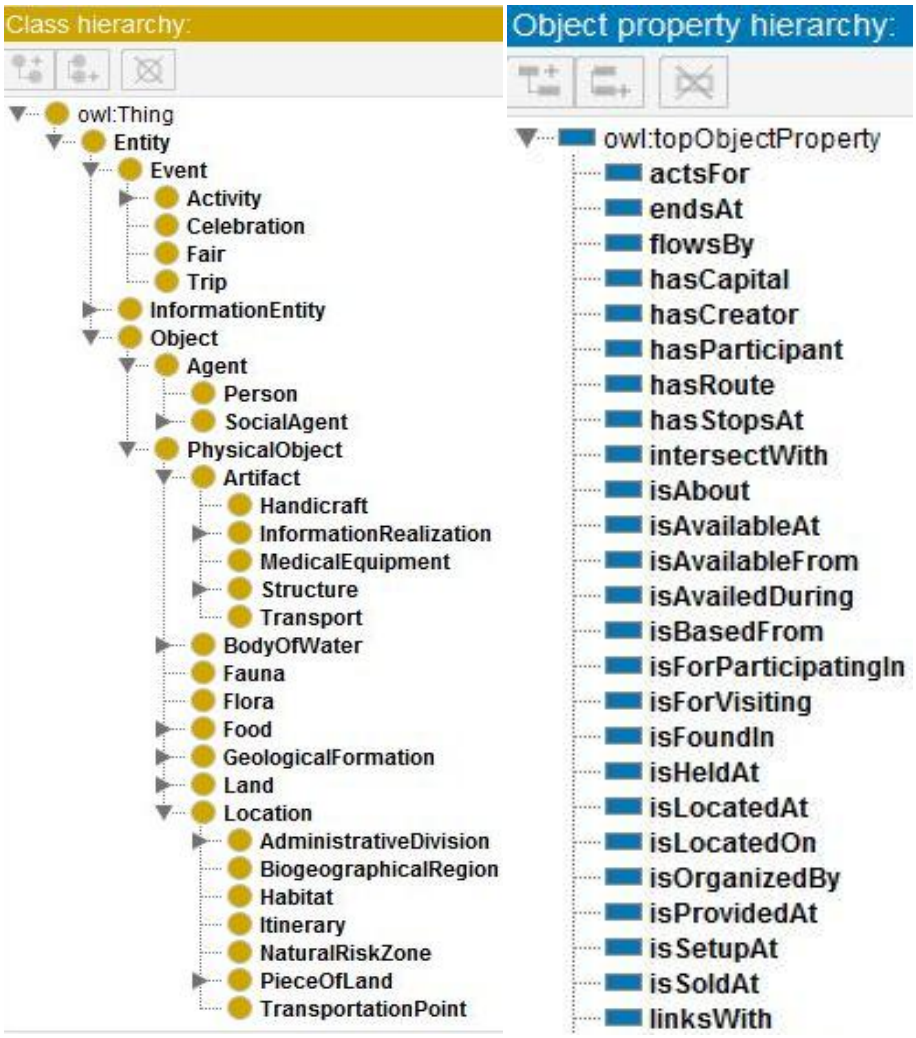

Figure 6: Partial display of classes and object properties used in the ontology

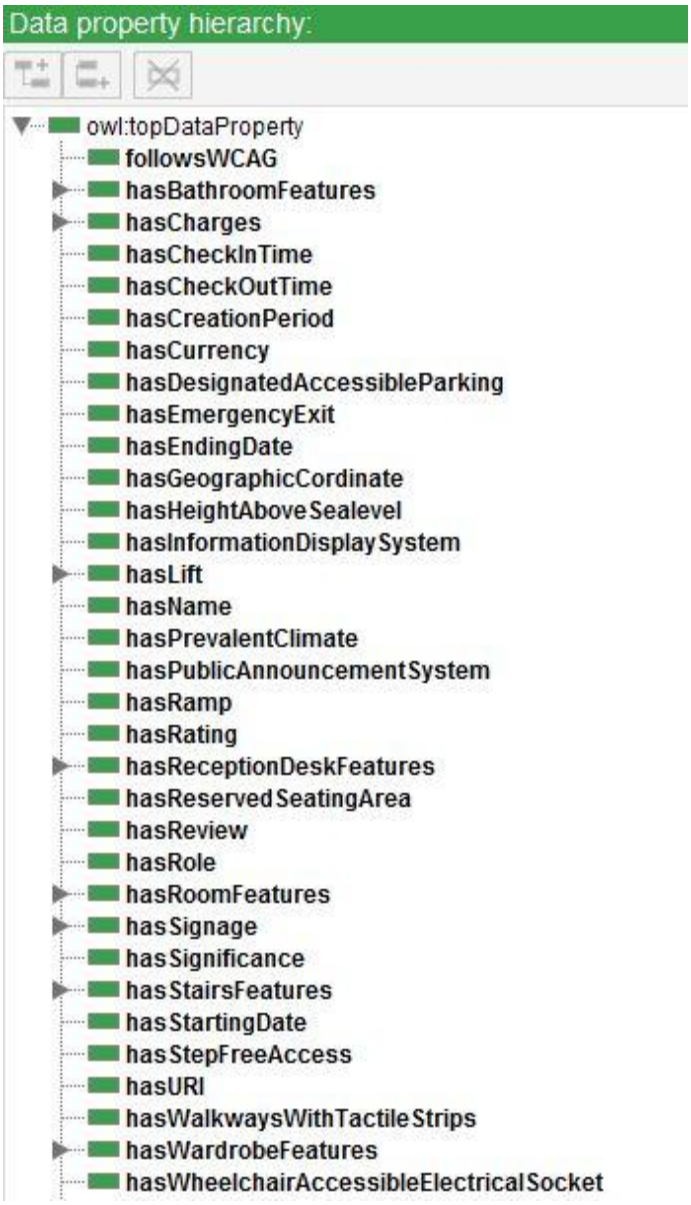

Figure 7: Partial display of data properties used in the ontology

the data properties denoting the availability of an accessibility feature (for example, lavatory with sidewall support, wheelchair accessible shelves, wheelchair accessible Braille control panel in lift, handrails in stairs etc.) were set to boolean. A similar approach of assigning the datatype to boolean has been discussed in Das (2018). Figure 6 and 7 partially shows the classes, object properties and data properties used in the ontology. Next competency questions were used to evaluate the ontology by following the methodology of Abacha et al. (2013) and Bezerra et al. (2013). Competency questions were collected from people with or without disabilities. A description of the purpose of the ontology was provided to the people and then they were asked to enlist the questions. The competency questions

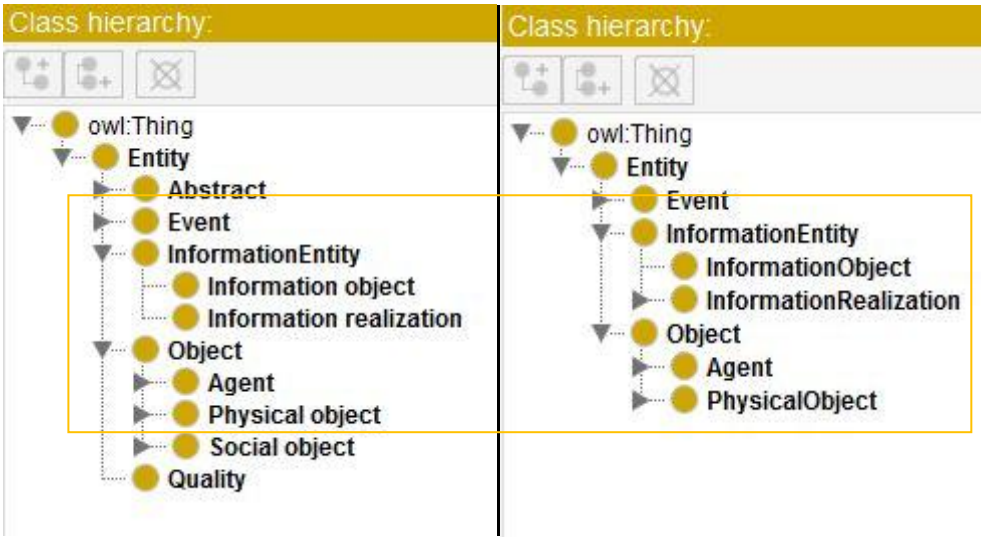

Figure 8: Mapping with DUL ontology

have been listed in Appendix C. The questions were subjected to a manual extraction of concepts and features which were used to construct SPARQL queries for testing the ontology. The competency questions revealed the limitations of the ontology and also helped in incorporating concepts that were not represented before.

5.3 Domain model for organizing reviews

The content of this section has been published in Ghosh and Chatterjee (2021). The content of this chapter demonstrates a semantic organization of tourist reviews for supporting destination managers in understanding the opinions expressed by the tourists. Destination managers can determine the points of advantage/disadvantage for their destination by studying reviews (Albarq, 2014). The factors that tourists like/do not like can be identified from reviews very easily (Berezan et al., 2015). Also, tourists' requirements and the components favored by them can be understood (Simeon, 2017). This, in turn can guide modifications of services and products (Fang et al. 2016). Thus, through reviews tourists can induce important changes that could be brought forward by destination managers (Sahin, 2017). The 2020 World Monuments Watch has stressed the usage of knowledge gained from community-dialogue for arriving at decisions regarding making changes at destinations (https://www.wmf.org/project/ontario-place).

Many have doubted the credibility of reviews regarding their use in research due to the perception of quality about them (Bansal & Voyer, 2000). Jindal and Liu (2008) have pointed out that reviews may get contributed with vested interests.

Some may contribute reviews for misleading people (Hennig-Thurau et al., 2004). Thus, trustworthiness of reviewers is a crucial factor in case of consideration of reviews for research (Jin et al., 2002). The credibility of TripAdvisor reviews has been vetted by Chua and Banerjee (2013). Yoo and Gretzel (2009) have proposed the examination of lexical structure, presence of brand names etc. for identifying deceptive reviews. Reviews with lower ratings or those that have been contributed by frequent reviewers can be considered to be trustworthy (Lee et al., 2011). These factors were given proper consideration while selecting reviews for analysis for the purpose of constructing the domain model under discussion in this chapter.

There are many tourism related studies that have carried out content analysis of reviews collected from TripAdvisor for their purpose, for example, Crotts et al. (2009), Levy et al. (2013), Pearce and Wu (2015), Baka (2016), Zhang and Cole (2016), Simeon (2017), Afzaal et al. (2019), Kirilenko et al. (2021), (Chen and Wu, 2021). Also, there exist many studies that have discussed about ontologies constructed from tourist reviews for example, Volkova et al. (2018), Pai et al. (2019). Aciar et al. (2020) have used text mining techniques to classify user reviews. SáNchez et al.'s (2016) study describes the classification of text based opinions and identification of focal groups for tourist packages based on the classification. Aye and Naing (2020) have proposed ontology based ranked opinion mining for supporting travellers. Hwang et al. (2013) have demonstrated the process of classifying discussion threads based on a travel goal-oriented model with features that can be quantified using lexicons and the named entity reaction technique. The process has been exemplified using data from TripAdvisor.com. The study notes that the demonstrated methodology of using lexical features and Named Entity Recognition has yielded better results than use of only lexican features. Furthermore, Chinnapatjeerat et al. (2017) have constructed an ontology to support tourism development planning. The methodology involved user study and development of information structure for construction of the ontology.

Taking inspiration from these studies the process of easy classification and labeling of reviews using the faceted approach to classification has been discussed. In addition to the facet categories discussed in Table 2 , the facet categories synthesized in this study draw inspiration from the systems discussed in Chatterjee (2017, pp. 129–131) namely, Kaiser's (1911) Systematic Indexing (where the proposed components are Concretes (things not signifying action or process) and Processes), Coates's (1960) Subject Catalogues (where the proposed components are Thing, Material and Action), Farradane's (1950, 1952) proposal of using a relationship for linking concepts (abstract or concrete). In addition to these, Saracevic and Kantor's (1997a; 1997b) taxonomy of library and information services also helped the process of facet synthesis. The synthesized facet categories

have been used to construct an ontological model for organizing tourist reviews. The aim of this model is to help destination managers in retrieving relevant destination reviews so that they can take important action(s) based on the information mined from the reviews.

5.3.1 Methodology

Reviews about Ecopark located in India and Ontario Place located in Canada that were present in TripAdvisor (https://www.tripadvisor.com/) till August 2020 were collected for the purpose of the study (data on the reviews has been presented in Table 3), by web scraping (*see* Bradley and James (2019)) using the packages rvest (by Wickham (2021)) and dplyr (by Wickham et al. (2021)) for R (by R Core Team (2020)). Some other studies discussing extraction of information from web pages are worthy of mention here. For example, Karoui et al. (2006) have also presented a framework for extracting information using structural features of HTML documents and location of words for identifying context. Tsou (2010) have demonstrated the extraction of geographic information from Chinese tourism web pages. Luberg et al. (2012) have demonstrated the process of identifying and merging duplicates during web scraping for tourist objects. Archana and Kumar (2016) have used web crawlers to get data from web archives and have modeled it using ontologies.

	Type of Travel	Persons		Language of Review	Persons
Eco Park, Kolkata	Traveled with family Traveled as a couple Traveled solo Traveled on business Traveled with friend(s) Unidentified	413 124 45 32 218 98		English Russian German French Japanese	924 3 1 1 1
Ontario Place, Canada	Traveled with family Traveled as a couple Traveled solo Traveled on business Traveled with friend(s) Unidentified	29 19 7 1 13 123		English Portuguese French Italian Japanese Polish Russian	180 4 2 2 2 1 1

Table 3: Data on extracted reviews

The reviews extracted for this study were analyzed with the motive of learning about the destinations from different types of visitors and to know about the

interactions of the visitors with different features of the destination. At first reviews about Eco Park from India were used to synthesize a faceted framework for organizing reviews. Then the reviews about Ontario Place from Canada were utilized to validate the framework. The Eco Park or 'Prakriti Tirtha' is in Newtown, Rajarhat. This urban tourism space showcases large open green spaces, small parks, recreational spaces etc. Eco Park presents nature in a way such that visitors can learn a lot (https://www.ecoparknewtown.com/aboutus.php). When it opened, the Ontario Place in Toronto featured themed areas, waterfront, amusement facilities etc. But its popularity declined over time. It is under the watch of World Monuments Fund (https://www.wmf.org/project/ontario-place). It remained closed for some time and has opened recently for catering to different communities (http://ontarioplace.com/en/).

There may be different strategies with different justifications for choosing the destinations for the study. But one of the prime reasons for chosing the Eco Park for this study is that it is located in Kolkata where this research is being carried out. The Eco Park is a place with diverse kind of features. Many visitors have reviewed that the place is vast with growing popularity and cannot be covered in a single day. So, it was decided to consider this destination for the study so that the synthesized framework has provisions for organizing a variety of features. After choosing a familiar destination from within the context another destination of similar type was chosen from outside of the context with no familiarity. In contrast to the Eco Park, it was found that the Ontario Place is in a declining phase of growth and has got the attention of the World Monuments Fund. Many reviews about Ontario Place reveal the negative points and the things that the visitors miss about the place. So, use of reviews about Ontario Place provides an opportunity for testing the framework widely on negative reviews. It is envisaged that this strategy behind selecting the destinations for the study will make the framework robust and exhaustive. Figure 9 presents a pictorial overview of the methodology.

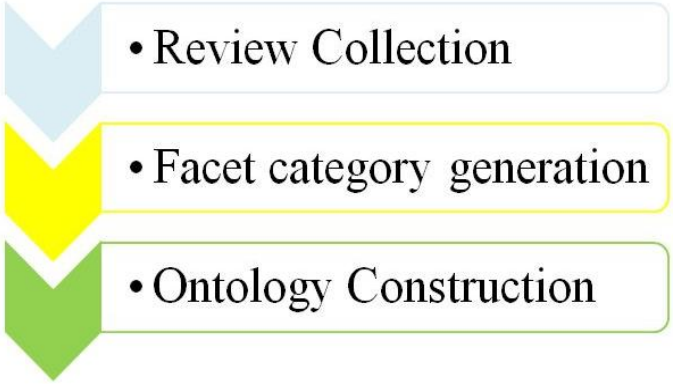

Figure 9: Pictorial overview of the methodology

5.3.2 Synthesis of categories and validation

The reviews were subjected to a facet analysis as propounded by Ranganathan. Three broad categories of facets were obtained namely, Component, Aspect and Output. Each category of top-level facet consists of several sub-facets. The Component [C] facet consists of Convenience Facility [C1], Recreational Facility [C2], Event [C3], Eatery [C4], Attraction [C5], Greenery [C6], Staff [C7] and Policy [C8]. The Aspect [A] facet consists of Availability [A1], Accessibility [A2], Adequacy [A3], Ambience [A4], Maintenance [A5], Performance [A6] and Management [A7]. The Outcome [O] facet consists of Perspective [O1], Expectation [O2], Time Utility [O3] and Expenditure Utility [O4]. In Table 4, the categories of facet synthesized from analysis of snippets from reviews about Ecopark have been presented and Table 5 presents the representation of snippets from reviews about Ontario Place using the already synthesized facet categories.

Main Facet : Component [C]	
Extracted snippets from Reviews containing isolate ideas	Synthesized sub-facets
Parking, E-cart, Toilet, Water resort, Cottages, Decorated benches, Vintage lights, Lighting, Water ATM, Online booking, Tickets	[C1] Convenience Facility
Children's Park, Golf, Boating, Water rides, Shikaras, Cycling, Dual-seated cycling, Shooting, Land Zorbing, Water Zorbing, Paddle boating, Photography, Wedding photo shoot, Rowing, Rides, Ice-skating, Kayaking, Archery, Jogging, Walking, Toy train, Gaming zone, Paved ways, Water scooters	[C2] Recreational Facility
Banquet, Open air theatre, Local arts & crafts fair, Picnic, Exhibition, Conference, Meeting, Kite festival	[C3] Event
Restaurant, Cafe, Misti Hub	[C4] Eatery
Mask garden, Animal models, Artists' cottage, Sculptures, Seven Wonders, Eiffel Tower, Light and Music show, Musical fountain, Laser show, Cultural huts, Replica of Ghoom station, Bankura terracotta, Bangla haat, Glass house, Museum, Bengal village	[C5] Attraction
Lake, Island, Eco-urban village, Tropical trees garden, Japanese garden, Butterfly garden, Grasslands, Rose garden, Meadow garden, Mist, Wild flowers, Fruits garden, plants, Bamboo garden, Coconut trees, Bonsai, Tea, Cactus, Herbal plants, Heliconia	[C6] Greenery
Security staff, Boatman, Booking counter staff	[C7] Staff
Outside food is allowed inside, Midway boarding not allowed in battery car	[C8] Policy

Main facet : [A] Aspect	
Extracted snippets from Reviews containing isolate ideas	Synthesized sub-facets
Online booking not possible, Only cash was accepted, Buy tickets multiple times, Local cuisines available	[A1] Availability
Visited on the way to airport, Opposite to Westin hotel Kolkata, Opposite Mother's Wax Museum, Segregated access, Too much walking, Poor Navigation instructions, Reached by Biswa Bangla Sarani, Very less local transport, Ramps are not present	[A2] Accessibility
Huge area, Open space, Not enough options for vegetarians, Big parking	[A3] Adequacy
Lungs of the city, Fresh air, Beautiful evenings ambience, Beautiful ambience, Bad behavior of fellow tourists, Mosquitoes, Beautiful view, Sunset view	[A4] Ambience
Clean and well maintained, Non-clean toilets	[A5] Maintenance
Staff Performance, Helpful staff at restaurant, Rude behavior of boatman, Bad behavior of guard, Efficient service at restaurant, Could not provide information related to refund	[A6] Performance
Proper organization, Crowded on weekends, Long queues for cycling and boating	[A7] Management
Main facet : [O] Outcome	
Extracted snippets from Reviews containing isolate ideas	Synthesized sub-facets
Serendipity, Knowledge reinforcement, Eco-friendly, Couple-friendly, Child-friendly, Senior-citizen friendly, Family-friendly, Feeling Fresh, Knowledge gained about seven wonders and different plants, Trust, Happiness, Attachment, Peaceful, Tranquility, Romantic, Relax, Soothing, Enjoyment, An oasis in the city, Lungs of the city	[O1] Perspective
Met, Not met, Satisfaction, Disappointment, Portrayal of local cultural heritage	[O2] Expectation
Well utilized, Wasted, Waiting time, Speed of service	[O3] Time utility
Utilization, Wasted, Costly parking, Reasonable prices, Quality of food	[O4] Expenditure utility

Table 4: Synthesis of facets from reviews about EcoPark

Main Facet : Component (C)	
Extracted snippets from Reviews referring to isolate ideas	Matching sub-facets
Bike trail, Jogging trail, Benches	[C1] Convenience Facility

Bike Sharing, Soak city splash area, Lego-land, Atom Blaster, Amphitheater, Boating, Water slide, Kids playing area, Splash area, Cinesphere, Water Park	[C2] Recreational Facility
Caribana Festival, Aurora Festival, Triathlon, Exhibition, Chinese Lantern Festivals, Echo Beach	[C3] Event
Food Kiosks, Beer gardens, Food Truck	[C4] Eatery
Santa and his band, Caricature Artists	[C7] Staff
Discounts, Play all day ride on Birthdays, Free 40th Anniversary, Food could be taken inside, School passes provided, Photography not allowed on ground, Pets are Allowed	[C8] Policy
Main facet : [A] Aspect	
Extracted snippets from Reviews containing isolate ideas	Matching sub-facets
Rides were not available, Refund against cancellation not given, No weather protection	[A1] Availability
Parking close to facility, Segregated Access, Poor Navigation instructions, Far from station, Lot of walking	[A2] Accessibility
Poor infrastructure of Skating, Proper quantity of food not served, Not enough attractions, Old attractions, Already tried attractions, Tiny bonfire, Nothing for adults	[A3] Adequacy
Windy, Beautiful outdoor setting, Walk, Mosquitoes,	[A4] Ambience
Cinesphere seats are not refurbished, Spots on screen, No maintenance, Bathroom not clean, Weeding required, Full of Litter, Paintwork required, Renovation required	[A5] Maintenance
Helpful Staff, Pleasant behavior of staff, Staff training	[A6] Performance
Bad movie selection, Crowded, Long queue for Skating	[A7]Management
Main facet : [O] Output	
Extracted snippets from Reviews containing isolate ideas	Matching sub-facets
Family place, Good band, Poor quality of food, Interesting architecture, For children only	[O1] Perspective
No Resemblance of Province	[O2] Expectation
Great time spent	[O3] Time utility
Costly Parking, Costly Tickets, Costly food, Costly Ice-skating	[O4]Expenditure utility

Table 5: Validation of synthesized facets using reviews about Ontario Place

5.3.3 Ontology creation

Several studies demonstrate the construction of ontologies from reviews. Mendis et al. (2019) have presented an ontology (populated with data and reviews from trip

advisor) based tourist assistant which can answer to queries in textual format. To provide a collective analysis of reviews, Bansal and Bathla (2020) have tokenized reviews based on a lexical approach and compared the reviews with ontology. Chen and Hoon (2020) have proposed an approach that includes ontology based feature extraction and classification for detecting opinion type of tourists reviews.

Figure 10: Partial display of the classes in the ontology

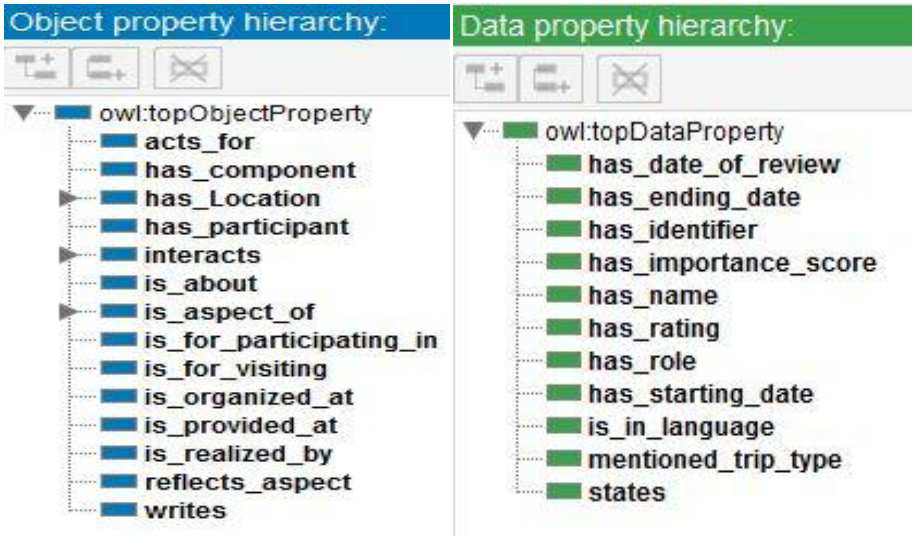

Figure 11: Partial display of object and data properties in the ontology

The approaches for facet based domain modeling discussed in section 5.1 have guided the construction of the demonstrated ontology. The classes, object properties and data properties of the ontology (displayed in the Figures 10 and 11) were synthesized using the facets belonging to the Component, Aspect and Output

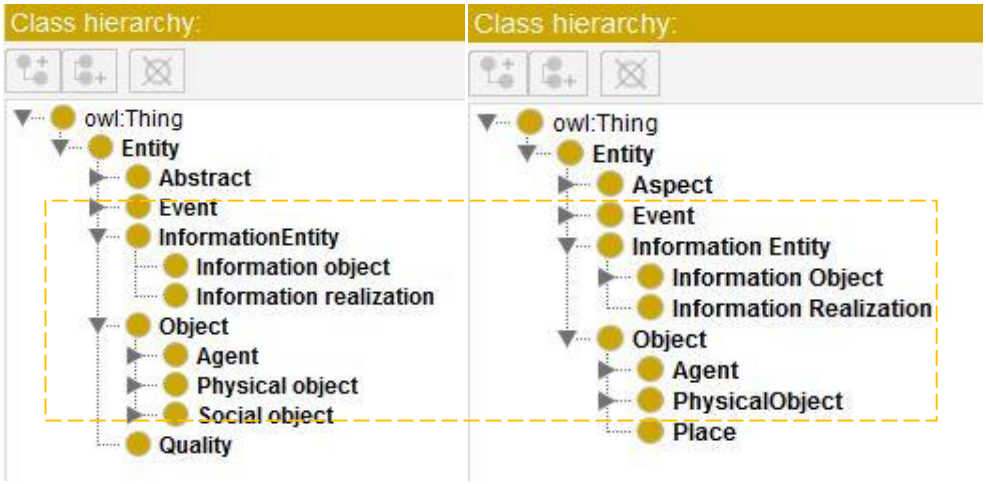

Figure 12: Mapping with DUL ontology

categories of facets that have been discussed in the previous section. As has been shown in Figure 12, the ontology was mapped with the DOLCE+DnS Ultralite (DUL) ontology (http://www.ontologydesignpatterns.org/ont/dul/DUL.owl).

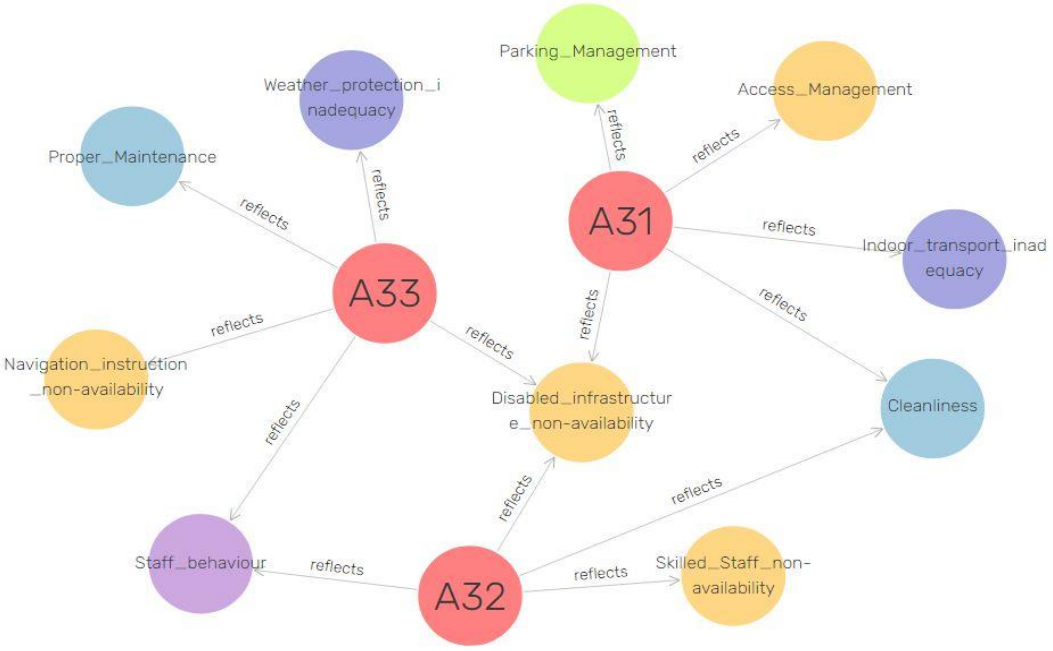

Figure13: Aspects discussed in reviews containing perspective of the reviewers

Before populating the ontology, each review was assigned an importance score based on the formula, $S_I = (N_A \times I_R)/100$. Here, N_A represents the number of aspects covered in the review. I_R represents the inverse rating assigned to a review that ranges from 1 to 5. A review that has a rating of 5 in TripAdvisor has an I_R of 1 and a review with rating 1 in TripAdvisor has an I_R of 5. Figure 15 demonstrates a snapshot of a ranked list of reviews retrieved based on S_I.(for the query *see* Appendix D, Q6)The reason behind this type of value assignment stems from the fact that if not contributed with vested interests, negative reviews have more credibility (Lee et al., 2011). Also, negative

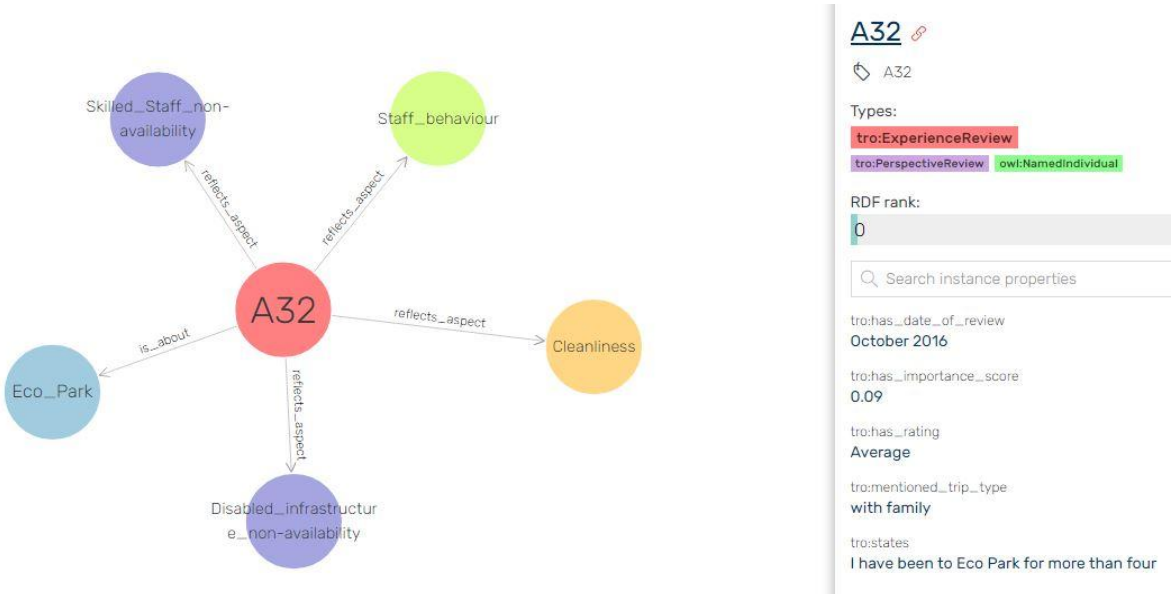

Figure 14: An individual review

reviews must be dealt at the earliest by tourism development managers. The RDF-rank algorithm (https://graphdb.ontotext.com/documentation/standard/rdf-rank.html), which is similar to Google's Page Rank, has influenced the idea of the importance-score calculation. In addition to this, several studies that have attempted to rank reviews like Ghose and Ipeirotis (2007), Hsieh and Wu (2015), Arif and Qamar (2018), Saumya et al. (2018), Chua and Banerjee (2015), Kumar and Abirami (2018), Alfarraj and AlZubi (2019) have also influenced the importance-score calculation. Score calculation for the purpose of providing recommendation can be also seen in other studies, for example, Luberg et al. (2011) have created a RDF based database enriched with meta-information fields. The facts contained in the database carry a confidence score that is used for recommendation purpose. Kitwatthanathawon (2014) have devised a system for analysis of hotel reviews. The feature extraction process has been used to construct a tourism ontology and a weighted-average rating approach has been used to assign

score to the hotels. Klotz et al. (2017) have integrated data from multiple sources for the purpose of providing tourism recommendation and have also proposed an interest score based on user inputs and driving conditions. Emotional scores related to tourist spots calculated from tweets and comments, stored in a RDF database were used by Sakamoto and Takama (2017) for tourist spot recommendation. Since, semantic graph databases help in the exploration, analysis and visualization of relationships in the data (Naskar and Das, 2019; Ghosh et al., 2020), the ontology was implemented in the graph database GraphDB (https://www.ontotext.com/products/graphdb/). Some of the obtained visualizations (for the queries *see* Appendix D) have been presented through the Figures 13 and 14. Figure 13 shows the aspects discussed in perspective based reviews. Figure 14 shows the aspects reflected by an indivual review.

review	content
A33	"I visited with my wife and 3 kids (10, 7 and 2 years old) and entered from Gate 1. This I the closest entrance to the kids play area. When we arrived in the mid afternoon it was c
A31	"A large open space which has been recently developed by the State Government as a tourist attraction.....it caters to all ages and has plenty of scope for improvement. The er
P42	"I visited Eco Park one afternoon in December. Huge crowds, no proper restaurants, badly maintained. There were plastic bottles floating on water bodies. The boat that was s
A32	"I have been to Eco Park for more than four times, each of my trip was as relaxing and refreshing. But this fifth visit (on Tuesday 11.10.2016) was a horrible and dreadful one.I, I
P41	"Having been born and brought up in Kolkata, I was quite excited to have a place like that in Kolkata. So one day wanted to go with a lot of time in hand. Unfortunately was quite

Figure 15: Output of query using S_I for ranked retrieval of reviews

References:

Abacha, A. B., Da Silveira, M., & Pruski, C. (2013). Medical ontology validation through question answering. *Lecture Notes in Computer Science. Artificial Intelligence in Medicine in Europe* (pp. 196-205). Springer. https://www.springerprofessional.de/en/medical-ontology-validation-through-question-answering/4101250

Aciar, S., Coto, M., & Aciar, G. (2020). Identifying user experiences for decision-making in service science. In G. Meiselwitz G. (Eds.), *Lecture Notes in Computer Science, Vol. 12195. Social Computing and Social Media: Participation, User Experience, Consumer Experience, and Applications of Social Computing* (pp.147-157). Springer. https://doi.org/10.1007/978-3-030-49576-3_10

Afzaal, M., Usman, M., Fong, A. C., & Fong, S. (2019). Multiaspect-based opinion classification model for tourist reviews. *Expert Systems, 36*(2), Article e12371. https://doi.org/10.1111/exsy.12371.

Albarq, A. N. (2014). Measuring the impacts of online word-of-mouth on tourists' attitude and intentions to visit Jordan: An empirical study. *International Business Research, 7*(1), 14-22. https://doi.org/10.5539/ibr.v7n1p14.

Alfarraj, O., & AlZubi, A. A. (2019). A novel approach for ranking customer reviews using a modified PSO-based aspect ranking algorithm. *Cluster Computing, 22,* 3175-3181. https://doi.org/10.1007/s10586-018-2012-7

Alonso, K., Aginako, N., Lozano, J., & Olaizola, I. G. (2012). Ontology based middleware for ranking and retrieving information on locations adapted for people with special needs. In K. Miesenberger, A. Karshmer, P. Penaz & W. Zagler (Eds.), *Lecture Notes in Computer Science, Vol. 7382. Computers Helping People with Special Needs* (pp.351-354). Springer. https://doi.org/10.1007/978-3-642-31522-0_53

Archana, A. B., & Kumar, J. (2016). Location based semantic information retrieval from web documents using webcrawler. Proceedings of the 2015 International Conference on Applied and TheoreticalComputing and Communication Technology, 370-375. https://doi.org/10.1109/ICATCCT.2015.7456912

Arif, M., & Qamar, U. (2018). A Framework for Feature Extraction and Ranking for Opinion Making from Online Reviews. In K. Arai, S. Kapoor & R. Bhatia (Eds.), *Advances in Intelligent Systems and Computing: Vol. 858. Intelligent Computing* (pp.359-371). Springer. https://doi.org/10.1007/978-3-030-01174-1_27

Aye, N., & Naing, T. T. (2020). Ranking based opinion mining in myanmar travel domain. In J. S. Pan, J. W. Lin, Y. Liang, S. C. Chu (Eds.), *Advances in Intelligent Systems and Computing: Vol. 1107. Genetic and Evolutionary Computing* (pp. 30-37). Springer. https://doi.org/10.1007/978-981-15-3308-2_4

Baka, V. (2016). The becoming of user-generated reviews: Looking at the past to understand the future of managing reputation in the travel sector. *Tourism Management, 53,* 148-162. https://doi.org/10.1016/j.tourman.2015.09.004.

Bansal, H. S., & Voyer, P. A. (2000). Word-of-mouth processes within a services purchase decision context. *Journal of service research, 3*(2), 166-177. https://doi.org/10.1177/109467050032005.

Bansal, M., & Bathla, A. (2020). Enhanced lexical based technique for opinion mining in tourism. *International Journal of Scientific and Technology Research, 9*(1), 1717-1721. http://www.ijstr.org/final-print/jan2020/Enhanced-Lexical-Based-Technique-For-Opinion-Mining-In-Tourism.pdf

Batouche, B., Nicolas, D., Ayed, H., & Khadraoui, D. (2012). Recommendation of travelling plan for elderly peopleaccording to their abilities and preferences. *Proceedings of the 2012 4th InternationalConference on Computational Aspects of Social Networks,* 327-332. https://doi.org/10.1109/CASoN.2012.6412423

Benjamin, P. C., Menzel, C. P., Mayer, R. J., Fillion, F., Futrell, M. T., deWitte, P. S., & Lingineni, M. (1994). Idef5 method report. *Knowledge Based Systems, Inc.*

Berezan, O., Raab, C., Tanford, S., & Kim, Y. S. (2015). Evaluating loyalty constructs among hotel reward program members using eWOM. *Journal of Hospitality & Tourism Research, 39*(2), 198-224. https://doi.org/10.1177/1096348012471384

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The semantic web. *Scientific american, 284*(5), 34-43. https://www.scientificamerican.com/article/the-semantic-web

Bezerra, C., Freitas, F., & Santana, F. (2013, November). Evaluating ontologies with competency questions. *Proceedings of 2013 IEEE/WIC/ACM International Joint Conferences on Web Intelligence (WI) and Intelligent Agent Technologies (IAT)*, 284-285. IEEE. https://doi.org/10.1109/WI-IAT.2013.199.

Bhattacharyya, G. (1975). POPSI: its fundamentals and procedure based on a general theory of Subject Indexing Languages. *Library Science with a Slant to Documentation, 16*(1), 1-34.

Biagetti, M.T. (2020), Ontologies (as knowledge organization systems). In B. Hjørland, & C. Gnoli (Eds.), ISKO Encyclopedia of Knowledge Organization. https://www.isko.org/cyclo/ontologies

Bradley, A., & James, R. J. (2019). Web scraping using R. *Advances in Methods and Practices in Psychological Science, 2*(3), 264-270. https://doi.org/10.1177/2515245919859535

Brodeala, L. C. (2020). Online recommender system for accessible tourism destinations. *14th ACM Conference on Recommender Systems,* 787-791. https://doi.org/10.1145/3383313.3411450

Broughton, V. (2006). The need for a faceted classification as the basis of all methods of information retrieval. *Aslib proceedings, 58*(1/2), 49-72. https://doi.org/10.1108/00012530610648671

Chakraborty, B., Nayek, P., Basak, S., Ghosh, D., & Debnath, N. (2010). A performance comparison between data-based KMS and ontology based KMS for e-tourism services. *Proceedings of IEEE International Conference on Industrial Informatics (INDIN),* 698-703. IEEE. https://doi.org/10.1109/INDIN.2010.5549656

Chatterjee, A. (2017). Index and indexing. In Chatterjee, A. (Ed.), *Elements of Information Organization and Dissemination* (pp. 125-134). Chandos Publishing. https://doi.org/10.1016/B978-0-08-102025-8.00009-0.

Chaware, S., & Rao, S. (2010). Integrated approach to ontology development methodology with case study. *International Journal of Database Management Systems, 2*(3), 13-19. http://www.airccse.org/journal/ijdms/papers/0810ijdms02.pdf

Chen, L. J., & Hoon, G. K. (2020). Feature expansion using lexical ontology for opinion type detection in tourism reviewsdomain. *International Journal of Advanced Computer Science and Applications, 11*(8), 628-637. https://doi.org/10.14569/IJACSA.2020.0110877

Chen, Y. S., & Wu, S. T. (2021). An exploration of actor-network theory and social affordance for the development of a tourist attraction: A case study of a Jimmy-related theme park,

Taiwan. *Tourism Management, 82,* Article 104206. https://doi.org/10.1016/j.tourman.2020.104206.

Chinnapatjeerat, R., Tuamsuk, K., & Supnithi, T. (2016). Ontology of information for tourism development planning in Thailand. *Proceedings of 2016 5th International Conference on Computer Science and Network Technology (ICCSNT),* 856-878. IEEE. doi:10.1109/iccsnt.2016.8070281.

Choksuchat, C., & Chantrapornchai, C. (2010). Benchmarking query complexity between RDB and OWL. In T. Kim, Y. Lee, B. H. Kang, D. Ślęzak (Eds.) *Lecture Notes in Computer Science: Vol. 6485. Future Generation Information Technology* (pp. 352-364). Springer. https://doi.org/10.1007/978-3-642-17569-5_35

Chua, A. Y., & Banerjee, S. (2013). Reliability of reviews on the Internet: The case of Tripadvisor. *Proceedings of the World Congress on Engineering & Computer Science*, 453-457. http://www.iaeng.org/publication/WCECS2013/WCECS2013_pp453-457.pdf

Chua, A. Y., & Banerjee, S. (2015). Understanding review helpfulness as a function of reviewer reputation, review rating, and review depth. *Journal of the Association for Information Science and Technology, 66*, 354-362. https://doi.org/10.1002/asi.23180

Chuenta, I. (2014). The construction of an ontologies using recommender management system for tourism website of northeast thailand In K. Tuamsuk, A. Jatowt, & E. Rasmussen (Eds.), *Lecture Notes in Computer Science, Vol. 8839. The Emergence of Digital Libraries – Research and Practices. Springer*. https://doi.org/10.1007/978-3-319-12823-8_12

Coates, E.J. (1960). *Subject Catalogues: Headings and Structures*. The Library Association.

Crotts, J. C., Mason, P. R., & Davis, B. (2009). Measuring guest satisfaction and competitive position in the hospitality and tourism industry: An application of stance-shift analysis to travel blog narratives. *Journal of Travel Research, 48*(2), 139-151. https://doi.org/10.1177/0047287508328795.

Das, S. (2018). *Domain Modeling: Theory and Practice* [Doctoral dissertation, University of Trento]. http://eprints-phd.biblio.unitn.it/2877/

Das, S., & Roy, S. (2016). Faceted Ontological Model for Brain Tumour Study. *Knowledge Organization, 43*(1), 3-12. https://doi.org/10.5771/0943-7444-2016-1-3

Bispo M. d. S. (2016). Tourism as practice. *Annals of Tourism Research, 61*, 170-179. https://doi.org/10.1016/j.annals.2016.10.009

DeGrolier, E. (1962). *A Study of General Categories Application to Classification and Coding in Documentation*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000025055.

Dewey, M. (2011). *Dewey Decimal Classification and Relative Index* (J. S. Mitchell, J. Beall, R. Green, G. Martin & M. Panzer Eds.). 23rd ed. OCLC Online Computer Library Center, Inc.

Dutta, B., Chatterjee, U., & Madalli, D. P. (2015). YAMO: yet another methodology for large-scale faceted ontology construction. *Journal of Knowledge Management,* 19(1), 6-24. https://doi.org/10.1108/JKM-10-2014-0439

Dutta, B., Giunchiglia, F., & Maltese, V. (2011, May). A facet-based methodology for geo-spatial modeling. In C. Claramunt, S. Levashkin, & M. Bertolotto (Eds.), *Lecture Notes in Computer Science: Vol. 6631. GeoSpatial Semantics* (pp. 133-150). Springer. https://doi.org/10.1007/978-3-642-20630-6_9

Fang, B., Ye, Q., Kucukusta, D., & Law, R. (2016). Analysis of the perceived value of online tourism reviews: Influence of readability and reviewer characteristics. *Tourism Management, 52,* 498-506. https://doi.org/10.1016/j.tourman.2015.07.018.

Farradane, J.E.L. (1950). A scientific theory of classification and indexing and its practical applications. *Journal of Documentation, 6*(2), 83-99, https://doi.org/10.1108/eb026155.

Farradane, J.E.L. (1952). A scientific theory of classification and indexing: further considerations. *Journal of Documentation, 8*(2), 73-92, https://doi.org/10.1108/eb026182.

Fernández-López, M., Gómez-Pérez, A., & Juristo, N. (1997). Methontology: from ontological art towards ontological engineering. *American Association for Artificial Intelligence*

Gangemi, A., Guarino, N., Masolo, C., Oltramari, A. and Schneider, L. (2002), Sweetening ontologies with DOLCE, In A. Gómez-Pérez & V. R. Benjamins (Eds.), *Lecture Notes in Computer Science, Vol. 2473. Knowledge Engineering and Knowledge Management: Ontologies and the Semantic Web* (pp. 166-181). Springer. https://doi.org/10.1007/3-540-45810-7_18

Ghose, A., & Ipeirotis, P. G. (2007). Designing novel review ranking systems: predicting the usefulness and impact of reviews. *Proceedings of the ninth international conference on Electronic commerce,* 303–310. https://doi.org/10.1145/1282100.1282158

Ghosh, S. S., Das, S., & Chatterjee, S. K. (2020). Human-centric faceted approach for ontology construction. *Knowledge Organization, 47*(1), 31-44. https://doi.org/10.5771/0943-7444-2020-1-31.

Ghosh, S.S., & Chatterjee, S.K. (2021). A knowledge organization framework for influencing tourism-centered place-making. *Journal of Documentation, ahead-of-print*(ahead-of-print). https://doi.org/10.1108/JD-12-2020-0220

Ghosh, S., & Panigrahi, P. (2015). Use of Ranganathan's analytico-synthetic approach in developing a domain ontology in library and information science. *Annals of Library and Information Studies, 62*(4), 274-80. http://nopr.niscair.res.in/handle/123456789/33723

Giunchiglia, F. & Dutta, B. (2011). DERA: a faceted knowledge organization framework. Unitn Eprints Research. http://eprints.biblio.unitn.it/2104/1/techRep457.pdf

Giunchiglia, F., Dutta, B. and Maltese, V. (2014). From knowledge organization to knowledge representation. *Knowledge Organization, 41*(1), 44-56, https://doi.org/10.5771/0943-7444-2014-1-44.

Giunchiglia, F., Dutta, B., & Maltese, V. (2009). Faceted lightweight ontologies. In A. T. Borgida, V. K. Chaudhri, P. Giorgini, E. S. Yu (Eds.), *Lecture Notes in Computer Science: Vol. 5600. Conceptual Modeling: Foundations and Applications* (pp. 36-51). Springer. https://doi.org/10.1007/978-3-642-02463-4_3

Giunchiglia, F., Dutta, B., Maltese, V. and Farazi, F. (2012). A facet-based methodology for the construction of a large-scale geospatial ontology. *Journal on data semantics*, *1*(1), 57-73. https://doi.org/10.1007/s13740-012-0005-x.

Gruber, T. R. (1993). A translation approach to portable ontology specifications. *Knowledge acquisition, 5*(2), 199-220.

Gruber, T. R. (1995). Toward principles for the design of ontologies used for knowledge sharing?. *International journal of human-computer studies, 43*(5-6), 907-928. https://doi.org/10.1006/ijhc.1995.1081

Grüninger, M., & Fox, M. S. (1995). Methodology for the design and evaluation of ontologies. *Proceedings of the 14th International Joint Conference on Artificial Intelligence IJCAI, Workshop on Basic Ontological Issues in Knowledge Sharing,* 1-10. http://stl.mie.utoronto.ca/publications/gruninger-ijcai95.pdf

Guarino, N. (1995). Formal ontology, conceptual analysis and knowledge representation. *International journal of human-computer studies, 43*(5-6), 625-640. https://doi.org/10.1006/ijhc.1995.1066

Guarino, N. (Ed.). (1998). Formal ontology in information systems: Proceedings of the first international conference (FOIS'98), June 6-8, Trento, Italy (Vol. 46). IOS press.

Hasan, R., Farazi, F., Bursi, O. S., & Reza, M. S. (2015). A faceted lightweight ontology for earthquake engineering research projects and experiments. In F. Taucer & R. Apostolska. (Eds.), *Experimental Research in Earthquake Engineering* (pp. 11-19). Springer. https://doi.org/10.1007/978-3-319-10136-1_2

Hennig-Thurau, T., Gwinner, K. P., Walsh, G., & Gremler, D. D. (2004). Electronic word-of-mouth via consumer-opinion platforms: what motivates consumers to articulate themselves

on the internet?. *Journal of interactive marketing, 18*(1), 38-52. https://doi.org/10.1002/dir.10073.

Hjørland, B. (2013). Facet analysis: the logical approach to knowledge organization. *Information Processing and Management, 49,* 545-557, https://doi.org/10.1016/j.ipm.2012.10.001.

Hooi, P. M., & Yaacob, N. M. (2019). Accessibility for Physically Challenged Persons in Heritage Buildings. *Journal of Design and Built Environment, 19*(1), 24-39. https://doi.org/10.22452/jdbe.vol19no1.3

Hsieh, H. Y., & Wu, S. H. (2015). Ranking online customer reviews with the SVR model. *Proceedings of the 2015 IEEE international conference on information reuse and integration,* 550-555. IEEE. https://doi.org/10.1109/IRI.2015.88.

Hudon, M. (2020). Facet. *Knowledge Organization, 47*(4), 320-333, https://doi.org/10.5771/0943-7444-2020-4-320.

Hwang, S. -Y., Chiang, R. H. L., Hsiao, Y. -L., & Chang, S. (2013). On classifying discussion threads using travel information goal-oriented model. *Proceedings of the Pacific Asia Conference on Information Systems (PACIS2013).* https://aisel.aisnet.org/pacis2013/161

Jin, Y., Bloch, P., & Cameron, G. T. (2002). A comparative study: does the word-of-mouth communications and opinion leadership model fit epinions on the internet?. *Proceedings of the Hawaii International Conference on Social Sciences*.

Jindal, N., & Liu, B. (2008, February). Opinion spam and analysis. *Proceedings of the 2008 international conference on web search and data mining,* 219-230. https://doi.org/10.1145/1341531.1341560.

Kaiser, J. (1911). *Systematic Indexing.* Pitman.

Karoui, L., Aufaure, M. -a., & Bennacer, N. (2006). A new extraction concept based on contextual clustering. *Proceedings of the International Conference on Computational Intelligence for Modelling, Control andAutomation and International Conference on Intelligent Agents Web Technologies and International Commerce, 91-91.* https://doi.org/10.1109/CIMCA.2006.19

Kashyap, M.M. (2003). Likeness between Ranganathan's postulations approach to knowledge classification and entity relationship data modelling approach. *Knowledge Organization,* 30(1), 1-19, https://doi.org/10.5771/0943-7444-2003-1-1.

Kehagias, D. D., Giakoumis, D., & Tzovaras, D. (2008). An ontology-based service-oriented application for mobilityimpaired users. *Proceedings of the 7th International Semantic Web Conference.* http://ceur-ws.org/Vol-401/iswc2008pd_submission_63.pdf

Kietz, J. U., Volz, R., & Maedche, A. (2000). Extracting a domain-specific ontology from a corporate intranet. *Proceedings of the Fourth Conference on Computational Natural Language Learning and the Second Learning Language in Logic Workshop, 167-175.* https://aclanthology.org/W00-0738.pdf

Kirilenko, A. P., Stepchenkova, S. O., & Dai, X. (2021). Automated topic modeling of tourist reviews: does the Anna Karenina principle apply?. *Tourism Management, 83,* Article 104241. https://doi.org/10.1016/j.tourman.2020.104241.

Kitwatthanathawon, P., Angskun, T., & Angskun, J. (2014). An automatic analysis system for online hotel reviews. *WIT Transactions on Information and Communication Technologies.*WIT Press. https://doi.org/10.2495/ICTE130071

Klotz, B., Lisena, P., Troncy, R., Wilms, D., & Bonnet, C. (2017). DrIveSCOVER: A tourism recommender system based on external driving factors. *CEUR Workshop Proceedings:Vol.1963.* http://ceur-ws.org/Vol-1963/paper577.pdf

Knight, K., Chander, I., Haines, M., Hatzivassiloglou, V., Hovy, E., Iida, M., Luk, S. K., Whitney, R. & Yamada, K. (1995). Filling knowledge gaps in a broad-coverage machine translation system. *arXiv preprint cmp-lg/9506009*.

Kumar, A., & Abirami, S. (2018). Aspect-based opinion ranking framework for product reviews using a Spearman's rank correlation coefficient method. *Information Sciences, 460-461*, 23-41. https://doi.org/10.1016/j.ins.2018.05.003

Lee, H. A., Law, R., & Murphy, J. (2011). Helpful reviewers in TripAdvisor, an online travel community. *Journal of Travel & Tourism Marketing, 28*(7), 675-688. https://doi.org/10.1080/10548408.2011.611739.

Levine-Clark, M., & Carter, T.M. (Eds.). (2013). *ALA Glossary of Library and Information Science* (4th ed.). American Library Association.

Levy, S. E., Duan, W., & Boo, S. (2013). An analysis of one-star online reviews and responses in the Washington, DC, lodging market. *Cornell Hospitality Quarterly,* 54(1), 49-63. https://doi.org/10.1177/1938965512464513.

Lisi, F. A., & Esposito, F. (2015). An AI application to integrated tourism planning. In M. Gavanelli, E. Lamma, F. Riguzzi (Eds.), *Lecture Notes in Computer Science: Vol. 9336. AI*IA 2015 Advances in Artificial Intelligence* (pp. 246-259). Springer. https://doi.org/10.1007/978-3-319-24309-2_19

Liu, Z., Sokhn, M., Le Calvé, A., & Schegg, R. (2016). City eye: Accessibility for all. *Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance,* 350-351. https://doi.org/10.1145/2910019.2910020

Luberg, A., Granitzer, M., Wu, H., Järv, P., & Tammet, T. (2012). Information retrieval and deduplication for tourismrecommender sightsplanner. *Proceedings of the 2nd International Conference on Web Intelligence, Mining and Semantics,* Article 50. https://doi.org/10.1145/2254129.2254191,

Luberg, A., Tammet, T., & Järv, P. (2011). Extended triple store structure used in recommender system. *Proceedings of the International Workshop on Database and Expert Systems Applications,* 539-543. https://doi.org/10.1109/DEXA.2011.32

Martínez-García, M., Valls, A., & Moreno, A. (2019). Inferring preferences in ontology-based recommender systems usingWOWA. *Journal of Intelligent Information Systems, 52*(2), 393-423. https://doi.org/10.1007/s10844-018-0532-5

McCarthy, J. (1980). Circumscription—a form of non-monotonic reasoning. *Artificial intelligence, 13*(1-2), 27-39. https://doi.org/10.1016/0004-3702(80)90011-9

Mendis, P., Siriwardene, S., Wijesiri, R., Kohomban, U., & Fernando, S. (2019). *Ontology based online tourist assistant* In J. Hemanth, T. Silva, A. Karunananda (Eds.), *Communications in Computer and Information Science: Vol: 890. Artificial Intelligence* (pp. 161-174). Springer. https://doi.org/10.1007/978-981-13-9129-3_12

Naskar, D., & Das, S. (2019). HNS ontology using faceted approach. *Knowledge Organization, 46*(3), 187-198. https://doi.org/10.5771/0943-7444-2019-3-187.

Neches, R., Fikes, R. E., Finin, T., Gruber, T., Patil, R., Senator, T., & Swartout, W. R. (1991). Enabling technology for knowledge sharing. *AI magazine*, *12*(3), 36-36. https://doi.org/10.1609/aimag.v12i3.902

Noy, N.F. and McGuinness, D.L. (2001). *Ontology development 101: a guide to creating your first ontology.* Stanford Knowledge Systems Laboratory Technical Report KSL-01-05 and Stanford Medical Informatics Technical Report SMI-2001-0880. http://www.ksl.stanford.edu/people/dlm/papers/ontology-tutorial-noy-mcguinness.pdf .

Pai, M. Y., Wang, D. C., Hsu, T. H., Lin, G. Y., & Chen, C. C. (2019). On ontology-based tourist knowledge representation and recommendation. *Applied Sciences, 9*(23), Article 5097. https://doi.org/10.3390/app9235097.

Palau, M., Gómez-Sebastià, I., Ceccaroni, L., Vázquez-Salceda, J., & Nieves, J. C. (2011). *A framework for the development and maintenance of adaptive, dynamic, context-aware information services.* In J. Filipe, A.Fred, B. Sharp (Eds.), *Communications in Computer and Information Science: Vol. 129. Agents and Artificial Intelligence* (pp. 227-239). Springer. https://doi.org/10.1007/978-3-642-19890-8_17

Pearce, P. L., & Wu, M. Y. (2018). Entertaining international tourists: An empirical study of an iconic site in China. *Journal of Hospitality & Tourism Research, 42*(5), 772-792. https://doi.org/10.1177/1096348015598202.

Prieto-Díaz, R. (2003). A faceted approach to building ontologies. Proceedings of the Fifth IEEE Workshop on Mobile Computing Systems and Applications, 458-465. IEEE. https://doi.org/10.1109/IRI.2003.1251451

R Core Team. (2020). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing. https://www.r-project.org

Ranganathan, S. R. (1987). *Colon Classification* (7th Ed.). Gopinath M A, (Rev and Ed), Sarada Ranganathan Endowment for Library Science.

Ranganathan, S.R. (1952). *Colon Classification* (4th Ed.). Madras Library Association.

Ranganathan, S.R. (1957). *Prolegomena to Library Classification* (2nd Ed.) Library Association.

Ranganathan, S.R. (1987). *Colon Classification (Basic and Depth Version)* (7th Ed.). M. A. Gopinath (Ed.), Sarada Ranganathan Endowment.

Real Patronato sobre Discapacidad (2011), Accesibilidad universal al patrimonio cultural. Fundamentos, criterios y pautas. Centro Español de Documentación sobre Discapacidad

Rodríguez-Rodríguez, A., Tejera-Correa, S., Jiménez-Jiménez, S., & Moreno-Díaz, R. (2013). Implementation of an IT-Services Practical Standard in Hotel and Tourism Industries. In *Lecture Notes in Computer Science International Conference on Computer Aided Systems Theory* (pp. 166-173). Springer.

Sahin, I., Gulmez, M., & Kitapci, O. (2017). E-complaint tracking and online problem-solving strategies in hospitality management: Plumbing the depths of reviews and responses on TripAdvisor. *Journal of Hospitality and Tourism Technology, 8*(3), 372-394. https://doi.org/10.1108/JHTT-02-2017-0009.

Sakamoto, Y., & Takama, Y. (2017). Proposal of sentiment-based tourist spot recommendation system using RDFdatabase. *Proceedings of the 2017 IEEE 10th International Workshop on Computational Intelligence andApplications,* 61-66. IEEE. https://doi.org/10.1109/IWCIA.2017.8203562

SáNchez, N. S. B., Tapia, S. A. A., Martínez, S. E. M., Guerrero, J. S., & Valencia, H. B. (2016). *Identification of semantic focal groups for tourist packages based on the semantic orientation of opinions.* In Á. Rocha, A. Correia, H. Adeli, L. Reis, M. Mendonça Teixeira (Eds.), *Advances in Intelligent Systems and Computing, Vol. 444. New Advances in Information Systems and Technologies* (441-453). Springer. https://doi.org/10.1007/978-3-319-31232-3_42

Saracevic, T., & Kantor, P. B. (1997a). Studying the value of library and information services. Part I. Establishing a theoretical framework. *Journal of the American Society for Information Science, 48*(6), 527-542.

Saracevic, T., & Kantor, P. B. (1997b). Studying the value of library and information services. Part II. Methodology and taxonomy. *Journal of the American Society for Information Science, 48*(6), 543-563.

Satija, M.P. (2017). Colon classification (CC). *Knowledge Organization*, *44*(4), 291-307, https://doi.org/10.5771/0943-7444-2017-4-291.

Saumya, S., Singh, J. P., Baabdullah, A. M., Rana, N. P., & Dwivedi, Y. K. (2018). Ranking online consumer reviews. *Electronic commerce research and applications, 29,* 78-89. https://doi.org/10.1016/j.elerap.2018.03.008

Scandic (2012). Scandic's Accessibility Standard. Scandic. https://www.accessibletourism.org/resources/scandics-accessibility-standard_2012_en.pdf.

Scarinci, J., & Myers, T. (2014). A semantic web framework to enable sustainable lodging best management practices in the USA. *Information Technology and Tourism, 14*(4), 291-315. https://doi.org/10.1007/s40558-014-0011-y

Simeon, M. I., Buonincontri, P., Cinquegrani, F., & Martone, A. (2017). Exploring tourists' cultural experiences in Naples through online reviews. *Journal of Hospitality and Tourism Technology, 8*(2), 220-238, https://doi.org/10.1108/JHTT-10-2016-0067.

Studer, R., Benjamins, V. R., & Fensel, D. (1998). Knowledge engineering: Principles and methods. *Data & knowledge engineering, 25*(1-2), 161-197. https://doi.org/10.1016/S0169-023X(97)00056-6

Tsou, M. -C. (2010). Geographic information retrieval and text mining on chinese tourism web pages. *International Journalof Information Technology and Web Engineering, 5*(1), 56-75. https://doi.org/10.4018/jitwe.2010010104

UDC Consortium (2005). *Universal Decimal Classification* (Standard Ed.). British Standard Institution.

UNWTO. (2001). *Thesaurus on Tourism & Leisure Activities (Trilingual: English, French, Spanish)*. World Tourism Organization. https://www.e-unwto.org/doi/book/10.18111/9789284404551

Uschold, M., & Gruninger, M. (1996). Ontologies: Principles, methods and applications. *The knowledge engineering review, 11*(2), 93-136. https://doi.org/10.1017/S0269888900007797

Vickery, B.C. (1960), *Faceted Classification*, ASLIB.

Volkova, L., Yagunova, E., Pronoza, E., Maslennikova, A., Bliznuk, D., Tokareva, M., & Abdullaev, A. (2018). Recommender system for tourist itineraries based on aspects extraction from reviews corpora. *Polibits, 57,* 81-88. https://doi.org/10.17562/PB-57-9.

Wickham, H. (2021). rvest: Easily Harvest (Scrape) Web Pages. R package version 1.0.0. https://cran.r-project.org/package=rvest

Wickham, H., François, R., Henry, L. and Müller, K. (2021). dplyr: A Grammar of Data Manipulation. R package version 1.0.7. https://cran.r-project.org/package=dplyr

World Health Organization (2001). *International Classification of Functioning*. WHO.

World Tourism Organization (2016a), Accessible Tourism for All: An Opportunity within Our Reach, UNWTO.

World Tourism Organization (2016b). *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module I: Accessible Tourism – Definition and Context.* UNWTO.

World Tourism Organization (2016c). *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module V: Best Practices in Accessible Tourism*. UNWTO.

World Tourism Organization and Fundación ACS (2015). Manual on Accessible Tourism for All – Public-Private Partnerships and Good Practices. UNWTO.

Yoo, K. H., & Gretzel, U. (2009). Comparison of deceptive and truthful travel reviews. In W. Höpken, U. Gretzel, R. Law (Eds.), *Information and communication technologies in tourism 2009* (pp. 37-47). Springer. https://doi.org/10.1007/978-3-211-93971-0_4

Zeng, M.L. (2019). Interoperability. *Knowledge Organization, 46*(2), 122-146. https://doi.org/10.5771/0943-7444-2019-2-122.

Zhang, S. -m., Guo, J. -y., Yu, Z. t-., Lei, C. -y., Mao, C. -l., & Wang, H. -x. (2010). An approach of domain ontology construction based on resource model and jena. *Proceedings of the 3rd International Symposium on Information Processing,* 311-315. https://doi.org/10.1109/ISIP.2010.44

Zhang, Y., & Cole, S. T. (2016). Dimensions of lodging guest satisfaction among guests with mobility challenges: A mixed-method analysis of web-based texts. *Tourism Management, 53,* 13-27. https://doi.org/10.1016/j.tourman.2015.09.001.

Zhu, Q., Kong, X., Hong, S., Li, J., & He, Z. (2015). Global ontology research progress: a bibliometric analysis. *Aslib Journal of Information Management, 67*(1), 27-54. http://dx.doi.org/10.1108/AJIM-05-2014-0061

Chapter 6: Conclusion & Future Work

It is important for stakeholders of a smart tourist city to be interconnected through a technological platform for exchanging information relating to tourism activities (Buhalis and Amaranggana, 2015). Digital and intelligent services help in efficient management of a city and its services (Hernández et al., 2020). In this concluding chapter of the thesis, the effective usage scenario of the tourism domain models in a prototype of a centralized tourism information system has been presented to which both tourists and destination managers can connect. Also, the limitations of the demonstrated domain models and avenues for improvement have been discussed.

6.1 Prototype System

The two domain models discussed in section 5.2 and 5.3 of this thesis have been used in combination to conceive a prototype of a tourism information system. The actual development and testing of the tourism information system is outside of the scope of this thesis. Figure 16 presents an outline of the proposed system. The prototype depicts two separate modules, one for serving tourists and external applications and the other is for serving destination managers. Each module has an ontology at the core that serves the purpose of the module. In the following section the feasibility (according to existence of relevant studies) of the development of the components of the prototype system has been presented.

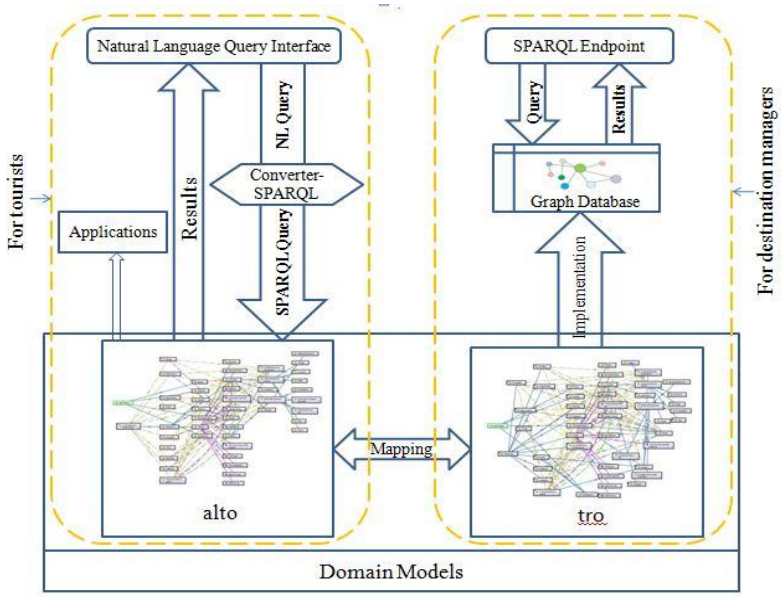

Figure 16: Outline of the proposed prototype system

6.1.1 Interface designing

A natural language interface for providing information to tourists as a response to queries expressed in natural language is required. Interface designing for tourism web portals using semantic web technologies has been discussed in Jraï and Aufaure (2007). The approach demonstrated in the study enables the use of web resources based on users' preferences. Ruiz-Martínez et al. (2009) have presented a method based on natural language processing and semantic web techniques for querying ontological knowledge bases. For providing hotel related information in the context of tourism, Ahmed et al. (2012) have designed an ontology based e-portal that can be queried using natural language queries. Oro and Ruffolo (2017) have discussed about a natural language interface for querying tourism information extracted from web and represented using ontologies.

6.1.2 Converter-SPARQL

A converter with the task of extraction of keywords from natural language queries and creation of SPARQL queries will be required. Valencia-García et al. (2011) have introduced a natural language query editor, named OWLPath that helps in creation of SPARQL queries. The interface developed by Boza-Quispe et al.'s (2017) is capable of accepting speech queries, converting them to text for extracting keywords which are then compared with pattern templates of SPARQL query. The SPARQL query then retrieves information from an ontology of a tourism website. Rahim et al. (2019) have presented a regex-based approach for a tourism question answering system. The process involves converting the questions posed into a natural language triple from which a SPARQL query is generated which in turn queries the system and return the answers.

6.1.3 Implementation in graph database

The purpose of implementing the review ontology in a graph database is to facilitate the visualization of the aspects discussed in the reviews so that selected reviews can be easily delineated to necessary organs of a tourist city for taking action. The implementation of the review ontology in a graph database has been already discussed in section 5.3 of this thesis.

6.1.4 Mapping between the modules

The two modules of the information system are to be mapped by establishing a mapping between the underlying ontologies. The ontologies have been conceptualized using similar kind of methodologies and also have common classes

between them. Figure 17 displays the already existing mapping between the demonstrated ontologies.

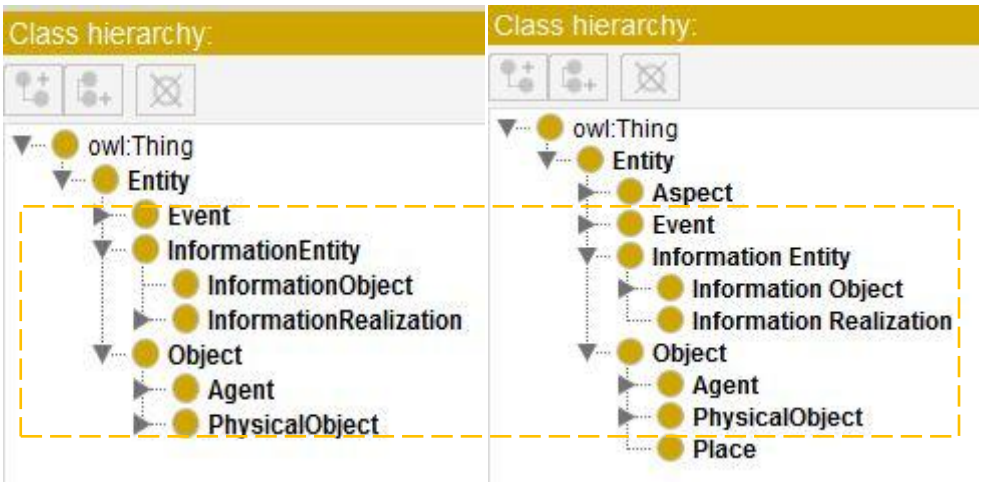

Figure 17: Already existing mapping between the ontologies

Complications may arise due to change in structure, if full integration of ontologies is attempted (Chaware & Rao, 2010). So, further research has to be carried out for developing an improved framework so that the ontologies can be used in an integrated manner. For reference, combined usage of domain models has been demonstrated in various studies. For example, the system for recommending tour plans demonstrated by Huang and Bian (2010) is based on a framework that uses two separate ontologies, one representing the perspective of the tourists and the other representing the perspective of the tourism information providers that have been mapped using formal concept analysis. Yan-Guang et al. (2014) have demonstrated a knowledge integration approach from local ontologies. Silva and Girardi (2014) have described a process of joining ontologies using the similarity between the terms to be reused in the sales and tourism domain.

6.2 Limitations & Future work

The tourism ontology discussed in section 5.2 has been evaluated using competency questions but it is yet to be evaluated in a real usage scenario. Only then a real measure of its comprehensiveness, expressivity and usability can be obtained. As has been noted by Chaware and Rao (2010), that formulation of competency question for each scenario may not be possible. The ontology has been populated from different tourism data sources on the web. Future research for automatically populating the ontology from Linked Open Data sources has to be carried out. For reference, Varga et al. (2014) have used data from proprietary sources and also the linked open data for populating a tourism ontology that has a natural language interface for the Romanian language on top of it. Dastgheib et al.

(2013) have demonstrated the mOntage framework for populating an ontology from selected Linked Open Data sources. Large scale point of interest data integration system that leverages the linked data paradigm has been discussed in (Athanasiou et al., 2019a, 2019b). Ozdikis et al. (2011) have demonstrated ontology population from sources like GeoNames, DBpedia, Google Maps etc. Other contextual studies that have discussed ontology population includes the study by Imsombut and Sirikayon (2016) where the use of natural language processing and machine learning techniques for populating a tourism ontology from documents in Thai language has been demonstrated. Ruiz-Martínez et al. (2009) have also demonstrated a method of populating ontology from web documents in natural language in the e-tourism domain.

It is envisaged that the facet framework discussed in section 5.2 will significantly influence research on knowledge organization centering reviews. But, as of now, the facet framework has been synthesized and validated using reviews from only two destinations. If it is tested on reviews from a wider variety of destinations, then a real measure of its exhaustiveness can be obtained. By virtue of being based on theories of facet analysis, the framework can be expanded and new categories can be accommodated if required. Also, required changes can be easily reflected in the accompanying ontology. The addition of new concepts to an ontology has been demonstrated for example in Kuntarto et al. (2019a, 2019b) where the DWIPA ontology has been subjected to an ontology enrichment methodology. Further research for automatic classification and ontology population with reviews extracted from review databases has to be carried out. For reference, Ruiz-Martínez et al. (2011) have demonstrated a methodology on the e-tourism domain for automatically extracting content from textual web resources and populating an ontology. Lisi and Esposito (2015) have also discussed a tool for extracting information from the web and populating a tourism ontology.

Tourism can contribute to advancement of urban infrastructure and revamp areas (https://www.unwto.org/tourism-in-2030-agenda). Keeping this in mind, in addition to the future avenues of work discussed in the above sections, further research will be focused on extending the domain models for including the concepts of sustainable tourism. Future work will also include the development of applications on top of the domain models such that they can be widely used and contribute to accessible and sustainable tourism research.

References:

Ahmed, F. F., Hussain, S. F., Hameed, S., & Ali, S. M. (2012). Semantic web E-portal for tourism. *Proceedings of the 2012 2nd International Conference on Digital Information and*

Communication Technology and its Applications, 154-158. IEEE. https://doi.org/10.1109/DICTAP.2012.6215342

Athanasiou, S., Alexakis, M., Giannopoulos, G., Karagiannakis, N., Kouvaras, Y., Mitropoulos, P., Patroumpas, K., & Skoutas, D. (2019a).SLIPO: Large-scale data integration for points of interest. *Proceedings of the 22nd International Conference on Extending Database Technology (EDBT),* 574-577. https://doi.org/10.5441/002/edbt.2019.59

Athanasiou, S., Giannopoulos, G., Graux, D., Karagiannakis, N., Lehmann, J., Ngomo, A. -C. N., Patroumpas, K., & Mohamed, A. S., & Skoutas, D. (2019b). Big POI data integration with linked data technologies. *Proceedings of the 22nd International Conference on Extending Database Technology*, 477-488. https://doi.org/10.5441/002/edbt.2019.44

Boza-Quispe, G., Montalvan-Figueroa, J., Rosales-Huamaní, J., & Puente-Mansilla, F. (2017). A friendly speech userinterface based on google cloud platform to access a tourism semantic website. *Proceedings of the 2017 CHILEAN Conference on Electrical, Electronics Engineering, Information and Communication Technologies,* 1-4. IEEE. https://doi.org/10.1109/CHILECON.2017.8229578

Chaware, S., & Rao, S. (2010). Integrated approach to ontology development methodology with case study. *International Journal of Database Management Systems, 2*(3), 13-19. http://www.airccse.org/journal/ijdms/papers/0810ijdms02.pdf

Dastgheib, Shima, Arsham Mesbah and Krys Kochut. (2013). mOntage: Building Domain Ontologies from Linked Open Data. *Proceedings of the IEEE Seventh International Conference on Semantic Computing,* 70-77. IEEE. https://doi.org/10.1109/icsc.2013.21

Huang, Y., & Bian, L. (2010). Ontology-driven tour-planning systems: A conceptual framework. *Environment and PlanningB: Planning and Design, 37*(3), 483-499. https://doi.org/10.1068/b34026

Imsombut, A., & Sirikayon, C. (2016). An alternative technique for populating thai tourism ontology from texts based on machine learning. *Proceedings of the 2016 IEEE/ACIS 15th International Conference on Computer and Information Science,* 1-4. https://doi.org/10.1109/ICIS.2016.7550762

Jrad, Z., & Aufaure, M. -A. (2007). *Personalized interfaces for a semantic web portal: Tourism information search In B. Apolloni, R. J. Howlett, L. Jain (Eds.) Lecture Notes in Computer Science: Vol. 4694. Knowledge-Based Intelligent Information and Engineering Systems* (pp. 695-702). Springer. https://doi.org/10.1007/978-3-540-74829-8_85

Kuntarto, G. P., Alrin, Y., & Gunawan, I. P. (2019). The key role of ontology alignment and enrichment methodologies foraligning and enriching dwipa ontology with the weather concept on the tourism domain. *Proceedings of the 3rd International Conference on Informatics and Computational Sciences,* 1-6. IEEE. https://doi.org/10.1109/ICICoS48119.2019.8982437

Kuntarto, G. P., Isyahrani, S., & Gunawan, I. P. (2019). Performance of K-means clustering algorithm in enriching a newconcept of amenities into dwipa ontology III within the indonesia tourism domain. *Proceedings of the 2019 2ndInternational Seminar on Research of Information Technology and Intelligent Systems*, 334-339. https://doi.org/10.1109/ISRITI48646.2019.9034563

Lisi, F. A., & Esposito, F. (2015, September). An AI application to integrated tourism planning. In M. Gavanelli, E. Lamma, F. Riguzzi (Eds.), *Lecture Notes in Computer Science, Vol. 9336. AI*IA 2015 Advances in Artificial Intelligence* (pp. 246-259). Springer. https://doi.org/10.1007/978-3-319-24309-2_19

Ozdikis, O., Orhan, F., & Danismaz, F. (2011). Ontology-based recommendation for points of interest retrieved from multiple data sources. *Proceedings of the International Workshop on Semantic Web Information Management*, 1-6. https://doi.org/10.1145/1999299.1999300

Rahim, M., Turabee, Z., Rajput, Q., & Khoja, S. A. (2019). Semantic based question answering system on travel ontology. *Proceedings of the 2019 6th International Conference on Social Networks Analysis, Management and Security*, 67-74. IEEE. https://doi.org/10.1109/SNAMS.2019.8931886

Ruiz-Martínez, J. M., Castellanos-Nieves, D., Valencia-García, R., Fernández-Breis, J. T., García-Sánchez, F., Vivancos-Vicente, P. J., Castejón-Garrido, J. S., Camón, J. B., & Martínez-Béjar, R. (2009). *Accessing touristic knowledge bases through a natural language interface.* In D. Richards, B.H. Kang (Eds.), *Lecture Notes in Computer Science, Vol. 5465. Knowledge Acquisition: Approaches, Algorithms and Applications* (pp.147-160). Springer. https://doi.org/10.1007/978-3-642-01715-5_13

Buhalis, D., & Amaranggana, A. (2015). Smart tourism destinations enhancing tourism experience through personalisation of services. In I. Tussyadiah & A. Inversini (Eds.), *Information and Communication Technologies in Tourism 2015* (pp. 377-389), Springer. https://doi.org/10.1007/978-3-319-14343-9_28

Hernandez, J., Garcia, R., Schonowski, J., Atlan, D., Chanson, G. and Ruohomaki, T. (2020). Interoperable open specifications framework for the implementation of standardized urban platforms. *Sensors, 20*(8), Article 2402. https://doi.org/10.3390/s20082402

Ruiz-Martínez, J. M., Miñarro-Giménez, J. A., Castellanos-Nieves, D., García-Sáanchez, F., & Valencia-García, R. (2011). Ontology population: An application for the E-tourism domain. *International Journal of Innovative Computing, Information and Control, 7*(11), 6115-6133. http://www.ijicic.org/10-05097-1.pdf

Silva, F., & Girardi, R. (2014). An approach to join ontologies and their reuse in the construction of application ontologies. *Proceedings of the 2014 IEEE/WIC/ACM International Joint Conference on Web Intelligence and Intelligent Agent Technologies*, 424-431. https://doi.org/10.1109/WI-IAT.2014.66

Valencia-García, R., García-Sánchez, F., Castellanos-Nieves, D., & Fernández-Breis, J. T. (2011). OWLPath: An OWLontology-guided query editor. *IEEE Transactions on Systems, Man, and Cybernetics Part A: Systems and Humans,41*(1), 121-136. https://doi.org/10.1109/TSMCA.2010.2048029

Varga, B., Trambitas-Miron, A. D., Roth, A., Marginean, A., Slavescu, R. R., & Groza, A. (2014). LELA-a natural languageprocessing system for romanian tourism. *In M. Ganzha, L. Maciaszek, M. Paprzycki (Eds.), Annals of Computer Science and Information Systems: Vol. 2, Proceedings of the 2014 Federated Conference on Computer Science and Information Systems* (pp. 281-288). http://dx.doi.org/10.15439/2014F323

Yan-Guang, C., Ya-Ming, Z., Tao, Z., & Yi, Y. (2014). A hybrid ontology knowledge integration for farmbased tourism withNFC. *Proceedings of the 2014 4th International Conference on Instrumentation and Measurement,Computer, Communication and Control,* 548-553. https://doi.org/10.1109/IMCCC.2014.118

Reference List

Abacha, A. B., Da Silveira, M., & Pruski, C. (2013). Medical ontology validation through question answering. *Lecture Notes in Computer Science. Artificial Intelligence in Medicine in Europe* (pp. 196-205). Springer. https://www.springerprofessional.de/en/medical-ontology-validation-through-question-answering/4101250

Abrahams, B., & Dai, W. (2005). Architecture for automated annotation and ontology based querying of Semantic Web Resources. *The 2005 IEEE/WIC/ACM International Conference on Web Intelligence (WI'05)*, 413-417. https://doi.org/10.1109/wi.2005.34

Aciar, S., Coto, M., & Aciar, G. (2020). Identifying user experiences for decision-making in service science. In G. Meiselwitz G. (Eds.), *Lecture Notes in Computer Science, Vol. 12195. Social Computing and Social Media: Participation, User Experience, Consumer Experience, and Applications of Social Computing* (pp.147-157). Springer. https://doi.org/10.1007/978-3-030-49576-3_10

Adel, A., & Abbdellah, B. (2010). CxQWS: Context-aware quality semantic web service. *2010 International Conference on Machine and Web Intelligence, ICMWI 2010 - Proceedings*, 69-76. https://doi.org/10.1109/ICMWI.2010.5648032

Afzaal, M., Usman, M., Fong, A. C., & Fong, S. (2019). Multiaspect-based opinion classification model for tourist reviews. *Expert Systems*, *36*(2), Article e12371. https://doi.org/10.1111/exsy.12371.

Agarwal, J., Goudar, R. H., Sharma, N., Kumar, P., Parshav, V., Sharma, R., & Rao, S. (2013). Cost effective dynamic packaging systems in E-tourism using semantic web. *Proceedings of the 2013 InternationalConference on Advances in Computing, Communications and Informatics (ICACCI 2013),* 1196-1200. https://doi.org/10.1109/ICACCI.2013.6637347

Agarwal, J., Sharma, N., Kumar, P., Parshav, V., Srivastava, A., Rathore, R., & Goudar, R. H. (2014). Semantic search in E-tourism services: Making data compilation easier. *Proceedings of the Second International Conference on Soft Computing for Problem Solving (SocProS 2012),* 811-820. https://doi.org/10.1007/978-81-322-1602-5_86

Ahlers, D. (2013). Assessment of the accuracy of GeoNames gazetteer data. *Proceedings of the 7th workshop on geographic information retrieval.* 74-81. https://doi.org/10.1145/2533888.2533938

Ahmed, F. F., Hussain, S. F., Hameed, S., & Ali, S. M. (2012). Semantic web E-portal for tourism. *Proceedings of the 2012 2nd International Conference on Digital Information and Communication Technology and its Applications*, 154-158. IEEE. https://doi.org/10.1109/DICTAP.2012.6215342

Akbar, Z., Fensel, A., & Fensel, D. (2017). An ontology-based coordination and integration of multi-channel onlinecommunication. *International Journal of Metadata, Semantics and Ontologies, 12*(4), 219-231. https://doi.org/10.1504/IJMSO.2017.093646

Albarq, A. N. (2014). Measuring the impacts of online word-of-mouth on tourists' attitude and intentions to visit Jordan: An empirical study. *International Business Research, 7*(1), 14-22. https://doi.org/10.5539/ibr.v7n1p14.

Alfarraj, O., & AlZubi, A. A. (2019). A novel approach for ranking customer reviews using a modified PSO-based aspect ranking algorithm. *Cluster Computing, 22*, 3175-3181. https://doi.org/10.1007/s10586-018-2012-7

Al-hassan M., Lu H., & Lu J. (2011). Personalized e-Government Services: Tourism Recommender System Framework. In Filipe J., & Cordeiro J. (Eds.), *Lecture notes in business information processing: Vol. 75. Web Information Systems and Technologies* (pp. 173-187). Springer. https://doi.org/10.1007/978-3-642-22810-0_13

Al-Hassan, M., Lu, H., & Lu, J. (2010). A framework for delivering personalized e-government tourism services. *Proceedings of the 6th International Conference on Web Information Systems and Technology (WEBIST 2010)*, 263-270. https://doi.org/10.5220/0002803802630270

Al-Hassan, M., Lu, H., & Lu, J. (2015). A semantic enhanced hybrid recommendation approach: A case study of e-government tourism service recommendation system. *Decision Support Systems, 72*, 97-109. https://doi.org/10.1016/j.dss.2015.02.001

Alhazbi, S., Lotfi, L., Ali, R., & Suwailih, R. (2013a). *An ontology-based context-aware mobile system for on-the-move tourists.* In M. J. O'Grady, H. Vahdat-Nejad, K.-H. Wolf, M. Dragone, J. Ye, C. Röcker, G. O'Hare (Eds.), *Communications in Computer and Information Science: Vol. 413. Evolving Ambient Intelligence* (pp. 252-256). Springer. https://doi.org/10.1007/978-3-319-04406-4_25

Alhazbi, S., Lotfi, L., Ali, R., & Suwailih, R. (2013b). Ontology-based model in tourism context-aware systems. *International Conference on ICT Convergence (ICTC)*, 775-779. https://doi.org/10.1109/ICTC.2013.6675476

Alonso, K., Aginako, N., Lozano, J., & Olaizola, I. G. (2012). Ontology based middleware for ranking and retrieving information on locations adapted for people with special needs. In K. Miesenberger, A. Karshmer, P. Penaz & W. Zagler (Eds.), *Lecture Notes in Computer Science, Vol. 7382. Computers Helping People with Special Needs* (pp.351-354). Springer. https://doi.org/10.1007/978-3-642-31522-0_53

Alonso, K., Zorrilla, M., Iñan, H., Palau, M., Confalonieri, R., Vázquez-Salceda, J., Calle, J., Castro, E. (2012). Ontology-based tourism for all recommender and information retrieval system for interactive community displays. *2012 8th International Conference on Information Science and Digital Content Technology (ICIDT 2012),3,* 650-655.

Alonso-Maturana, R., Alvarado-Cortes, E., López-Sola, S., Martínez-Losa, M. O., & Hermoso-González, P. (2018). La riojaturismo: The construction and exploitation of a queryable tourism knowledge graph. In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.), *Lecture Notes in Computer Science: Vol. 11153.* Springer. https://doi.org/10.1007/978-3-030-03056-8_20

Anderson, W., & Westcott, M. (Eds.). (2021). *Introduction to tourism and hospitality in B.C* (2nd ed.). BCcampus. https://opentextbc.ca/introtourism2e/

Archana, A. B., & Kumar, J. (2016). Location based semantic information retrieval from web documents using webcrawler. Proceedings of the 2015 International Conference on Applied and TheoreticalComputing and Communication Technology, 370-375. https://doi.org/10.1109/ICATCCT.2015.7456912

Aria, M., Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*. *11*(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Arif, M., & Qamar, U. (2018). A Framework for Feature Extraction and Ranking for Opinion Making from Online Reviews. In K. Arai, S. Kapoor & R. Bhatia (Eds.), *Advances in Intelligent Systems and Computing: Vol. 858. Intelligent Computing* (pp.359-371). Springer. https://doi.org/10.1007/978-3-030-01174-1_27

Aslam, T., Latif, M., Sehar, P., Shaheen, H., Kousar, T., & Nazir, N. (2020). *Ontological approach to analyze Traveler'sinterest towards adventures club.* In A. Khanna, D. Gupta, S. Bhattacharyya, V. Snasel, J. Platos, A. Hassanien (Eds.), *Advances in Intelligent Systems and Computing: Vol. 1087. International Conference on Innovative Computing and Communications* (pp. 147-159). Springer. https://doi.org/10.1007/978-981-15-1286-5_13

Athanasiou, S., Alexakis, M., Giannopoulos, G., Karagiannakis, N., Kouvaras, Y., Mitropoulos, P., Patroumpas, K., & Skoutas, D. (2019a).SLIPO: Large-scale data integration for points of interest. *Proceedings of the 22nd International Conference on Extending Database Technology (EDBT)*, 574-577. https://doi.org/10.5441/002/edbt.2019.59

Athanasiou, S., Giannopoulos, G., Graux, D., Karagiannakis, N., Lehmann, J., Ngomo, A. -C. N., Patroumpas, K., & Mohamed, A. S., & Skoutas, D. (2019b). Big POI data integration with linked data technologies. *Proceedings of the 22nd International Conference on Extending Database Technology*, 477-488. https://doi.org/10.5441/002/edbt.2019.44

Aye, N., & Naing, T. T. (2020). Ranking based opinion mining in myanmar travel domain. In J. S. Pan, J. W. Lin, Y. Liang, S. C. Chu (Eds.), *Advances in Intelligent Systems and Computing: Vol. 1107. Genetic and Evolutionary Computing* (pp. 30-37). Springer. https://doi.org/10.1007/978-981-15-3308-2_4

Bahramian, Z., & Ali Abbaspoura, R. (2015). An ontology-based tourism recommender system based on spreading activation model. *International Archives of the Photogrammetry,*

Remote Sensing and Spatial Information Sciences - ISPRS Archives, 40-1/W5. 83-90. https://doi.org/10.5194/isprsarchives-XL-1-W5-83-2015

Bahramian, Z., Abbaspour, R. A., & Claramunt, C. (2017). A context-aware tourism recommender system based on a spreading activation method. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives, 42*-4/W4, 333-339. https://doi.org/10.5194/isprs-archives-XLII-4-W4-333-2017

Baka, V. (2016). The becoming of user-generated reviews: Looking at the past to understand the future of managing reputation in the travel sector. *Tourism Management, 53,* 148-162. https://doi.org/10.1016/j.tourman.2015.09.004.

Bansal, H. S., & Voyer, P. A. (2000). Word-of-mouth processes within a services purchase decision context. *Journal of service research, 3*(2), 166-177. https://doi.org/10.1177/109467050032005.

Bansal, M., & Bathla, A. (2020). Enhanced lexical based technique for opinion mining in tourism. *International Journal of Scientific and Technology Research, 9*(1), 1717-1721. http://www.ijstr.org/final-print/jan2020/Enhanced-Lexical-Based-Technique-For-Opinion-Mining-In-Tourism.pdf

Barta, R., Feilmayr, C., Pröll, B., Grün, C., & Werthner, H. (2009). Covering the semantic space of tourism: An approach based on modularized ontologies. *ACM International Conference Proceeding Series,* 1-8, Article 1. https://doi.org/10.1145/1552262.1552263

Barzegar, M., Sadeghi-Niaraki, A., Shakeri, M., & Choi, S.-M. (2019). A context-aware route finding algorithm for self-driving tourists using ontology. *Electronics, 8*(7), Article 808. https://doi.org/10.3390/electronics8070808

Batet, M., Valls, A., & Gibert, K. (2011). Semantic clustering based on ontologies: An application to the study of visitors in a natural reserve. *Proceedings of the 3rd International Conference on Agents and Artificial Intelligence,* 283-289. https://upcommons.upc.edu/handle/2117/18478

Batouche, B., Nicolas, D., Ayed, H., & Khadraoui, D. (2012). Recommendation of travelling plan for elderly peopleaccording to their abilities and preferences. *Proceedings of the 2012 4th InternationalConference on Computational Aspects of Social Networks,* 327-332. https://doi.org/10.1109/CASoN.2012.6412423

Bawden, D., & Robinson, L. (2012). *Introduction to information science.* Neal-Schuman Publishers.

Becheru, A., Buşe, F., Colhon, M., & Bădicə, C. (2015). Tourist review analytics using complex networks. Proceedings of the 7th Balkan Conference on Informatics Conference, Article 25. https://doi.org/10.1145/2801081.2801088

Becker, C., & Bizer, C. (2009). Exploring the geospatial semantic web with DBpedia mobile. *Journal of Web Semantics, 7*(4), 278-286. https://doi.org/10.1016/j.websem.2009.09.004

Benjamin, P. C., Menzel, C. P., Mayer, R. J., Fillion, F., Futrell, M. T., deWitte, P. S., & Lingineni, M. (1994). Idef5 method report. *Knowledge Based Systems, Inc.*

Berezan, O., Raab, C., Tanford, S., & Kim, Y. S. (2015). Evaluating loyalty constructs among hotel reward program members using eWOM. *Journal of Hospitality & Tourism Research, 39*(2), 198-224. https://doi.org/10.1177/1096348012471384

Berners-Lee, T. (2006, July 27). Linked data-design issues. World Wide Web Consortium (W3C). https://www.w3.org/DesignIssues/LinkedData.html

Berners-Lee, T., Hendler, J., & Lassila, O. (2001). The semantic web. *Scientific american, 284*(5), 34-43. https://www.scientificamerican.com/article/the-semantic-web

Berners-Lee, T., Hendler, J., & Lassila, O. (2001, May 17). The semantic web. *Scientific american, 284*(5), 34-43. https://www.scientificamerican.com/article/the-semantic-web/

Berners-Lee, T., Hendler, J., Lassila, O., (2001, May 17). The Semantic Web. *Scientific american*. 284(5), 34-43. https://www.scientificamerican.com/article/the-semantic-web/

Bezerra, C., Freitas, F., & Santana, F. (2013, November). Evaluating ontologies with competency questions. *Proceedings of 2013 IEEE/WIC/ACM International Joint Conferences on Web Intelligence (WI) and Intelligent Agent Technologies (IAT)*, 284-285. IEEE. https://doi.org/10.1109/WI-IAT.2013.199.

Bhattacharyya, G. (1975). POPSI: its fundamentals and procedure based on a general theory of Subject Indexing Languages. *Library Science with a Slant to Documentation, 16*(1), 1-34.

Biagetti, M.T. (2020), Ontologies (as knowledge organization systems). In B. Hjørland, & C. Gnoli (Eds.), *ISKO Encyclopedia of Knowledge Organization.* https://www.isko.org/cyclo/ontologies

Biagetti, M.T. (2020), Ontologies (as knowledge organization systems). In B. Hjørland, & C. Gnoli (Eds.), ISKO Encyclopedia of Knowledge Organization. https://www.isko.org/cyclo/ontologies

Bilbao, S., & Herrero, J. (2009). Semantic platform for the composition of tourism products and services. *SMAP'09 - 4th International Workshop on Semantic Media Adaptation and Personalization*, 111-114. https://doi.org/10.1109/SMAP.2009.14

Bispo M. d. S. (2016). Tourism as practice. *Annals of Tourism Research, 61*, 170-179. https://doi.org/10.1016/j.annals.2016.10.009

Blanco-Fernández, Y., López-Nores, M., Pazos-Arias, J. J., García-Duque, J., & Martín-Vicente, M. I. (2011). TripFromTV+:Targeting personalized tourism to interactive digital TV viewers by social networking and semantic reasoning. *IEEE Transactions on Consumer Electronics, 57*(2), 953-961. https://doi.org/10.1109/TCE.2011.5955245

Blersch, M., Weigelt, S., Tichy, W. F., & Angele, K. (2019). Automatic generation of virtual assistants from databases using active ontologies. *Proceedings of the International Conference on Software Engineering and Knowledge Engineering*. https://doi.org/10.18293/SEKE2019-077

Boldrini, E., Ferrández, S., Izquierdo, R., Tomás, D., & Vicedo, J. L. (2009). *A parallel corpus labeled using open andrestricted domain ontologies.* In A. Gelbukh (Eds.), *Lecture Notes in Computer Science, Vol. 5449. Computational Linguistics and Intelligent Text Processing* (pp. 346-356). Springer. https://doi.org/10.1007/978-3-642-00382-0_28

Bordoni, L. (2011). Technologies to support cultural tourism for latin latium. *Journal of Hospitality and Tourism Technology, 2*(2), 96-104. https://doi.org/10.1108/17579881111154218

Borràs, J., Moreno, A., & Valls, A. (2014). Intelligent tourism recommender systems: A survey. *Expert Systems with Applications, 41*(16), 7370-7389. https://doi.org/10.1016/j.eswa.2014.06.007

Borràs, J., Valls, A., Moreno, A., Isern, D. (2012). Ontology-based management of uncertain preferences in user profiles. In S. Greco, B. Bouchon-Meunier, G. Coletti, M. Fedrizzi, B. Matarazzo, R.R. Yager (Eds.), *Communications in Computer and Information Science, Vol. 298. Advances in Computational Intelligence* (pp. 127-136). Springer. https://doi.org/10.1007/978-3-642-31715-6_15

Boudaa, B., Figuir, D., Hammoudi, S., & Benslimane, S. M. (2021). DATAtourist: A constraint-based recommender system using datatourisme ontology. International Journal of Decision Support System Technology, 13(2), 62-84. https://doi.org/10.4018/IJDSST.2021040104

Boulakbech, M., Cheniki, N., Messai, N., Sam, Y., & Devogele, T. (2018). Linked data graphs for semantic data integration in the CART system. https://doi.org/10.1007/978-3-030-03056-8_21. In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.), *Lecture Notes in Computer Science, Vol. 11153. Current Trends in Web Engineering* (pp. 221-226). Springer. https://doi.org/10.1007/978-3-030-03056-8_21

Boza-Quispe, G., Montalvan-Figueroa, J., Rosales-Huamaní, J., & Puente-Mansilla, F. (2017). A friendly speech userinterface based on google cloud platform to access a tourism semantic website. *Proceedings of the 2017 CHILEAN Conference on Electrical, Electronics Engineering, Information and Communication Technologies,* 1-4. IEEE. https://doi.org/10.1109/CHILECON.2017.8229578

Bradley, A., & James, R. J. (2019). Web scraping using R. *Advances in Methods and Practices in Psychological Science, 2*(3), 264-270. https://doi.org/10.1177/2515245919859535

Braşoveanu, A. M. P., Sabou, M., Scharl, A., Hubmann-Haidvogel, A., & Fischl, D. (2017). Visualizing statistical linked knowledge for decision support. *Semantic Web, 8*(1), 113-137. https://doi.org/10.3233/SW-160225

Brodeala, L. C. (2020). Online recommender system for accessible tourism destinations. *14th ACM Conference on Recommender Systems,* 787-791. https://doi.org/10.1145/3383313.3411450

Broughton, V. (2006). The need for a faceted classification as the basis of all methods of information retrieval. *Aslib proceedings, 58*(1/2), 49-72. https://doi.org/10.1108/00012530610648671

Budsapawanich, P., Anutariya, C., & Haruechaiyasak, C. (2018). A conceptual framework for linking open governmentdata based-on geolocation: A case of Thailand. In R. Ichise, F. Lecue, T. Kawamura, D. Zhao, S. Muggleton, K. Kozaki (Eds.), *Lecture Notes in Computer Science: Vol. 11341. Semantic Technology* (pp.352-366). Springer. https://doi.org/10.1007/978-3-030-04284-4_24

Buhalis, D., & Amaranggana, A. (2015). Smart tourism destinations enhancing tourism experience through personalisation of services. In I. Tussyadiah & A. Inversini (Eds.), *Information and Communication Technologies in Tourism 2015* (pp. 377-389), Springer. https://doi.org/10.1007/978-3-319-14343-9_28

Buján, D., Martín, D., Torices, O., & Uriarte, A. (2012). New approaches in context modelling for tourism applications. In J. Bravo, D. López-de-Ipiña, F. Moya (Eds.), *Lecture Notes in Computer Science, Vol. 7656. Ubiquitous Computing and Ambient Intelligence* (pp. 379-386). Springer. https://doi.org/10.1007/978-3-642-35377-2_53

Buján, D., Martín, D., Torices, O., López-de-Ipiña, D., Lamsfus, C., Abaitua, J., & Alzua-Sorzabal, A. (2013). Context management platform for tourism applications. *Sensors, 13*(7), 8060-8078. https://doi.org/10.3390/s130708060

Burzagli, L., Como, A., & Gabbanini, F. (2010). Towards the convergence of web 2.0 and semantic web for E-inclusion. In K. Miesenberger, J. Klaus, W. Zagler, A. Karshmer (Eds.), *Lecture Notes in Computer Science, Vol. 6179. Computers Helping People with Special Needs* (pp. 343-350). Springer. https://doi.org/10.1007/978-3-642-14097-6_55

Cabrera Rivera L., Vilches-Blázquez L.M., Torres-Ruiz M., Moreno Ibarra M.A. (2015). Semantic Recommender System for Touristic Context Based on Linked Data. In V. Popovich, C. Claramunt, M. Schrenk, K. Korolenko, J. Gensel (Eds.), *Lecture Notes in Geoinformation and Cartography*. Information Fusion and Geographic Information Systems (IF&GIS' 2015) (pp. 77-89). Springer. https://doi.org/10.1007/978-3-319-16667-4_5

Cambria, E., Speer, R., Havasi, C., & Hussain, A. (2010). SenticNet: A publicly available semantic resource for opinion mining. *Commonsense Knowledge: Papers from the AAAI Fall Symposium (FS-10-02),* 14-18. https://www.aaai.org/ocs/index.php/FSS/FSS10/paper/viewFile/2216/2617

Canadian Transportation Agency (2009). *Take Charge of Your Travel – A Guide for Persons with Disabilities.* Minister of Public Works and Government Services Canada.

Cao, T., & Nguyen, Q. (2012). Semantic approach to travel information search and itinerary recommendation. *International Journal of Web Information Systems, 8*(3), 256-277. https://doi.org/10.1108/17440081211258169

Cao, T., & Tuan, N. (2011). Improving travel information access with semantic search application on mobile environment. *Proceedings of the 9th International Conference on Advances in Mobile Computing and Multimedia,* 95-102. https://doi.org/10.1145/2095697.2095716

Cardona, G. P., & Garijo, M. (2012). A conceptual architecture for semantic mash up recommender framework. *8th International Conference on Signal Image Technology and Internet Based Systems,* 1002-1009. https://doi.org/10.1109/SITIS.2012.148

Castells, M. (2010). The new economy: informationalism, globalization, networking. In M. Castells (Ed.), *The rise of the Network Society* (pp. 77-162). https://doi.org/10.1002/9781444319514.ch2

Castillo, L., Armengol, E., Onaindía, E., Sebastiá, L., González-Boticario, J., Rodríguez, A., Fernández, S., Arias, J. D., & Borrajo, D. (2008). Samap:An user-oriented adaptive system for planning tourist visits. *Expert Systems with Applications, 34*(2), 1318-1332. https://doi.org/10.1016/j.eswa.2006.12.029

Čech, P., & Bureš, V. (2009). Advanced technologies in e-tourism. *Proceedings of the 9th WSEAS International Conference on Applied Computer Science,* 85-92.http://www.wseas.us/e-library/conferences/2009/genova/ACS/ACS-12.pdf

CEN TC278 WG3. (2006). SIRI-Service interface for Real-time Information CEN TS 15531 1-5 (SG7). http://www.transmodel-cen.eu/standards/siri/

Chakraborty, B., Nayek, P., Basak, S., Ghosh, D., & Debnath, N. (2010). A performance comparison between data-based KMS and ontology based KMS for e-tourism services. *Proceedings of IEEE International Conference on Industrial Informatics (INDIN),* 698-703. IEEE. https://doi.org/10.1109/INDIN.2010.5549656

Chantrapornchai, C., Bunlaw, N., & Choksuchat, C. (2018). Semantic image search: Case study for western region tourism in thailand. *Journal of Information Processing Systems, 14*(5), 1195-1214. https://doi.org/10.3745/JIPS.04.0088

Chatterjee, A. (2017). Index and indexing. In Chatterjee, A. (Ed.), *Elements of Information Organization and Dissemination* (pp. 125-134). Chandos Publishing. https://doi.org/10.1016/B978-0-08-102025-8.00009-0.

Chaves, M. S., Freitas, L., & Vieira, R. (2012). Hontology: A multilingual ontology for the accommodation sector in thetourism industry. *Proceedings of the International Conference on KnowledgeEngineering and Ontology Development*, 149-154. https://doi.org/10.5220/0004107401490154

Chaware, S., & Rao, S. (2010). Integrated approach to ontology development methodology with case study. *International Journal of Database Management Systems, 2*(3), 13-19. http://www.airccse.org/journal/ijdms/papers/0810ijdms02.pdf

Chaware, S., & Rao, S. (2010). Integrated approach to ontology development methodology with case study. *International Journal of Database Management Systems, 2*(3), 13-19. http://www.airccse.org/journal/ijdms/papers/0810ijdms02.pdf

Che, S., Nan, D., Kamphuis, P., Jin, X., & Kim, J. H. (2021). A Cluster Analysis of Lotte Young Plaza Using Semantic Network Analysis Method. *15th International Conference on Ubiquitous Information Management and Communication (IMCOM)*, 1-6. IEEE. https://doi.org/10.1109/IMCOM51814.2021.9377390.

Chen, L. J., & Hoon, G. K. (2020). Feature expansion using lexical ontology for opinion type detection in tourism reviewsdomain. *International Journal of Advanced Computer Science and Applications, 11*(8), 628-637. https://doi.org/10.14569/IJACSA.2020.0110877

Chen, Y. S., & Wu, S. T. (2021). An exploration of actor-network theory and social affordance for the development of a tourist attraction: A case study of a Jimmy-related theme park, Taiwan. *Tourism Management, 82,* Article 104206. https://doi.org/10.1016/j.tourman.2020.104206.

Cheniki, N., Boulakbech, M., Labbaci, H., Messai, N., Sam, Y., & Devogele, T. (2019). A linked open data based approachfor trip recommendation. *Proceedings - 2019 IEEE 28th International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE),* 192-195. IEEE. https://doi.org/10.1109/WETICE.2019.00048

Cheniki, N., Sam, Y., Messai, N., & Belkhir, A. (2018). Context-aware and linked open data based service discovery. In T. Mikkonen, R. Klamma, J. Hernández, (Eds.), *Lecture Notes in Computer Science: Vol. 10845. Web Engineering* (pp. 448-462). Springer. https://doi.org/10.1007/978-3-319-91662-0_36

Chifu, E. S., & Leţia, I. A. (2008). Text-based ontology enrichment using hierarchical self-organizing maps. *Proceedings of the First International Conference on Nature Inspired Reasoning for the Semantic Web, 419,* 36-50. https://dl.acm.org/doi/10.5555/2889615.2889619

Chinnapatjeerat, R., Tuamsuk, K., & Supnithi, T. (2016). Ontology of information for tourism development planning in Thailand. *Proceedings of 2016 5th International Conference on Computer Science and Network Technology (ICCSNT),* 856-878. IEEE. doi:10.1109/iccsnt.2016.8070281.

Chochiang, K., Hanna, F., Betbeder, M., & Lapayre, J. (2016). A new web-services based platform for semantic transliterated words searching to facilitate tourist strips in thailand. *Proceedings of the 2016 IEEE 20th International Conference on Computer Supported Cooperative Work in Design,* 310-315. https://doi.org/10.1109/CSCWD.2016.7566006

Choi, C., Cho, M., Choi, J., Hwang, M., Park, J., & Kim, P. (2009). Travel ontology for intelligent recommendation system. *Proceedings - 2009 3rd Asia International Conference on Modelling and Simulation,* 637-642. https://doi.org/10.1109/AMS.2009.75

Choi, C., Cho, M., Kang, E.-y., & Kim, P. (2006). Travel ontology for recommendation system based on semantic web. *8th International Conference Advanced Communication Technology, ICACT 2006 –Proceedings,* 624-627. https://doi.org/10.1109/ICACT.2006.206046.

Choksuchat, C., & Chantrapornchai, C. (2010). Benchmarking query complexity between RDB and OWL. In T. Kim, Y. Lee, B. H. Kang, D. Ślęzak (Eds.) *Lecture Notes in Computer Science: Vol. 6485. Future Generation Information Technology* (pp. 352-364). Springer. https://doi.org/10.1007/978-3-642-17569-5_35

Chu, Y., Wang, H., Zheng, L., Wang, Z., & Tan, K.-L. (2016). *TRSO: A tourism recommender system based on ontology.* In F. Lehner, N. Fteimi (Eds.), *Lecture Notes in Computer Science, Vol. 9983. Knowledge Science, Engineering and Management* (pp. 567-579). Springer. https://doi.org/10.1007/978-3-319-47650-6_45

Chua, A. Y., & Banerjee, S. (2013). Reliability of reviews on the Internet: The case of Tripadvisor. *Proceedings of the World Congress on Engineering & Computer Science,* 453-457. http://www.iaeng.org/publication/WCECS2013/WCECS2013_pp453-457.pdf

Chua, A. Y., & Banerjee, S. (2015). Understanding review helpfulness as a function of reviewer reputation, review rating, and review depth. *Journal of the Association for Information Science and Technology, 66,* 354-362. https://doi.org/10.1002/asi.23180

Chuenta, I. (2014). The construction of an ontologies using recommender management system for tourism website of northeast thailand In K. Tuamsuk, A. Jatowt, & E. Rasmussen (Eds.), *Lecture Notes in Computer Science, Vol. 8839. The Emergence of Digital Libraries – Research and Practices. Springer.* https://doi.org/10.1007/978-3-319-12823-8_12

Cimmino, A., Mihindukulasooriya, N., Priyatna, F., & Rico, M. (2018). Linked-fiestas: A knowledge graph to promote cultural tourism in spain. In C. Pautasso, F. Sánchez-Figueroa, K. Systä & J. Murillo Rodríguez (Eds.), *Lecture Notes in Computer Science: Vol.*

11153. Current Trends in Web Engineering (pp. 202-205). Springer. https://doi.org/10.1007/978-3-030-03056-8_18

Ciobanica, C., Tudic, F., & Slavescu, R. R. (2012). Designing an information gathering application for a personalized travel recommender system. *Proceedings of the 2012 IEEE/WIC/ACM International Conference onWeb Intelligence and Intelligent Agent Technology Workshops,* 102-106. https://doi.org/10.1109/WI-IAT.2012.101

Coates, E.J. (1960). *Subject Catalogues: Headings and Structures*. The Library Association.

Codescu, M., Horsinka, G., Kutz, O., Mossakowski, T., & Rau, R. (2011). Osmonto-an ontology of openstreetmap tags. *State of the map Europe (SOTM-EU 2011)*. http://www.inf.unibz.it/~okutz/resources/osmonto.pdf

Cresci, S., D'Errico, A., Gazzé, D., Lo Duca, A., Marchetti, A., & Tesconi, M. (2014). Towards a DBpedia of tourism: The case of tourpedia. Paper presented at the *CEUR Workshop Proceedings, 1272,* 129-132. http://ceur-ws.org/Vol-1272/paper_106.pdf

Crotts, J. C., Mason, P. R., & Davis, B. (2009). Measuring guest satisfaction and competitive position in the hospitality and tourism industry: An application of stance-shift analysis to travel blog narratives. *Journal of Travel Research, 48*(2), 139-151. https://doi.org/10.1177/0047287508328795.

Damljanović, D., & Devedžić, V. (2009). Applying semantic web to E-tourism. In Z. Ma, & H. Wang (Eds.), *The semantic web for knowledge and data management: Technologies and practices* (pp. 243-265). IGI Global. https://doi.org/10.4018/978-1-60566-028-8.ch010

Darcy, S. (2006). *Setting a Research Agenda for Accessible Tourism*. Cooperative Research Centre for Sustainable Tourism.

Das, S. (2018). *Domain Modeling: Theory and Practice* [Doctoral dissertation, University of Trento]. http://eprints-phd.biblio.unitn.it/2877/

Das, S. (2018). *Domain Modeling: Theory and Practice* [Doctoral dissertation, University of Trento]. http://eprints-phd.biblio.unitn.it/2877/

Das, S. (2018). *Domain Modeling: Theory and Practice* [Doctoral dissertation, University of Trento]. http://eprints-phd.biblio.unitn.it/2877/

Das, S., & Roy, S. (2016). Faceted Ontological Model for Brain Tumour Study. *Knowledge Organization, 43*(1), 3-12. https://doi.org/10.5771/0943-7444-2016-1-3

Dastgheib, Shima, Arsham Mesbah and Krys Kochut. (2013). mOntage: Building Domain Ontologies from Linked Open Data. *Proceedings of the IEEE Seventh International Conference on Semantic Computing,* 70-77. IEEE. https://doi.org/10.1109/icsc.2013.21

De Vita, E., Marcialis, I., Fadda, S. S., Farci, A., & Malagnini, G. L. (2017). Instrumenting the UNWTO's Thesaurus on Tourism & Leisure Activities for seamless adoption in the Web of Data. In J. Fernández, S. Hellmann (Eds.), *Proceedings of the Posters and Demos Track of the 13th International Conference on Semantic Systems - SEMANTiCS2017*. http://ceur-ws.org/Vol-2044/paper15

DeGrolier, E. (1962). *A Study of General Categories Application to Classification and Coding in Documentation*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000025055.

Dell'Erba, M., Fodor, O., Ricci, F., & Werthner, H. (2003). Harmonise: a solution for data interoperability. In J. L. Monteiro, P. M. C. Swatman, L.V. Tavares (Eds.), *IFIP — The International Federation for Information Processing: Vol. 105. Towards the Knowledge Society* (pp. 433-445). Springer. https://doi.org/10.1007/978-0-387-35617-4_28

Descamps-Vila, L., Conesa, J., & Péarro, A. (2012). Itiner@: Ontology for personalizing tourist routes in mobile devices. *Proceedings of the 2012 4th International Conference on Intelligent Networking and Collaborative Systems*, 420-427. https://doi.org/10.1109/iNCoS.2012.47

Devasanthiya, C., Vigneshwari, S., & Vivek, J. (2016). An enhanced tourism recommendation system with relevancy feedback mechanism and ontological specifications. In L. Suresh & B. Panigrahi (Eds.) *Advances in Intelligent Systems and Computing: Vol. 398. Proceedings of the International Conference on Soft Computing Systems* (pp. 281-289). Springer. https://doi.org/10.1007/978-81-322-2674-1_28

Dewey, M. (2011). *Dewey Decimal Classification and Relative Index* (J. S. Mitchell, J. Beall, R. Green, G. Martin & M. Panzer Eds.). 23rd ed. OCLC Online Computer Library Center, Inc.

Di Giorgio, S. (2014). Culturaitalia, the italian national content aggregator in europeana. *Procedia Computer Science, 38*, 40-43. https://doi.org/10.1016/j.procs.2014.10.008

Dimitrakis, E., Sgontzos, K., & Tzitzikas, Y. (2020). A survey on question answering systems over linked data and documents. *Journal of Intelligent Information Systems, 55*(2), 233-259. https://doi.org/10.1007/s10844-019-00584-7

Ding, Y. (2010). Semantic Web: Who is who in the field — a bibliometric analysis. *Journal of Information Science,* 36(3), 335–356. https://doi.org/10.1177/0165551510365295

Dînşoreanu, M., Dobrin, M., Florea, M., & Fodor, A. (2012). An integrated case-based reasoning and ontology-drivenapproach for designing recommendation systems. *Proceedings - 2012 IEEE 8th International Conference on Intelligent Computer Communication and Processing,* 301-304. https://doi.org/10.1109/ICCP.2012.6356203

Directive 2007/2/EC. *Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European*

Community (INSPIRE). European Parliament, Council of the European Union. https://eur-lex.europa.eu/eli/dir/2007/2/oj

Directive 2007/2/EC. *Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)*. European Parliament, Council of the European Union. https://eur-lex.europa.eu/eli/dir/2007/2/oj

Doan, P. H., Arch-Int, N., & Arch-Int, S. (2020). A semantic framework for extracting taxonomic relations from text corpus. *International Arab Journal of Information Technology, 17*(3), 325-337. https://doi.org/10.34028/iajit/17/3/6

Dorobăț, I. C., & Posea, V. (2021). The usability of romanian open data in the development of tourist applications. In M. Ioannides, E. Fink, L. Cantoni, E. Champion (Eds.), *Lecture Notes in Computer Science: Vol. 12642. Digital Heritage: Progress in Cultural Heritage: Documentation, Preservation, and Protection* (pp. 596-602). Springer. https://doi.org/10.1007/978-3-030-73043-7_51

Dumitrache, A., & Lange, C. (2011). Baudenkmalnetz - creating a semantically annotated web resource of historicalbuildings. *CEUR Workshop Proceedings, 721,* 30-41. http://ceur-ws.org/Vol-721/paper-04.pdf

Dupre, K. (2019). Trends and gaps in place-making in the context of urban development and tourism: 25 years of literature review. *Journal of Place Management and Development,* 12(1), 102-120. https://doi.org/10.1108/JPMD-07-2017-0072.

Dutta, B., Chatterjee, U., & Madalli, D. P. (2015). YAMO: yet another methodology for large-scale faceted ontology construction. *Journal of Knowledge Management,* 19(1), 6-24. https://doi.org/10.1108/JKM-10-2014-0439

Dutta, B., Giunchiglia, F., & Maltese, V. (2011, May). A facet-based methodology for geo-spatial modeling. In C. Claramunt, S. Levashkin, & M. Bertolotto (Eds.), *Lecture Notes in Computer Science: Vol. 6631. GeoSpatial Semantics* (pp. 133-150). Springer. https://doi.org/10.1007/978-3-642-20630-6_9

Economic and Social Commission for Asia and the Pacific. (2009). *Takayama Declaration on the Development of Communities-for-All in Asia and the Pacific.* https://www.accessibletourism.org/resources/takayama_declaration_top-e-fin_171209.pdf

Eftekhari, M. H., Barzegar, Z., & Isaai, M. T. (2011). Web 1.0 to web 3.0 evolution: Reviewing the impacts on tourism development and opportunities In F.V. Cipolla Ficarra, C. de Castro Lozano, E. Nicol, A. Kratky, M. Cipolla-Ficarra (Eds.), *Lecture Notes in Computer Science, Vol. 6529.* Springer. https://doi.org/10.1007/978-3-642-18348-5_17

Emaldi, M., Lázaro, J., Laiseca, X., & López-De-Ipiña, D. (2012). LinkedQR: Improving tourism experience through linked data and QR codes. In J. Bravo, D. López-de-Ipiña, F.

Moya (Eds.), *Lecture Notes in Computer Science: Vol. 7656. Ubiquitous Computing and Ambient Intelligence* (pp. 371-378). Springer. https://doi.org/10.1007/978-3-642-35377-2_52

Fang, B., Ye, Q., Kucukusta, D., & Law, R. (2016). Analysis of the perceived value of online tourism reviews: Influence of readability and reviewer characteristics. *Tourism Management, 52*, 498-506. https://doi.org/10.1016/j.tourman.2015.07.018.

Fang, Y., Jiaming, Z., Yaohui, L., & Mei, G. (2016). Semantic description and link construction of smart tourism linked databased on big data. *Proceedings of 2016 IEEE International Conference on Cloud Computingand Big Data Analysis*, 32-36. https://doi.org/10.1109/ICCCBDA.2016.7529530

Fang, Y., Yin, J., & Wu, B. (2017). Climate change and tourism: a scientometric analysis using CiteSpace. *Journal of Sustainable Tourism,* 26(1), 108–26. https://doi.org/10.1080/09669582.2017.1329310

Farradane, J.E.L. (1950). A scientific theory of classification and indexing and its practical applications. *Journal of Documentation, 6*(2), 83-99, https://doi.org/10.1108/eb026155.

Farradane, J.E.L. (1952). A scientific theory of classification and indexing: further considerations. *Journal of Documentation, 8*(2), 73-92, https://doi.org/10.1108/eb026182.

Fensel, A., Kärle, E., & Toma, I. (2015). TourPack: Packaging and disseminating touristic services with linked data andsemantics. *CEUR Workshop Proceedings, 1339,* 43-54.

Fermoso, A. M., Mateos, M., Beato, M. E., & Berjón, R. (2015). Open linked data and mobile devices as e-tourism tools Apractical approach to collaborative e-learning. *Computers in Human Behavior, 51*, 618-626. https://doi.org/10.1016/j.chb.2015.02.032

Fernández-López, M., Gómez-Pérez, A., & Juristo, N. (1997). Methontology: from ontological art towards ontological engineering. *American Association for Artificial Intelligence*

Ferrández, O., Spurk, C., Kouylekov, M., Dornescu, I., Ferrández, S., Negri, M., Izquierdo, R., Tomás, D., Orasan, C., Neumann, G., Magnini, B. & Vicedo, J. L. (2011). The QALL-MEframework: A specifiable-domain multilingual question answering architecture. *Journal of Web Semantics*, *9*(2), 137-145. https://doi.org/10.1016/j.websem.2011.01.002

Ferraro P., Lo Re G. (2014) Designing Ontology-Driven Recommender Systems for Tourism. In S. Gaglio, G. Lo Re (Eds.), *Advances in Intelligent Systems and Computing: Vol. 260.* Springer. https://doi.org/10.1007/978-3-319-03992-3_24

Fodness, D., & Murray, B. (1999). A model of tourist information search behavior. *Journal of Travel Research*, 37(3), 220–230. https://doi.org/10.1177/004728759903700302

Formica, A., Missikoff, M., Pourabbas, E., & Taglino, F. (2013). Semantic search for matching user requests with profiled enterprises. *Computers in Industry, 64*(3), 191-202. https://doi.org/10.1016/j.compind.2012.09.007

Friedmann, J. (2010). Place and place-making in cities: a global perspective. *Planning Theory and Practice*, 11(2), 149-165. https://doi.org/10.1080/14649351003759573.

Frikha M., Mhiri M., Gargouri F. (2015) Designing a User Interest Ontology-Driven Social Recommender System: Application for Tunisian Tourism. In J. Bajo, J. Z. Hernández, P. Mathieu, A. Campbell, A Fernández-Caballero, M. N. Moreno, V. Julián, A. Alonso-Betanzos, M. D. Jiménez-López, V. Botti (Eds.) *Advances in Intelligent Systems and Computing: Vol. 372. Trends in Practical Applications of Agents, Multi-Agent Systems and Sustainability (pp. 159-166). Springer.* https://doi.org/10.1007/978-3-319-19629-9_18

Frikha, M., Mhiri, M., & Gargouri, F. (2015). *Designing a user interest ontology-driven social recommender system: Application for tunisian tourism* https://doi.org/10.1007/978-3-319-19629-9_18

Frikha, M., Mhiri, M., & Gargouri, F. (2017). An user interest ontology based on trusted friends preferences for personalized recommendation. In M. Themistocleous, V. Morabito, (Eds.), *Lecture Notes in Business Information Processing: Vol. 299. Information Systems* (pp. 54-67). Springer. https://doi.org/10.1007/978-3-319-65930-5_5

Frikha, M., Mhiri, M., & Gargouri, F. (2018). Using social interaction between friends in knowledge-based personalized recommendation. *Proceedings of IEEE/ACS International Conference on Computer Systems and Applications,* 1454-1461. https://doi.org/10.1109/AICCSA.2017.206

Frikha, M., Mhiri, M., Zarai, M., & Gargouri, F. (2016). Time-sensitive trust calculation between social network friends for personalized recommendation. *Proceedings of the 18th Annual International Conference on Electronic Commerce: e-Commerce in Smart connected World,* Article 36, https://doi.org/10.1145/2971603.2971639

Gala, A. P.-D. L., Cardinale, Y., Dongo, I., & Ticona-Herrera, R. (2021). Towards an ontology for urban tourism. *Proceedings of the 36th Annual ACM Symposium on Applied Computing,* 1887–1890. https://doi.org/10.1145/3412841.3442142

Gangemi, A., Guarino, N., Masolo, C., Oltramari, A. and Schneider, L. (2002), Sweetening ontologies with DOLCE, In A. Gómez-Pérez & V. R. Benjamins (Eds.), *Lecture Notes in Computer Science, Vol. 2473. Knowledge Engineering and Knowledge Management: Ontologies and the Semantic Web* (pp. 166-181). Springer. https://doi.org/10.1007/3-540-45810-7_18

García-Barriocanal E., Sicilia MA. (2008). On Linking Cultural Spaces and e-Tourism: An Ontology-Based Approach. In L. Miltiadis D., C. John M., D. Ernesto, T. Robert D., A. David, G. Vossen, P. Patricia Ordonez De (Eds.), *Communications in Computer and*

Information Science: Vol. 19. The Open Knowlege Society: A Computer Science and Information Systems Manifesto (pp. 694-701) Springer. https://doi.org/10.1007/978-3-540-87783-7_88

García-Crespo, A., López-Cuadrado, J. L., Colomo-Palacios, R., González-Carrasco, I., & Ruiz-Mezcua, B. (2011). Sem-fit:A semantic based expert system to provide recommendations in the tourism domain. *Expert Systems with Applications, 38*(10), 13310-13319. https://doi.org/10.1016/j.eswa.2011.04.152

Gasmi, A., Tamani, N., Faucher, C., & Ghamri-Doudane, Y. (2017). OAISIS: An ontological-based approach for interlinking Crowd Sensing information systems. *IEEE International Conference on Systems, Man, and Cybernetics - Conference Proceedings*, 3995-4000. IEEE. https://doi.org/10.1109/SMC.2016.7844858

Gazzè, D., Duca, A. L., Marchetti, A., & Tesconi, M. (2015). An overview of the tourpedia linked dataset with a focus on relations discovery among places. *Proceedings of the 11th International Conference on Semantic Systems*, 157-160. https://doi.org/10.1145/2814864.2814876

Getahun, F., & Woldemariyam, K. (2017). Integrated ontology learner: Towards generic semantic annotation framework. *Proceedings of the 9th International Conference on Management of Digital EcoSystems*, 142-149. https://doi.org/10.1145/3167020.3167042

Ghose, A., & Ipeirotis, P. G. (2007). Designing novel review ranking systems: predicting the usefulness and impact of reviews. *Proceedings of the ninth international conference on Electronic commerce*, 303–310. https://doi.org/10.1145/1282100.1282158

Ghosh, S. S., Das, S., & Chatterjee, S. K. (2020). Human-centric faceted approach for ontology construction. *Knowledge Organization, 47*(1), 31-44. https://doi.org/10.5771/0943-7444-2020-1-31.

Ghosh, S.S., & Chatterjee, S.K. (2021). A knowledge organization framework for influencing tourism-centered place-making. *Journal of Documentation, ahead-of-print*(ahead-of-print). https://doi.org/10.1108/JD-12-2020-0220

Ghosh, S., & Panigrahi, P. (2015). Use of Ranganathan's analytico-synthetic approach in developing a domain ontology in library and information science. *Annals of Library and Information Studies, 62*(4), 274-80. http://nopr.niscair.res.in/handle/123456789/33723

Giunchiglia, F. & Dutta, B. (2011). DERA: a faceted knowledge organization framework. Unitn Eprints Research. http://eprints.biblio.unitn.it/2104/1/techRep457.pdf

Giunchiglia, F., Dutta, B. and Maltese, V. (2014). From knowledge organization to knowledge representation. *Knowledge Organization, 41*(1), 44-56, https://doi.org/10.5771/0943-7444-2014-1-44.

Giunchiglia, F., Dutta, B., & Maltese, V. (2009). Faceted lightweight ontologies. In A. T. Borgida, V. K. Chaudhri, P. Giorgini, E. S. Yu (Eds.), *Lecture Notes in Computer Science: Vol. 5600. Conceptual Modeling: Foundations and Applications* (pp. 36-51). Springer. https://doi.org/10.1007/978-3-642-02463-4_3

Giunchiglia, F., Dutta, B., Maltese, V. and Farazi, F. (2012). A facet-based methodology for the construction of a large-scale geospatial ontology. *Journal on data semantics, 1*(1), 57-73. https://doi.org/10.1007/s13740-012-0005-x.

Giunchiglia, F., Maltese, V., Farazi, F., & Dutta, B. (2010). GeoWordNet: A Resource for Geo-spatial Applications. In L. Aroyo, G. Antoniou, E. Hyvönen, A. t. Teije, H. Stuckenschmidt, L. Cabral & T. Tudorache (Eds.), *Lecture Notes in Computer Science: Vol. 6088. The Semantic Web: Research and Applications* (pp. 121-136). Springer. https://doi.org/10.1007/978-3-642-13486-9_9

Gouveia, M., & Cardoso, J. (2007). Tourism information aggregation using an ontology based approach. *Proceedings of the 9th International Conference on Enterprise Information Systems - DISI*, 569-572. https://doi.org/*10.5220/0002371705690572*

Gruber, T. R. (1993). A translation approach to portable ontology specifications. *Knowledge acquisition, 5*(2), 199-220.

Gruber, T. R. (1995). Toward principles for the design of ontologies used for knowledge sharing?. *International journal of human-computer studies, 43*(5-6), 907-928. https://doi.org/10.1006/ijhc.1995.1081

Grüninger, M., & Fox, M. S. (1995). Methodology for the design and evaluation of ontologies. *Proceedings of the 14th International Joint Conference on Artificial Intelligence IJCAI, Workshop on Basic Ontological Issues in Knowledge Sharing*, 1-10. http://stl.mie.utoronto.ca/publications/gruninger-ijcai95.pdf

Guarino, N. (1995). Formal ontology, conceptual analysis and knowledge representation. *International journal of human-computer studies, 43*(5-6), 625-640. https://doi.org/10.1006/ijhc.1995.1066

Guarino, N. (Ed.). (1998). Formal ontology in information systems: Proceedings of the first international conference (FOIS'98), June 6-8, Trento, Italy (Vol. 46). IOS press.

Gunathilaka D., Pathirana S., Senarathne S., Weerasekara J., Silva T. (2019). Feature Based Opinion Mining for Hotel Profiling. In J. Hemanth, T. Silva, A. Karunananda (Eds.), *Communications in Computer and Information Science: Vol. 890. Artificial Intelligence* (pp. 219-231). Springer. https://doi.org/10.1007/978-981-13-9129-3_16

Haklay, M., & Weber, P. (2008). Openstreetmap: User-generated street maps. *IEEE Pervasive computing, 7*(4), 12-18. https://doi.org/10.1109/MPRV.2008.80

Harvey, D. (2003). The fetish of technology: Causes and consequences. *Macalester International, 13,* Article 7. https://digitalcommons.macalester.edu/macintl/vol13/iss1/7

Hasan, R., Farazi, F., Bursi, O. S., & Reza, M. S. (2015). A faceted lightweight ontology for earthquake engineering research projects and experiments. In F. Taucer & R. Apostolska. (Eds.), *Experimental Research in Earthquake Engineering* (pp. 11-19). Springer. https://doi.org/10.1007/978-3-319-10136-1_2

Hendrik, & Perdana, D. H. F. (2014). Trip guidance: A linked data based mobile tourists guide. *Advanced Science Letters, 20*(1), 75-79. https://doi.org/10.1166/asl.2014.5285

Hennig-Thurau, T., Gwinner, K. P., Walsh, G., & Gremler, D. D. (2004). Electronic word-of-mouth via consumer-opinion platforms: what motivates consumers to articulate themselves on the internet?. *Journal of interactive marketing, 18*(1), 38-52. https://doi.org/10.1002/dir.10073.

Hernandez, J., Garcia, R., Schonowski, J., Atlan, D., Chanson, G. and Ruohomaki, T. (2020). Interoperable open specifications framework for the implementation of standardized urban platforms. *Sensors, 20*(8), Article 2402. https://doi.org/10.3390/s20082402

Hernández-Méndez, J., Muñoz-Leiva, F., & Sánchez-Fernández, J. (2013). The influence of e-word-of-mouth on travel decision-making: Consumer profiles. *Current Issues in Tourism, 18*(11), 1001–1021. https://doi.org/10.1080/13683500.2013.802764

Hjørland, B. (2013). Facet analysis: the logical approach to knowledge organization. *Information Processing and Management, 49,* 545-557, https://doi.org/10.1016/j.ipm.2012.10.001.

Hoffart, J., Suchanek, F. M., Berberich, K., & Weikum, G. (2013). YAGO2: A spatially and temporally enhanced knowledge base from Wikipedia. *Artificial Intelligence, 194*, 28–61. https://doi.org/10.1016/j.artint.2012.06.001

Hołodnik, D., & Perechuda, K. (2019). Route ontology in value recognition of self-tour planning application. In N. Nguyen, R. Chbeir, E. Exposito, P. Aniorté, B. Trawiński, (Eds.), *Lecture Notes in Computer Science: Vol. 11684. Computational Collective Intelligence* (pp. 346-356). Springer. https://doi.org/10.1007/978-3-030-28374-2_30

Hooi, P. M., & Yaacob, N. M. (2019). Accessibility for Physically Challenged Persons in Heritage Buildings. *Journal of Design and Built Environment, 19*(1), 24-39. https://doi.org/10.22452/jdbe.vol19no1.3

Hsieh, H. Y., & Wu, S. H. (2015). Ranking online customer reviews with the SVR model. *Proceedings of the 2015 IEEE international conference on information reuse and integration,* 550-555. IEEE. https://doi.org/10.1109/IRI.2015.88.

Hu, J. -T., & Li, S. (2016). An information recommendation method based on user interest model. *Frontiers in Artificial Intelligence and Applications: Vol. 281. Fuzzy System and Data Mining* (pp.284-292). IOS Press. https://doi.org/10.3233/978-1-61499-619-4-284

Huang, Y., & Bian, L. (2010). Ontology-driven tour-planning systems: A conceptual framework. *Environment and PlanningB: Planning and Design, 37*(3), 483-499. https://doi.org/10.1068/b34026

Hudon, M. (2020). Facet. *Knowledge Organization, 47*(4), 320-333, https://doi.org/10.5771/0943-7444-2020-4-320.

Hwang, S. -Y., Chiang, R. H. L., Hsiao, Y. -L., & Chang, S. (2013). On classifying discussion threads using travel information goal-oriented model. *Proceedings of the Pacific Asia Conference on Information Systems (PACIS2013).* https://aisel.aisnet.org/pacis2013/161

Ikkala, E., Mäkelä, E., & Hyvönen, E. (2015). TourRDF: Representing, enriching, and publishing curated tours based on linked data. In L. Patrick, H. Eero, B. Eva, P. Valentina, Q. Guilin, S. Uli, D. Ying, G. Chiara. (Eds.), *Lecture Notes in Computer Science: Vol. 8982. Knowledge Engineering and Knowledge Management* (pp. 145-149). Springer. https://doi.org/10.1007/978-3-319-17966-7_19

Imsombut, A., & Sirikayon, C. (2016). An alternative technique for populating thai tourism ontology from texts based on machine learning. *Proceedings of the 2016 IEEE/ACIS 15th International Conference on Computer and Information Science*, 1-4. https://doi.org/10.1109/ICIS.2016.7550762

Inkpen, G. (1998). *Information technology for travel and tourism* (2nd ed.). Addison Wesley Longman.

Islam, M. R., Hossain, B. A., Imteaj, M. N., Akhter, S., Jogesh, H. S., & Mostafa, M. B. (2018). OnTraNetBD: A knowledge base for the travel network in bangladesh. *5th IEEE Region 10 HumanitarianTechnology Conference 2017*, 170-174. IEEE. https://doi.org/10.1109/R10-HTC.2017.8288931

Jentsch, A. (2005). *Tourism Standards*. XML Clearinghouse. http://195.130.87.21:8080/dspace/bitstream/123456789/632/1/Tourism%20standards.pdf

Jin, Y., Bloch, P., & Cameron, G. T. (2002). A comparative study: does the word-of-mouth communications and opinion leadership model fit epinions on the internet?. *Proceedings of the Hawaii International Conference on Social Sciences*.

Jindal, N., & Liu, B. (2008, February). Opinion spam and analysis. *Proceedings of the 2008 international conference on web search and data mining*, 219-230. https://doi.org/10.1145/1341531.1341560.

Jingxuan, Z., Bing, L., Fei, T., Can, C., & Yikai, D. (2017). Analysis of Evaluating Dimensions of Chinese Express Hotels Based on User Generated Content. *Proceedings of the International Conference on Business and Information Management,* 62-67. https://doi.org/10.1145/3134271.3134276

Jrad, Z., & Aufaure, M. -A. (2007). *Personalized interfaces for a semantic web portal: Tourism information search In B. Apolloni, R. J. Howlett, L. Jain (Eds.) Lecture Notes in Computer Science: Vol. 4694. Knowledge-Based Intelligent Information and Engineering Systems* (pp. 695-702). Springer. https://doi.org/10.1007/978-3-540-74829-8_85

Kaiser, J. (1911). *Systematic Indexing.* Pitman.

Kanellopoulos, D., & Kotsiantis, S. (2007). A semantic-based architecture for intelligent destination managementsystems. *International Journal of Soft Computing, 2*(1), 61-68. https://www.medwelljournals.com/abstract/?doi=ijscomp.2007.61.68

Kärle, E., Fensel, A., Toma, I., & Fensel, D. (2015). Schema.org usage for hotels: An analysis based on the web datacommons data set. *CEUR Workshop Proceedings, 1481,* 75-78. http://ceur-ws.org/Vol-1481/paper24.pdf

Kärle, E., Şimşek, U., Panasiuk, O., & Fensel, D. (2018). *Building an ecosystem for the tyrolean tourism knowledge graph.* In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.) *Lecture Notes in Computer Science: Vol. 11153. Current Trends in Web Engineering* (pp. 260-267). Springer. https://doi.org/10.1007/978-3-030-03056-8_25

Karoui, L., Aufaure, M. -a., & Bennacer, N. (2006). A new extraction concept based on contextual clustering. *Proceedings of the International Conference on Computational Intelligence for Modelling, Control andAutomation and International Conference on Intelligent Agents Web Technologies and International Commerce, 91-91.* https://doi.org/10.1109/CIMCA.2006.19

Kashyap, M.M. (2003). Likeness between Ranganathan's postulations approach to knowledge classification and entity relationship data modelling approach. *Knowledge Organization,* 30(1), 1-19, https://doi.org/10.5771/0943-7444-2003-1-1.

Kasri, S., & Benchikha, F. (2016). Refactoring ontologies using design patterns and relational concepts analysis tointegrate views: The case of tourism. *International Journal of Metadata, Semantics and Ontologies, 11*(4), 243-263. https://doi.org/10.1504/IJMSO.2016.083519

Keates, N. (2007). Deconstructing TripAdvisor. *Wall Street Journal*, https://www.wsj.com/articles/SB118065569116920710.

Kehagias, D. D., Giakoumis, D., & Tzovaras, D. (2008). An ontology-based service-oriented application for mobilityimpaired users. *Proceedings of the 7th International Semantic Web Conference.* http://ceur-ws.org/Vol-401/iswc2008pd_submission_63.pdf

Keller, C., Brunk, S., & Schlegel, T. (2014). Introducing the public transport domain to the web of data. In B. Benatallah, A. Bestavros, Y. Manolopoulos, A. Vakali, Y. Zhang (Eds.), *Lecture Notes in Computer Science: Vol. 8787. Web Information Systems Engineering – WISE 2014* (pp. 521-530). Springer. https://doi.org/10.1007/978-3-319-11746-1_38

Khalil, V. A., Ishida, T., Otani, M., & Lin, D. (2017). A culturally-situated agent to support intercultural collaboration. In T. Yoshino, T. Yuizono, G. Zurita, Vassileva J. (Eds.), *Lecture Notes in Computer Science: Vol. 10397. Collaboration Technologies and Social Computing* (pp. 130-144). Springer. Cham. https://doi.org/10.1007/978-3-319-63088-5_12

Khallouki, H., Abatal, A., & Bahaj, M. (2018). An ontology-based context awareness for smart tourism recommendation system. *Proceedings of the International Conference on Learning and Optimization Algorithms: Theory and Applications.* Article 43. https://doi.org/10.1145/3230905.3230935

Kietz, J. U., Volz, R., & Maedche, A. (2000). Extracting a domain-specific ontology from a corporate intranet. *Proceedings of the Fourth Conference on Computational Natural Language Learning and the Second Learning Language in Logic Workshop, 167-175.* https://aclanthology.org/W00-0738.pdf

Kim, J. -B., & Park, C. (2011). Development of mobile AR tour application for the national palace museum of korea. In Shumaker R. (Ed.), *Lecture Notes in Computer Science: Vol. 6773. Virtual and Mixed Reality - New Trends* (pp. 55-60). Springer. https://doi.org/10.1007/978-3-642-22021-0_7

Kirilenko, A. P., Stepchenkova, S. O., & Dai, X. (2021). Automated topic modeling of tourist reviews: does the Anna Karenina principle apply?. *Tourism Management, 83*, Article 104241. https://doi.org/10.1016/j.tourman.2020.104241.

Kitwatthanathawon, P., Angskun, T., & Angskun, J. (2012). A knowledge extraction system from online reviews usingfuzzy logic. *Proceedings of 9th International Joint Conference on Computer Science andSoftware Engineering,* 189-196. https://doi.org/10.1109/JCSSE.2012.6261950

Kitwatthanathawon, P., Angskun, T., & Angskun, J. (2014). An automatic analysis system for online hotel reviews. *WIT Transactions on Information and Communication Technologies.*WIT Press. https://doi.org/10.2495/ICTE130071

Klein, E., Gschwend, A., & Neuroni, A. C. (2016). Towards a linked data publishing methodology. *Proceedings of the 6th International Conference for E-Democracy and Open Government, CeDEM 2016,* 188-196. https://doi.org/10.1109/CeDEM.2016.12

Klotz, B., Lisena, P., Troncy, R., Wilms, D., & Bonnet, C. (2017). DrIveSCOVER: A tourism recommender system based on external driving factors. *CEUR Workshop Proceedings:Vol.1963.* http://ceur-ws.org/Vol-1963/paper577.pdf

Knight, K., Chander, I., Haines, M., Hatzivassiloglou, V., Hovy, E., Iida, M., Luk, S. K., Whitney, R. & Yamada, K. (1995). Filling knowledge gaps in a broad-coverage machine translation system. *arXiv preprint cmp-lg/9506009*.

Kularbphettong, K. (2018). Enrichment ontology instance by using data mining techniques: A case of thai tourist interest in culture tourism. In R. Silhavy, P. Silhavy, Z. Prokopova (Eds.), *Advances in Intelligent Systems and Computing, Vol. 662. Applied Computational Intelligence and Mathematical Methods* (pp. 150-155). Springer. https://doi.org/10.1007/978-3-319-67621-0_13

Kumar, A., & Abirami, S. (2018). Aspect-based opinion ranking framework for product reviews using a Spearman's rank correlation coefficient method. *Information Sciences, 460-461*, 23-41. https://doi.org/10.1016/j.ins.2018.05.003

Kuntarto, G. P., & Gunawan, D. (2012). Dwipa search engine: When E-tourism meets the semantic web. *2012 International Conference on Advanced Computer Science and Information Systems, ICACSIS 2012 -Proceedings,* 155-160. IEEE. https://ieeexplore.ieee.org/abstract/document/6468741

Kuntarto, G. P., Alrin, Y., & Gunawan, I. P. (2019). The key role of ontology alignment and enrichment methodologies foraligning and enriching dwipa ontology with the weather concept on the tourism domain. *Proceedings of the 3rd International Conference on Informatics and Computational Sciences,* 1-6. IEEE. https://doi.org/10.1109/ICICoS48119.2019.8982437

Kuntarto, G. P., Alrin, Y., & Gunawan, I. P. (2019a). The key role of ontology alignment and enrichment methodologies for aligning and enriching dwipa ontology with the weather concept on the tourism domain. *Proceedings of 3rd International Conference on Informatics and Computational Sciences (ICICOS),* 1-6. IEEE. https://doi.org/10.1109/ICICoS48119.2019.8982437

Kuntarto, G. P., Isyahrani, S., & Gunawan, I. P. (2019). Performance of K-means clustering algorithm in enriching a newconcept of amenities into dwipa ontology III within the indonesia tourism domain. *Proceedings of the 2019 2ndInternational Seminar on Research of Information Technology and Intelligent Systems,* 334-339. https://doi.org/10.1109/ISRITI48646.2019.9034563

Kuntarto, G. P., Isyahrani, S., & Gunawan, I. P. (2019b). Performance of K-means clustering algorithm in enriching a newconcept of amenities into dwipa ontology III within the indonesia tourism domain. Proceedings of *2nd International Seminar on Research of Information Technology and Intelligent Systems,* 334-339. IEEE. https://doi.org/10.1109/ISRITI48646.2019.9034563

Laddha, S. S., & Jawandhiya, P. M. (2021). Onto-semantic indian tourism information retrieval system. In A. Khanna, A.K. Singh, A. Swaroop (Eds.) *Studies in Computational*

Intelligence: Vol. 921. *Recent Studies on Computational Intelligence* (pp. 1-18). Springer. https://doi.org/10.1007/978-981-15-8469-5_1

Laddha, S., & Jawandhiya, P. M. (2020). Novel concept of spelling correction for semantic tourism search interface. In M. Tuba, S. Akashe, A. Joshi (Eds.) *Advances in Intelligent Systems and Computing: Vol. 933. Information and Communication Technology for Sustainable Development* (pp. 13-21). Springer. https://doi.org/10.1007/978-981-13-7166-0_2

Lam, T. H. W., & Lee, R. S. T. (2006). iJADE FreeWalker: An ontology-based tourist guiding system. In B. Gabrys, R.J. Howlett, L.C. Jain (Eds.) *Lecture Notes in Computer Science: Vol. 4252. Knowledge-Based Intelligent Information and Engineering Systems* (pp.644-651). Springer. https://doi.org/10.1007/11893004_83

Lam, T. H. W., & Liu, J. N. K. (2008). SemTour: HK - a tourist information system. In M.-C. Chan, R. Cheung, J. N. K. Liu (Eds.), *Challenges in information technology management* (pp. 137-144). https://doi.org/10.1142/9789812819079_0021

Lam, T. H. W., Liu, J. N. K., & Lee, R. S. T. (2009). Master: An intelligent ontology-based multi-agent system for sightseer. *International Journal of Software Engineering and Knowledge Engineering, 19*(2), 137-147. https://doi.org/10.1142/S021819400900412X

Lamsfus, C., Martín, D., Alzua-Sorzabal, A., López-de-Ipiña, D., & Torres-Manzanera, E. (2012). Context-based tourism information filtering with a semantic rule engine. *Sensors, 12*(5), 5273-5289. https://doi.org/10.3390/s120505273

Lamsfus, C., Martin, D., Salvador, Z., Usandizaga, A., & Alzua-Sorzabal, A., (2009). Human-centric ontology-based context modelling in tourism. *MCIS 2009 Proceedings.* Article 64. http://aisel.aisnet.org/mcis2009/64

Lapi, E., Tcholtchev, N., Bassbouss, L., Marienfeld, F., & Schieferdecker, I. (2012). Identification and utilization ofcomponents for a linked open data platform. *Proceedings - International Computer Software and Applications Conference,* 112-115. IEEE. https://doi.org/10.1109/COMPSACW.2012.30

Latour, B. (1996). On actor-network theory: A few clarifications. *Soziale Welt,* 47(4), 369-381. http://www.jstor.org/stable/40878163

Lee, C. -I., Hsia, T. -C., Hsu, H. -C., & Lin, J. -Y. (2017). Ontology-based tourism recommendation system. *Proceedings of 4th International Conference on Industrial Engineering and Applications,* 376-379. https://doi.org/10.1109/IEA.2017.7939242

Lee, C. -S., Chang, Y. -C., & Wang, M. -H. (2009). Ontological recommendation multi-agent for tainan city travel. *Expert Systems with Applications, 36*(3), 6740-6753. https://doi.org/10.1016/j.eswa.2008.08.016

Lee, H. A., Law, R., & Murphy, J. (2011). Helpful reviewers in TripAdvisor, an online travel community. *Journal of Travel & Tourism Marketing, 28*(7), 675-688. https://doi.org/10.1080/10548408.2011.611739.

Levine-Clark, M., & Carter, T.M. (Eds.). (2013). *ALA Glossary of Library and Information Science* (4th ed.). American Library Association.

Levy, S. E., Duan, W., & Boo, S. (2013). An analysis of one-star online reviews and responses in the Washington, DC, lodging market. *Cornell Hospitality Quarterly,* 54(1), 49-63. https://doi.org/10.1177/1938965512464513.

Lew, A.A. (2017). Tourism planning and place making: place-making or placemaking? Tourism Geographies, 19(3), 448-466, https://doi.org/10.1080/14616688.2017.1282007.

Leydesdorff, L., & Milojevic, S. (2015). Scientometrics. In J.D. Wright (Ed.), *International Encyclopedia of Social and Behavioral Sciences* (2nd ed., pp. 322-327), Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.85030-8

Li, L., Liu, Y., Zhu, H., Ying, S., Luo, Q., Luo, H., Kuai, X., Xia, H., & Shen, H. (2017). A bibliometric and visual analysis of global geo-ontology research. *Computers & Geosciences*, *99*, 1–8. https://doi.org/10.1016/j.cageo.2016.10.006

Li, L.-H., Hsu, R. -W., Lee, F. -M., & Chen, M. -C. (2013). A study on automated semantic analysis of customer satisfactioncomments-a case study on service quality of hotels on a chinese tourism website. *Research Journal of AppliedSciences, Engineering and Technology*, *6*(8), 1366-1381. https://doi.org/10.19026/rjaset.6.3958

Li, X., Chen, M., & Wang, X. (2011). Construction method of travel knowledge database based on ontology. *Proceedings - 2011 3rd International Conference on Intelligent Human-Machine Systems andCybernetics,* 182-185. https://doi.org/10.1109/IHMSC.2011.115

Li, X., Rousseau, J.F., Ding, Y., Song, M., & Lu, W. (2020). Understanding drug repurposing from the perspective of biomedical entities and their evolution: bibliographic research using aspirin. *JMIR medical informatics*, 8(6), Article e16739. https://doi.org/10.2196/16739

Lima, S., & Moreira, J. (2013). A semantic framework for touristic information systems. In P. Ordóñez de Pablos, M. Lytras, R. Tennyson, & J. Gayo (Eds.), *Cases on Open-Linked Data and Semantic Web Applications* (pp. 132-155). IGI Global. http://doi:10.4018/978-1-4666-2827-4.ch007

Ling, L., Shengqun, T., Lina, F., Ruliang, X., Xinguo, D., Youwei, X., & Yang, X. (2007). VOEditor: A visual environment forontology construction and collaborative querying of semantic web resources. *Proceedings -International Computer Software and Applications Conference,* 591-597. https://doi.org/10.1109/COMPSAC.2007.237

Lisi, F. A., & Esposito, F. (2014). Semantic web services for integrated tourism in the apulia region. *CEUR Workshop Proceedings,1195,* 178-193. http://ceur-ws.org/Vol-1195/long12.pdf

Lisi, F. A., & Esposito, F. (2014). Supporting integrated tourism services with semantic technologies and machine learning. *CEUR Workshop Proceedings, 1272,* 361-364. http://ceur-ws.org/Vol-1272/paper_98.pdf

Lisi, F. A., & Esposito, F. (2015). An AI application to integrated tourism planning. In M. Gavanelli, E. Lamma, F. Riguzzi (Eds.), *Lecture Notes in Computer Science: Vol. 9336. AI*IA 2015 Advances in Artificial Intelligence* (pp. 246-259). Springer. https://doi.org/10.1007/978-3-319-24309-2_19

Lisi, F. A., & Esposito, F. (2015, September). An AI application to integrated tourism planning. In M. Gavanelli, E. Lamma, F. Riguzzi (Eds.), *Lecture Notes in Computer Science, Vol. 9336. AI*IA 2015 Advances in Artificial Intelligence* (pp. 246-259). Springer. https://doi.org/10.1007/978-3-319-24309-2_19

Liu, Y., Liu, S. Q., & Li, P. (2013). Tourism domain ontology construction method based on fuzzy formal concept analysis. *Applied Mechanics and Materials, 347–350,* 2809–2813.https://doi.org/10.4028/www.scientific.net/amm.347-350.2809

Liu, Z., Shan, J., Glassey Balet, N., & Fang, G. (2017). Semantic social media analysis of chinese tourists in switzerland. *Information Technology and Tourism, 17*(2), 183-202. https://doi.org/10.1007/s40558-016-0066-z

Liu, Z., Sokhn, M., Le Calvé, A., & Schegg, R. (2016). City eye: Accessibility for all. *Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance*, 350-351. https://doi.org/10.1145/2910019.2910020

Lo Bue, A., Machì, A., & Taibi, D. (2019). PCC2018-bot: A telegram bot for "Palermo capitale della cultura 2018" events powered by linked open data and schema.org annotations. *CEUR Workshop Proceedings, 2418,* 125-131. http://ceur-ws.org/Vol-2418/paper13.pdf

Lo Bue. A., Machì, A. (2015) Open Data Integration Using SPARQL and SPIN: A Case Study for the Tourism Domain. In M. Gavanelli, E. Lamma, F. Riguzzi (Eds.), *Lecture Notes in Computer Science: Vol. 9336. AI*IA 2015 Advances in Artificial Intelligence* (pp. 316-326). Springer. https://doi.org/10.1007/978-3-319-24309-2_24

Lohvynenko, C., & Nedbal, D. (2019). Usage of semantic web in austrian regional tourism organizations. In M. Acosta, P. Cudré-Mauroux, M. Maleshkova, T. Pellegrini, H. Sack, Y. Sure-Vetter (Eds.), *Lecture Notes in Computer Science, Vol. 11702. Semantic Systems: The Power of AI and Knowledge Graphs* (pp. 3-18). Springer. https://doi.org/10.1007/978-3-030-33220-4_1

Lu C., Laublet P., Stankovic M. (2016) Travel Attractions Recommendation with Knowledge Graphs. In E. Blomqvist, P. Ciancarini, F. Poggi, F. Vitali (Eds.), *Lecture Notes in Computer Science: Vol. 10024. Knowledge Engineering and Knowledge Management* (pp. 416-431). Springer. https://doi.org/10.1007/978-3-319-49004-5_27

Lu C., Stankovic M., Radulovic F., Laublet P. (2017). Crowdsourced Affinity: A Matter of Fact or Experience. In E. Blomqvist, D. Maynard, A. Gangemi, R. Hoekstra, P. Hitzler, O. Hartig (Eds.), *Lecture Notes in Computer Science: Vol. 10249. The Semantic Web.* Springer. https://doi.org/10.1007/978-3-319-58068-5_34

Lu, C., Stankovic, M., & Laublet, P. (2015). Leveraging semantic web technologies for more relevant e-tourism behavioralretargeting. *Proceedings of the 24th International Conference on World Wide Web,* 1287-1292. https://doi.org/10.1145/2740908.2742001

Luberg, A., Granitzer, M., Wu, H., Järv, P., & Tammet, T. (2012). Information retrieval and deduplication for tourismrecommender sightsplanner. *Proceedings of the 2nd International Conference on Web Intelligence, Mining and Semantics,* Article 50. https://doi.org/10.1145/2254129.2254191,

Luberg, A., Tammet, T., & Järv, P. (2011). Extended triple store structure used in recommender system. *Proceedings of the International Workshop on Database and Expert Systems Applications,* 539-543. https://doi.org/10.1109/DEXA.2011.32

Lully, V., Laublet, P., Stankovic, M., & Radulovic, F. (2018). Enhancing explanations in recommender systems withknowledge graphs. *Procedia Computer Science, 137,* 211-222. https://doi.org/10.1016/j.procs.2018.09.020

Luz, N., Almeida, A., Anacleto, R., & Silva, N. (2013). Collective intelligence in toursplan: An online tourism social networkwith planning and recommendation services. *Proceedings of the International C* Conference on Computer Science and Software Engineering,* 42-48. https://doi.org/10.1145/2494444.2494449

Ma, C., & Zhou, X. (2012). Affection behavior approach for WSMO based on ant colony algorithm. *International Review on Computers and Software, 7*(5), 2673-2678.

Mahdisoltani, F., Biega, J., & Suchanek, F. (2015). Yago3: A knowledge base from multilingual wikipedias. *Proceedings of 7th biennial conference on innovative data systems research* (*CIDR 2015).*

Mahmood, F. M., & Bin Abdul Salam, Z. A. (2013). A conceptual framework for personalized location-based services (LBS) tourism mobile application leveraging semantic web to enhance tourism experience. *Proceedings of the 2013 3rd IEEE International Advance Computing Conference,* 287-291. https://doi.org/10.1109/IAdCC.2013.6514237

Makiyama, T., Ono, Y., Sugiyama, T., Morita, T., Kogusuri, H., Tejima, H., & Yamaguchi, T. (2014). Implementing tourism service based on linked data with social experiments. *CEUR*

Workshop Proceedings, 1312, 120-123. http://ceur-ws.org/Vol-1312/jist2014pd_paper3.pdf

Manna M., Ricca F., Saccà L. (2011) Logic-Based Technologies for e-Tourism: The iTravel System. In A. D'Atri, M. Ferrara, J. George, P. Spagnoletti (Eds.) *Information Technology and Innovation Trends in Organizations* (311-318). Physica-Verlag HD. https://doi.org/10.1007/978-3-7908-2632-6_35

Martelli, C., & Bellini, E. (2012). The role of a semantic approach of complex statistical information system planning andmanagement. *Proceedings of the 8th International Conference on Signal Image Technology and Internet Based Systems,* 876-883. https://doi.org/10.1109/SITIS.2012.152

Martínez-García M., Valls A., Moreno A. (2016). Construction of an Outranking Relation Based on Semantic Criteria with ELECTRE-III. In J. Carvalho, M. J. Lesot, U. Kaymak, S. Vieira, B. Bouchon-Meunier, R. Yager (Eds.), *Communications in Computer and Information Science: Vol. 611. Information Processing and Management of Uncertainty in Knowledge-Based Systems.* Springer. https://doi.org/10.1007/978-3-319-40581-0_20

Martínez-García, M., Valls, A., & Moreno, A. (2019). Inferring preferences in ontology-based recommender systems usingWOWA. *Journal of Intelligent Information Systems, 52*(2), 393-423. https://doi.org/10.1007/s10844-018-0532-5

Matuszka, T. (2013). Augmented Reality Supported by Semantic Web Technologies. In P. Cimiano, O. Corcho, V. Presutti, L. Hollink, S. Rudolph (Eds.), *Lecture Notes in Computer Science: Vol. 7882. The Semantic Web: Semantics and Big Data.* Springer. https://doi.org/10.1007/978-3-642-38288-8_51

McCarthy, J. (1980). Circumscription—a form of non-monotonic reasoning. *Artificial intelligence, 13*(1-2), 27-39. https://doi.org/10.1016/0004-3702(80)90011-9

Mekhabunchakij, K. (2017). Towards modeling linked open data for decision support: An example application of Thailand tourism linked data visualization. Proceedings of the *2016 Management and Innovation Technology International Conference,* MIT88-MIT92. IEEE. https://doi.org/10.1109/MITICON.2016.8025240

Mendis, P., Siriwardene, S., Wijesiri, R., Kohomban, U., & Fernando, S. (2019). *Ontology based online tourist assistant* In J. Hemanth, T. Silva, A. Karunananda (Eds.), *Communications in Computer and Information Science: Vol: 890. Artificial Intelligence* (pp. 161-174). Springer. https://doi.org/10.1007/978-981-13-9129-3_12

Merinero-Rodríguez, R., & Pulido-Fernández, J. I. (2016). Analysing relationships in tourism: A review. *Tourism Management,* 54, 122-135. https://doi.org/10.1016/j.tourman.2015.10.010

Mihindukulasooriya, N., Priyatna, F., & Rico, M. (2018). Publishing tourism statistics as linked data a case study of srilanka. In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo

Rodríguez (Eds.), *Lecture Notes in Computer Science, Vol. 11153. Current Trends in Web Engineering.* Springer. https://doi.org/10.1007/978-3-030-03056-8_17

Mikhailov, S., & Kashevnik, A. (2018). An ontology for service semantic interoperability in the smart phone-based touristtrip planning system. *Proceedings of 23rd Conference of Open Innovations Association,* 240-245. IEEE. https://doi.org/10.23919/FRUCT.2018.8588027

Mikhailov, S., Kashevnik, A., & Smirnov, A. (2020). Tourist behaviour analysis based on digital pattern of life. *Proceedings of the 7th International Conference on Control, Decision and Information Technologies,* 622-627. https://doi.org/10.1109/CoDIT49905.2020.9263945

Mili, H., Valtchev, P., Szathmary, L., Boubaker, A., Leshob, A., Charif, Y., & Martin, L. (2018). Ontology-based model-driven development of a destination management portal: Experience and lessons learned. *Software: Practice and Experience, 48*(8), 1438-1460. https://doi.org/10.1002/spe.2581

Miller, H. (2004). Tobler's First Law and Spatial Analysis. *Annals of the Association of American Geographers,* 94(2), 284-289. http://www.jstor.org/stable/3693985

Mínguez, I., Berrueta, D., & Polo, L. (2009). CRUZAR: An application of semantic matchmaking to e-tourism. In Y. Kalfoglou (Ed.), *Cases on semantic interoperability for information systems integration: Practices and applications* (pp. 255-271). IGI Global. https://doi.org/10.4018/978-1-60566-894-9.ch012

Ministry of Tourism (2020). *India Tourism Statistics 2020*. Government of India. https://tourism.gov.in/market-research-and-statistics

Moreno, A., Valls, A., Isern, D., Marin, L., & Borràs, J. (2013). SigTur/E-destination: Ontology-based personalized recommendation of tourism and leisure activities. *Engineering Applications of Artificial Intelligence, 26*(1), 633-651. https://doi.org/10.1016/j.engappai.2012.02.014

Mouhim, S., El Aoufi, A., Cherkaoui, C., Megder, E., & Mammass, D. (2011). Towards a knowledge management systemfor tourism based on the semantic web technology. *Proceedings of the International Conference on Multimedia Computing and Systems,* https://doi.org/10.1109/ICMCS.2011.5945640

Mountasser, I., Ouhbi, B., Hdioud, F., & Frikh, B. (2019). Ontology-based open tourism data integration framework: Trip planning platform. In M. Strydom, & S. Buckley (Ed.), *AI and Big Data's Potential for Disruptive Innovation (pp. 44-70).* IGI Global. http://doi:10.4018/978-1-5225-9687-5.ch002

Nahari, M. K., Ghadiri, N., Jafarifard, Z., Dastjerdi, A. B., & Sack, J. R. (2017). A framework for linked data fusion and quality assessment. *Proceedings of the 2017 3rd International Conference on Web Research,* 67-72. IEEE. https://doi.org/10.1109/ICWR.2017.7959307

Nakatoh, T., Yin, C., & Hirokawa, S. (2012). Characteristic grammatical context of tourism information. *ICIC Express Letters, 6*(3), 753-758. https://kyushu-u.pure.elsevier.com/en/publications/characteristic-grammatical-context-of-tourism-information

Nakatoh, T., Yin, C., Matsuura, H., & Hirokawa, S. (2011). Visualization of tourism information using WordNet. *Proceedings of the 2011 3rd International Conference on Awareness Science and Technology,* 412-417. https://doi.org/10.1109/ICAwST.2011.6163110

Namahoot, C. S., Brückner, M., & Panawong, N. (2015). Context-aware tourism recommender system using temporal ontology and naïve bayes. In H. Unger, P. Meesad, S. Boonkrong (Eds.), *Advances in Intelligent Systems and Computing: Vol. 361. Recent Advances in Information and Communication Technology 2015* (pp.183-194). Springer. https://doi.org/10.1007/978-3-319-19024-2_19

Namahoot, C. S., Panawong, N., & Brückner, M. (2016). A tourism recommendation system for thailand using semanticweb rule language and K-NN algorithm. *Information, 19*(7B), 3017-3023. http://www.nsru.ac.th/tung/papers/I2BM_Paper2_2016.pdf

Nasingkun, K., Ikeda, M., Suntisrivaraporn, B., & Supnithi, T. (2014). Ontology refinement using implicit user preferences: A case study in cultural tourism domain. *CEUR Workshop Proceedings,1312,* 92-101. http://ceur-ws.org/Vol-1312/ldop2014_paper4.pdf

Nasingkun, K., Srijuntongsiri, G., Supnithi, T., & Ikeda, M. (2017). An ontology based tour design support to extendtourist's cultural interest. *International Journal of Knowledge and Systems Science, 8*(4), 1-16. https://doi.org/10.4018/IJKSS.2017100101

Naskar, D., & Das, S. (2019). HNS ontology using faceted approach. *Knowledge Organization, 46*(3), 187-198. https://doi.org/10.5771/0943-7444-2019-3-187.

Navigli, R. (2002). Automatically extending, pruning and trimming general purpose ontologies. *Proceedings of the IEEE International Conference on Systems, Man and Cybernetics,* 631-635. IEEE. https://doi.org/10.1109/ICSMC.2002.1168049.

Neches, R., Fikes, R. E., Finin, T., Gruber, T., Patil, R., Senator, T., & Swartout, W. R. (1991). Enabling technology for knowledge sharing. *AI magazine, 12*(3), 36-36. https://doi.org/10.1609/aimag.v12i3.902

Nguyen, H. H., Beel, D., Webster, G., Mellish, C., Pan, J. Z., & Wallace, C. (2015). CURIOS mobile: Linked dataexploitation for tourist mobile apps in rural area. In T. Supnithi, T. Yamaguchi, J. Z. Pan, V. Wuwongse, M. Buranarach (Eds.), *Lecture Notes in Computer Science. Semantic Technology.* Springer. https://doi.org/10.1007/978-3-319-15615-6_10

Niemann, M., Mochol, M., & Tolksdorf, R. (2008). Enhancing hotel search with semantic web technologies. *Journal of Theoretical and Applied Electronic Commerce Research, 3*(2), 82-96. https://doi.org/10.4067/s0718-18762008000100008

Niknia, M., & Mirtaheri, S.L. (2015). Mapping a decade of linked data progress through co-word analysis. *Webology,* 12(2), 1-14. https://www.webology.org/abstract.php?id=276

Noulas, A., Scellato, S., Mascolo, C., & Pontil, M. (2011). Exploiting semantic annotations for clustering geographic areas and users in location-based social networks. *Proceedings of the International AAAI Conference on Web and Social Media,* 5(3), 32-35. https://ojs.aaai.org/index.php/ICWSM/article/view/14212

Noy, N.F. and McGuinness, D.L. (2001). *Ontology development 101: a guide to creating your first ontology.* Stanford Knowledge Systems Laboratory Technical Report KSL-01-05 and Stanford Medical Informatics Technical Report SMI-2001-0880. http://www.ksl.stanford.edu/people/dlm/papers/ontology-tutorial-noy-mcguinness.pdf .

Open Geospatial Consortium. (2012). *OGC GeoSPARQL - A Geographic Query Language for RDF Data* (Project reference no. OGC 11-052r4). http://www.opengis.net/doc/IS/geosparql/1.0

OpenTravel Alliance. (2019). *OpenTravel Alliance message specifications* (2019A-2.0Version). http://www.opentravelmodel.net/pubs/specifications/Specifications.html

Organización Mundial del Turismo (2015a), *Manual sobre Turismo Accesible para Todos:Principios, herramientas y buenas prácticas – Módulo II: Cadena de accesibilidad y recomendaciones*, OMT. https://www.e-unwto.org/doi/pdf/10.18111/9789284416509

Organización Mundial del Turismo (2015b), *Manual sobre Turismo Accesible para Todos:Principios, herramientas y buenas prácticas – Módulo III: Principales áreas de intervención,* OMT. https://www.e-unwto.org/doi/pdf/10.18111/9789284416523

Organización Mundial del Turismo (2015c), *Manual sobre Turismo Accesible para Todos: Principios, herramientas y buenas prácticas – Módulo IV: Indicadores para el estudio de la accesibilidad en el turismo,* OMT. https://www.e-unwto.org/doi/pdf/10.18111/9789284416547

Ortega P.M.M., Ávila L.G., Gómez J.M. (2014) Business Intelligence Taxonomy. In R. Espin, R. Pérez, A. Cobo, J. Marx, A. Valdés (Eds.), *Studies in Computational Intelligence: Vol. 537. Soft Computing for Business Intelligence.* Springer. https://doi.org/10.1007/978-3-642-53737-0_10

Ou, Y. Z., Tsai, S. H., Lai, Y. A., Su, J., Yu, C. W., Hsiao, C. T., Chu, E. T.-H., Lin, K. J., Ho, J. M., & Liu, J. W. S. (2013). A linked-data based virtual repository for disaster management tools and applications. *Proceedings of the WIT Transactions on the Built Environment, 133,* 185-196. WIT Press. https://doi.org/10.2495/DMAN130171

Oxford University Press. (2010). Interpreter. In *Oxford Dictionary of English*. (3rd ed., p. 915)

Ozdikis, O., Orhan, F., & Danismaz, F. (2011). Ontology-based recommendation for points of interest retrieved from multiple data sources. *Proceedings of the International Workshop on Semantic Web Information Management,* 1-6. https://doi.org/10.1145/1999299.1999300

Paganelli, F., Bianchi, G., & Giuli, D. (2007). A context model for context-aware system design towards the ambientintelligence vision: Experiences in the eTourism domain. In C. Stephanidis, M. Pieper (Eds.), *Lecture Notes in Computer Science, Vol. 4397. Universal Access in Ambient Intelligence Environments.* Springer. https://doi.org/10.1007/978-3-540-71025-7_12

Pai, M. -Y., Wang, D. -C., Hsu, T. -H., Lin, G. -Y., & Chen, C. -C. (2019). On ontology-based tourist knowledge representationand recommendation. *Applied Sciences, 9*(23), Article 5097. https://doi.org/10.3390/app9235097

Pai, M. Y., Wang, D. C., Hsu, T. H., Lin, G. Y., & Chen, C. C. (2019). On ontology-based tourist knowledge representation and recommendation. *Applied Sciences, 9*(23), Article 5097. https://doi.org/10.3390/app9235097.

Palanca, J., Aranda, G., & Fornes, A. G. (2009). Building service-based applications for the iphone using RDF: A tourismapplication. In Y. Demazeau, J. Pavón, J.M. Corchado, J. Bajo (Eds.), *Advances in Intelligent and Soft Computing: Vol. 55. 7th International Conference on Practical Applications of Agents and Multi-Agent Systems (PAAMS 2009).* Springer. https://doi.org/10.1007/978-3-642-00487-2_45https://doi.org/10.1007/978-3-642-00487-2_45

Palaniammal, K., Indra Devi, M., & Vijayalakshmi, S. (2012). An unfangled approach to semantic search for E-tourism domain. *Proceedings of the 2012 International Conference on Recent Trends in Information Technology,* 130-135. https://doi.org/10.1109/ICRTIT.2012.6206758

Palau, M., Gómez-Sebastià, I., Ceccaroni, L., Vázquez-Salceda, J., & Nieves, J. C. (2011). *A framework for the development and maintenance of adaptive, dynamic, context-aware information services.* In J. Filipe, A.Fred, B. Sharp (Eds.), *Communications in Computer and Information Science: Vol. 129. Agents and Artificial Intelligence* (pp. 227-239). Springer. https://doi.org/10.1007/978-3-642-19890-8_17

Pan, J., Mou, N., & Liu, W. (2019). Emotion analysis of tourists based on domain ontology. *Proceedings of the 2019 International Conference on Data Mining and Machine Learning,* 146-150. https://doi.org/10.1145/3335656.3335701

Panawong, N., Snae Namahoot, C., & Brückner, M. (2014). Classification of tourism web with modified naïve bayes algorithm. *Advanced Materials Research*, 931–932, 1360–1364. https://doi.org/10.4028/www.scientific.net/amr.931-932.1360

Pandolfo, L., Pulina, L., & Grosso, E. (2018). A user model ontology for adaptive systems in cultural tourism domain. *Frontiers in Artificial Intelligence and Applications: Vol. 310.*

Applications of Intelligent Systems (pp.212-219). IOS Press. https://doi.org/10.3233/978-1-61499-929-4-212

Paramonov, I., Lagutina, K., Mamedov, E., & Lagutina, N. (2016). Thesaurus-based method of increasing text-via-keyphrase graph connectivity during keyphrase extraction for e-tourism applications. In A. C. Ngonga Ngomo, P. Křemen (Eds.). *Communications in Computer and Information Science, Vol. 649. Knowledge Engineering and Semantic Web* (pp 129-141). Springer. https://doi.org/10.1007/978-3-319-45880-9_11

Park, H. (2013). Task model and task ontology based on mobile users' generic activities for task-oriented tourist information service. *International Journal of Smart Home, 7*(3), 33-44. https://gvpress.com/journals/IJSH/vol7_no3/3.pdf

Park, H., Kwon, S., & Kwon, H. -C. (2009). Ontology-based approach to intelligent ubiquitous tourist information system. *Proceedings of the 4th International Conference on Ubiquitous Information Technologies and Applications,* 1-6. IEEE. https://doi.org/10.1109/ICUT.2009.5405697

Patroumpas, K., Skoutas, D., Mandilaras, G., Giannopoulos, G., & Athanasiou, S. (2019). Exposing points of interest as linked geospatial data. *Proceedings of the 16th International Symposium on Spatial and Temporal Databases,* 21-30. https://doi.org/10.1145/3340964.3340976

Pavković, I., & Štajduhar, I. (2015). Semantic approach to accommodation & booking related web services. *38th International Convention on Information and Communication Technology, Electronicsand Microelectronics (MIPRO) - Proceedings,* 419-424. https://doi.org/10.1109/MIPRO.2015.7160307

Pearce, P. L., & Wu, M. Y. (2018). Entertaining international tourists: An empirical study of an iconic site in China. *Journal of Hospitality & Tourism Research, 42*(5), 772-792. https://doi.org/10.1177/1096348015598202.

Pierce, J., Martin, D.G., & Murphy, J.T. (2011). Relational place-making: the networked politics of place. *Transactions of the Institute of British Geographers,* 36(1), 54-70. https://doi.org/10.1111/j.1475-5661.2010.00411.x.

Ponomarev, A., & Parfenov, V. (2015). Verification-enabling interaction model for services in smart space: A TAIS case. Proceedings of the *17th Conference of Open Innovation Association (FRUCT),* 163-172. IEEE. https://doi.org/10.1109/FRUCT.2015.7117988

Prasath, R., Kumar, V., & Sarkar, S. (2015). Assisting web document retrieval with topic identification in tourism domain. *Web Intelligence and Agent Systems, 13*(1), 31-41. https://doi.org/10.3233/WEB-150308

Premananthan, P., Btgs, K., Kudavidanage, E. P., & Kuhaneswaran, B. (2020). A data mining and ontology-based approach for predicting the research ideas in the wildlife sector of sri

lanka. Proceedings of the *2020 IEEE 15th International Conference on Industrial and Information Systems (ICIIS)*, 606-610. https://doi.org/10.1109/ICIIS51140.2020.9342637

Prieto-Díaz, R. (2003). A faceted approach to building ontologies. Proceedings of the Fifth IEEE Workshop on Mobile Computing Systems and Applications, 458-465. IEEE. https://doi.org/10.1109/IRI.2003.1251451

R Core Team. (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing. https://www.R-project.org/

R Core Team. (2020). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing. https://www.r-project.org

Rahim, M., Turabee, Z., Rajput, Q., & Khoja, S. A. (2019). Semantic based question answering system on travel ontology. *Proceedings of the 2019 6th International Conference on Social Networks Analysis, Management and Security,* 67-74. IEEE. https://doi.org/10.1109/SNAMS.2019.8931886

Rajapaksha, L. H. S. U., Jayasena, L. I., Wijerathna, G. G. C., Samarakoon, P. G. K. B., & Bandara, K. Y. (2016). Web-based intelligent tour planner and advisor. *Proceedings of the 15th International Conference on Advances in ICT for Emerging Regions*, 277-277. https://doi.org/10.1109/ICTER.2015.7377710

Ranganathan, S. R. (1987). *Colon Classification* (7th Ed.). Gopinath M A, (Rev and Ed), Sarada Ranganathan Endowment for Library Science.

Ranganathan, S.R. (1952). *Colon Classification* (4th Ed.). Madras Library Association.

Ranganathan, S.R. (1957). *Prolegomena to Library Classification* (2nd Ed.) Library Association.

Ranganathan, S.R. (1987). *Colon Classification (Basic and Depth Version)* (7th Ed.). M. A. Gopinath (Ed.), Sarada Ranganathan Endowment.

Rashid, M., Rizzo, G., Torchiano, M., Mihindukulasooriya, N., & Corcho, O. (2018). Knowledge base evolution analysis: Acase study in the tourism domain. In C. Pautasso, F. Sánchez-Figueroa, K. Systä, J. Murillo Rodríguez (Eds.) *Lecture Notes in Computer Science, Vol. 11153. Current Trends in Web Engineering* (pp.268-278). Springer. https://doi.org/10.1007/978-3-030-03056-8_26

Real Patronato sobre Discapacidad (2011), Accesibilidad universal al patrimonio cultural. Fundamentos, criterios y pautas. Centro Español de Documentación sobre Discapacidad

Refanidis, I., Emmanouilidis, C., Sakellariou, I., Alexiadis, A., Koutsiamanis, R. -A., Agnantis, K., Tasidou, A., Kokkoras, F., & Efraimidis, P. S. (2014). myVisitPlanner^{GR}: Personalized itinerary planning system for tourism. In A. Likas, K. Blekas, D. Kalles (Eds.), *Lecture*

Notes in Computer Science, Vol. 8445. Artificial Intelligence: Methods and Applications. Springer. https://doi.org/10.1007/978-3-319-07064-3_53

Rios-Alvarado, A. B., Martinez-Rodriguez, J. L., Guerrero-Melendez, T. Y., Rodriguez-Rodriguez, A. J., & Vargas-Requena, D. T. (2020). Axiomatic relation extraction from text in the domain of tourism. In B. Villazón-Terrazas, F. Ortiz-Rodríguez, S.M. Tiwari, S.K. Shandilya (Eds.). *Communications in Computer and Information Science, Vol. 1232. Knowledge Graphs and Semantic Web* (pp. 14-28). Springer. https://doi.org/10.1007/978-3-030-65384-2_2

Rodríguez-Rodríguez, A., Tejera-Correa, S., Jiménez-Jiménez, S., & Moreno-Díaz, R. (2013). Implementation of an IT-Services Practical Standard in Hotel and Tourism Industries. In *Lecture Notes in Computer Science International Conference on Computer Aided Systems Theory* (pp. 166-173). Springer.

Rosyiq, A., Hayah, A. R., Hidayanto, A. N., Naisuty, M., Suhanto, A., & Avuning Budi, N. F. (2019). Information extraction from twitter using DBpedia ontology: Indonesia tourism places. *Proceedings of International Conference on Informatics, Multimedia, Cyber and Information System (ICIMCIS),* 91-96. https://doi.org/10.1109/ICIMCIS48181.2019.8985194

Ruiz-Martínez, J. M., Castellanos-Nieves, D., Valencia-García, R., Fernández-Breis, J. T., García-Sánchez, F., Vivancos-Vicente, P. J., Castejón-Garrido, J. S., Camón, J. B., & Martínez-Béjar, R. (2009). *Accessing touristic knowledge bases through a natural language interface.* In D. Richards, B.H. Kang (Eds.), *Lecture Notes in Computer Science, Vol. 5465. Knowledge Acquisition: Approaches, Algorithms and Applications* (pp.147-160). Springer. https://doi.org/10.1007/978-3-642-01715-5_13

Ruiz-Martínez, J. M., Miñarro-Giménez, J. A., Castellanos-Nieves, D., García-Sáanchez, F., & Valencia-García, R. (2011). Ontology population: An application for the E-tourism domain. *International Journal of Innovative Computing, Information and Control, 7*(11), 6115-6133. http://www.ijicic.org/10-05097-1.pdf

Ruotsalo, T., Haav, K., Stoyanov, A., Roche, S., Fani, E., Deliai, R., Mäkelä, E., Kauppinen, T., & Hyvönen, E. (2013). SMARTMUSEUM: A mobilerecommender system for the web of data. *Journal of Web Semantics, 20,* 50-67. https://doi.org/10.1016/j.websem.2013.03.001

Ryu, K. -. (2017). Research on semantic web-based custom travel model. *International Journal of Applied EngineeringResearch, 12*(20), 9794-9798. https://www.ripublication.com/ijaer17/ijaerv12n20_73.pdf

Sabou, M., Arsal, I., & Braşoveanu, A. M. P. (2013). TourMISLOD: A tourism linked data set. *Semantic Web, 4*(3), 271-276. https://doi.org/10.3233/SW-2012-0087

Sabou, M., Braşoveanu, A. M. P., & Arsal, I. (2012). Supporting tourism decision making with linked data. *Proceedings of the 8th International Conference on Semantic Systems,* 201–204. https://doi.org/10.1145/2362499.2362533https://doi.org/10.1145/2362499.2362533

Sabou, M., Onder, I., Brasoveanu, A. M. P., & Scharl, A. (2016). Towards cross-domain data analytics in tourism: A linked data based approach. *Information Technology and Tourism, 16*(1), 71-101. https://doi.org/10.1007/s40558-015-0049-5

Sahin, I., Gulmez, M., & Kitapci, O. (2017). E-complaint tracking and online problem-solving strategies in hospitality management: Plumbing the depths of reviews and responses on TripAdvisor. *Journal of Hospitality and Tourism Technology, 8*(3), 372-394. https://doi.org/10.1108/JHTT-02-2017-0009.

Sakamoto, Y., & Takama, Y. (2017). Proposal of sentiment-based tourist spot recommendation system using RDFdatabase. *Proceedings of the 2017 IEEE 10th International Workshop on Computational Intelligence andApplications,* 61-66. IEEE. https://doi.org/10.1109/IWCIA.2017.8203562

Salaiwarakul, A. (2018). Thai natural language based cultural tourism ontology. *ICIC Express Letters, 12*(2), 159-165. https://doi.org/10.24507/icicel.12.02.159

Salaiwarkul, A., & Khruakong, S. (2018). A hybrid approach for natural language querying segmentation for tourism ontology. *Journal of Telecommunication, Electronic and Computer Engineering, 10*(1-5), 109-113. https://jtec.utem.edu.my/jtec/article/view/3640

SáNchez, N. S. B., Tapia, S. A. A., Martínez, S. E. M., Guerrero, J. S., & Valencia, H. B. (2016). *Identification of semantic focal groups for tourist packages based on the semantic orientation of opinions.* In Á. Rocha, A. Correia, H. Adeli, L. Reis, M. Mendonça Teixeira (Eds.), *Advances in Intelligent Systems and Computing, Vol. 444. New Advances in Information Systems and Technologies* (441-453). Springer. https://doi.org/10.1007/978-3-319-31232-3_42

Saracevic, T., & Kantor, P. B. (1997a). Studying the value of library and information services. Part I. Establishing a theoretical framework. *Journal of the American Society for Information Science, 48*(6), 527-542.

Saracevic, T., & Kantor, P. B. (1997b). Studying the value of library and information services. Part II. Methodology and taxonomy. *Journal of the American Society for Information Science, 48*(6), 543-563.

Satija, M.P. (2017). Colon classification (CC). *Knowledge Organization, 44*(4), 291-307, https://doi.org/10.5771/0943-7444-2017-4-291.

Saumya, S., Singh, J. P., Baabdullah, A. M., Rana, N. P., & Dwivedi, Y. K. (2018). Ranking online consumer reviews. *Electronic commerce research and applications, 29,* 78-89. https://doi.org/10.1016/j.elerap.2018.03.008

Scandic (2012). Scandic's Accessibility Standard. Scandic. https://www.accessibletourism.org/resources/scandics-accessibility-standard_2012_en.pdf.

Scandic (2012). Scandic's Accessibility Standard. Scandic. https://www.accessibletourism.org/resources/scandics-accessibility-standard_2012_en.pdf.

Scandic. (2012). Scandic's Accessibility Standard. Scandic. https://www.accessibletourism.org/resources/scandics-accessibility-standard_2012_en.pdf.

Scarinci, J., & Myers, T. (2014). A semantic web framework to enable sustainable lodging best management practices in the USA. *Information Technology and Tourism, 14*(4), 291-315. https://doi.org/10.1007/s40558-014-0011-y

Schenk, S., Saathoff, C., Staab, S., & Scherp, A. (2009). SemaPlorer-interactive semantic exploration of data and media based on a federated cloud infrastructure. *Journal of Web Semantics, 7*(4), 298-304. https://doi.org/10.1016/j.websem.2009.09.006

Schiel, U., Souza Baptista, C., De Jesus Maia, A., & De Andrade, F. (2007). SEI-tur: A system based on composed web-service discovery to support the creation of trip plans. Proceedings of the *1st International Conference on the Digital Society,* 28-28. https://doi.org/10.1109/ICDS.2007.36

Sengloiluean, K., Arch-Int, N., & Arch-Int, S. (2020). An ontology-based semantic extraction approach from text corpus. *Journal of Theoretical and Applied Information Technology, 98*(14), 2721-2731.

Sharafuddin, M. A., & Madhavan, M. (2020). Thematic Evolution of Blue Tourism: A Scientometric Analysis and Systematic Review. *Global Business Review*. https://doi.org/10.1177/0972150920966885

Shaw, G., & Williams, A. M. (1994). *Critical issues in tourism: A geographical perspective.* Blackwell Publishers.

She, K. -S., Haw, S. -C., & Chew, L. -J. (2020). Tourism recommender system utilising property graph ontology as knowledge base. *Proceedings of the 12th International Conference on Computer Modeling and Simulation,* 14-18. https://doi.org/10.1145/3408066.3408102

Shi, L., Lin, F., Yang, T., Qi, J., Ma, W., & Xu, S. (2014). Context-based ontology-driven recommendation strategies for tourism in ubiquitous computing. *Wireless Personal Communications, 76*(4), 731-745. https://doi.org/10.1007/s11277-013-1550-9

Shi, M., Zhu, W., Yang, H., & Li, C. (2016). Applying semantic web and big data techniques to construct a balance model referring to stakeholders of tourism intangible cultural heritage. *International Journal of Computer Applications in Technology, 54*(3), 192-200. https://doi.org/10.1504/IJCAT.2016.079873

Silva, F., & Girardi, R. (2014). An approach to join ontologies and their reuse in the construction of application ontologies. *Proceedings of the 2014 IEEE/WIC/ACM International Joint Conference on Web Intelligence and Intelligent Agent Technologies,* 424-431. https://doi.org/10.1109/WI-IAT.2014.66

Simeon, M. I., Buonincontri, P., Cinquegrani, F., & Martone, A. (2017). Exploring tourists' cultural experiences in Naples through online reviews. *Journal of Hospitality and Tourism Technology, 8*(2), 220-238, https://doi.org/10.1108/JHTT-10-2016-0067.

Şimşek, U., Angele, K., Kärle, E., Panasiuk, O., & Fensel, D. (2020). Domain-specific customization of schema.org basedon SHACL. In J. Z. Pan, V. Tamma, C. d'Amato, K. Janowicz, B. Fu, A. Polleres, O, Seneviratne & L. Kagal (Eds.), *Lecture Notes in Computer Science, Vol. 12507. The Semantic Web – ISWC 2020* (pp.585-600). Springer. https://doi.org/10.1007/978-3-030-62466-8_36

Siricharoen, W. V. (2008). Learning semantic web from E-tourism. In N.T. Nguyen, G.S. Jo, R. J. Howlett, L.C. Jain (Eds.) *Lecture Notes in Computer Science: Vol. 4953. Agent and Multi-Agent Systems: Technologies and Applications* (pp.516-525). Springer. https://doi.org/10.1007/978-3-540-78582-8_52

Sittisaman, A., & Panawong, N. (2019). A development of real-time tourism information recommendation system for smart phone using responsive web design, spatial and temporal ontology. *International Journal of Engineering and Advanced Technology, 8*(5), 994-999. https://www.ijeat.org/wp-content/uploads/papers/v8i5/E7066068519.pdf

Smirnov, A., Kashevnik, A., Ponomarev, A., Shchekotov, M., & Kulakov, K. (2016). Application for e-tourism: Intelligent mobile tourist guide. *Proceedings of the 4th International Congress on Advanced Applied Informatics,* 40-45. IEEE. https://doi.org/10.1109/IIAI-AAI.2015.190

Smirnov, A., Kashevnik, A., Ponomarev, A., Shilov, N., Schekotov, M., & Teslya, N. (2013). Recommendation system for tourist attraction information service. *Proceedings of the Conference of Open Innovation Association,* 148-155. https://doi.org/10.1109/FRUCT.2013.6737957

Smirnov, A., Levashova, T., Shilov, N., & Ponomarev, A. (2019). Human-computer cloud for decision support: Main ontological models and dynamic resource network configuration. In A. Abraham, S. Kovalev, V. Tarassov, V. Snasel, A. Sukhanov (Eds.), Advances in Intelligent Systems and Computing: Vol. 874. Proceedings of the Third International Scientific Conference "Intelligent Information Technologies for Industry" (IITI'18) (pp.16-25). Springer. https://doi.org/10.1007/978-3-030-01818-4_2

Smirnov, A., Ponomarev, A., & Kashevnik, A. (2016). Tourist attraction recommendation service: An approach,architecture and case study. *Proceedings of the 18th International Conferenceon Enterprise Information Systems, 2,* 251-261. https://doi.org/10.5220/0005870202510261

Smirnov, A., Ponomarev, A., & Kashevnik, A. (2017). Multi-model service for recommending tourist attractions. In S. Hammoudi, L. Maciaszek, M. Missikoff, O. Camp, J. Cordeiro (Eds.), *Lecture Notes in Business Information Processing, Vol. 291. Enterprise Information Systems* (pp. 364-386). Springer. https://doi.org/10.1007/978-3-319-62386-3_17

Smirnov, A., Shilov, N., Kashevnik, A., Teslya, N., & Laizane, S. (2013). Smart space-based ride sharing service in e-tourism application for Karelia region accessibility: Ontology-based approach and implementation. *Proceedings of the 8th International Joint Conference on Software Technologies*, 591-598. https://www.scitepress.org/papers/2013/44190/44190.pdf

Sofield, T., Guia, J., & Specht, J. (2017). Organic 'folkloric' community driven place-making and tourism. *Tourism Management*, 61, 1-22. https://doi.org/10.1016/j.tourman.2017.01.002.

Soualah-Alila, F., Faucher, C., Bertrand, F., Coustaty, M., & Doucet, A. (2015). Applying semantic web technologies forimproving the visibility of tourism data. *Proceedings of the 2015 Workshop on Exploiting Semantic Annotations in Information Retrieval*, 5-10. https://doi.org/10.1145/2810133.2810137

Stadler, C., Lehmann, J., Höffner, K., & Auer, S. (2012). Linkedgeodata: A core for a web of spatial open data. *Semantic Web, 3*(4), 333-354. https://dl.acm.org/doi/10.5555/2590208.2590210

Stoyanova-Doycheva, A., Ivanova, V., Glushkova, T., Stoyanov, S., & Radeva, I. (2020). Dynamic generation of cultural routes in a tourist guide. *International Journal of Computing, 19*(1), 39-48. https://doi.org/10.47839/ijc.19.1.1691

Studer, R., Benjamins, V. R., & Fensel, D. (1998). Knowledge engineering: Principles and methods. *Data & knowledge engineering, 25*(1-2), 161-197. https://doi.org/10.1016/S0169-023X(97)00056-6

Subramaniyaswamy, V., Manogaran, G., Logesh, R., Vijayakumar, V., Chilamkurti, N., Malathi, D., & Senthilselvan, N.(2019). An ontology-driven personalized food recommendation in IoT-based healthcare system. *Journal of Supercomputing, 75*(6), 3184-3216. https://doi.org/10.1007/s11227-018-2331-8

Suchanek, F. M., Kasneci, G., & Weikum, G. (2007). Yago: a core of semantic knowledge. *Proceedings of the 16th international conference on World Wide Web*, 697-706. https://doi.org/10.1145/1242572.1242667

Suganya, G., & Porkodi, R. (2018). Ontology based information extraction -A review. *Proceedings of the 2018 International Conference on Current Trends Towards Converging Technologies*, 1-7, https://doi.org/10.1109/ICCTCT.2018.8551071

Tang, S., & Cai, Z. (2010). Using the format concept analysis to construct the tourism information ontology. *Proceedings of the 2010 7th International Conference on Fuzzy Systems and Knowledge Discovery,* 2941-2944. https://doi.org/10.1109/FSKD.2010.5569075

Tatsiopoulos, C., & Boutsinas, B. (2010). Automatic knowledge exchanging between tourists via mobile devices. *Journal of Hospitality and Tourism Technology, 1*(2), 163-173. https://doi.org/10.1108/17579881011065056

Tian, Y., Jing, D., Yang, C., Chen, Y., & Yang, H. (2020). An ontological approach for architecture design of a smarttourism system-of-systems. *International Journal of Performability Engineering, 16*(4), 587-598. https://doi.org/10.23940/ijpe.20.04.p10.587598

Tiwari, S., & Kaushik, S. (2012). Extracting region of interest (ROI) details using LBS infrastructure and web-databases. *Proceedings of the 2012 IEEE 13th International Conference on Mobile Data Management,* 376-379. IEEE. https://doi.org/10.1109/MDM.2012.29

Tobler, W. R. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography*, 46, 234-240. https://doi.org/10.2307/143141

Toma, I., Stanciu, C., Fensel, A., Stavrakantonakis, I., & Fensel, D. (2014). Improving the online visibility of touristic service providers by using semantic annotations. In V. Presutti, E. Blomqvist, R. Troncy, H. Sack, I. Papadakis, A. Tordai (Eds.), *Lecture Notes in Computer Science, Vol. 8798. The Semantic Web: ESWC 2014 Satellite Events.* Springer. https://doi.org/10.1007/978-3-319-11955-7_31

Tomai, E., Spanaki, M., Prastacos, P., & Kavouras, M. (2005). Ontology assisted decision making - A case study in trip planning for tourism. In R. Meersman, Z. Tari, P. Herrero (Eds.), *Lecture Notes in Computer Science: Vol. 3762. On the Move to Meaningful Internet Systems 2005: OTM 2005 Workshops.* Springer (pp.1137-1146). https://doi.org/10.1007/11575863_136

Tryfona, N., & Pfoser, D. (2005). Data semantics in location-based services. In S. Spaccapietra & E. Zimányi (Eds.), *Lecture Notes in Computer Science: Vol. 3534. Journal on Data Semantics III.* Springer. https://doi.org/10.1007/11496168_8

Tsou, M. -C. (2010). Geographic information retrieval and text mining on chinese tourism web pages. *International Journalof Information Technology and Web Engineering, 5*(1), 56-75. https://doi.org/10.4018/jitwe.2010010104

UDC Consortium (2005). *Universal Decimal Classification* (Standard Ed.). British Standard Institution.

United Nations Organization. (2006). *Convention on the Rights of Persons with Disabilities.* https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html

UNWTO. (2001). *Thesaurus on Tourism & Leisure Activities (Trilingual: English, French, Spanish).* World Tourism Organization. https://www.e-unwto.org/doi/book/10.18111/9789284404551

UNWTO. (2001). *Thesaurus on Tourism & Leisure Activities (Trilingual: English, French, Spanish).* World Tourism Organization. https://www.e-unwto.org/doi/book/10.18111/9789284404551

UNWTO. (2010). *International Recommendations for Tourism Statistics 2008*. United Nations Publication. https://unstats.un.org/unsd/publication/seriesm/seriesm_83rev1e.pdf

UNWTO. (2010). *International Recommendations for Tourism Statistics 2008.* United Nations Publication. https://unstats.un.org/unsd/publication/Seriesm/SeriesM_83rev1e.pdf

Uschold, M., & Gruninger, M. (1996). Ontologies: Principles, methods and applications. *The knowledge engineering review, 11*(2), 93-136. https://doi.org/10.1017/S0269888900007797

Valencia-García, R., García-Sánchez, F., Castellanos-Nieves, D., & Fernández-Breis, J. T. (2011). OWLPath: An OWLontology-guided query editor. *IEEE Transactions on Systems, Man, and Cybernetics Part A: Systems and Humans,41*(1), 121-136. https://doi.org/10.1109/TSMCA.2010.2048029

Van Aart, C., Wielinga, B., & Van Hage, W. R. (2010). Mobile cultural heritage guide: Location-aware semantic search. In P. Cimiano & H.S. Pinto (Eds.), *Lecture Notes in Computer Science, Vol. 6317. Knowledge Engineering and Management by the Masses.* Springer. https://doi.org/10.1007/978-3-642-16438-5_18

Varfolomeyev, A., Korzun, D., Ivanovs, A., Soms, H., & Petrina, O. (2015). Smart space based recommendation servicefor historical tourism. *Procedia Computer Science, 77,* 85-91. https://doi.org/10.1016/j.procs.2015.12.363

Varga, B., Trambitas-Miron, A. D., Roth, A., Marginean, A., Slavescu, R. R., & Groza, A. (2014). LELA-a natural languageprocessing system for romanian tourism. *In M. Ganzha, L. Maciaszek, M. Paprzycki (Eds.), Annals of Computer Science and Information Systems: Vol. 2, Proceedings of the 2014 Federated Conference on Computer Science and Information Systems* (pp. 281-288). http://dx.doi.org/10.15439/2014F323

Vert, S., & Vasiu, R. (2014). Relevant aspects for the integration of linked data in mobile augmented reality applications for tourism. In G. Dregvaite & R. Damasevicius (Eds.), *Communications in Computer and Information Science: Vol. 465. Information and*

Software Technologies (pp.334-345). Springer. https://doi.org/10.1007/978-3-319-11958-8_27

Viana, W., Bringel Filho, J., Gensel, J., Villanova-Oliver, M., & Martin, H. (2008). PhotoMap: From location and time tocontext-aware photo annotations. *Journal of Location Based Services, 2*(3), 211-235. https://doi.org/10.1080/17489720802487956

Viana, W., Filho, J. B., Gensel, J., Oliver, M. V., & Martin, H. (2007). PhotoMap - automatic spatio temporal annotation for mobile photos. *In J.M. Ware & G. E. Taylor (Eds.), Lecture Notes in Computer Science: Vol. 4857. Web and Wireless Geographical Information Systems* (pp. 187-201). Springer. https://doi.org/10.1007/978-3-540-76925-5_14

Vicient, C., Sánchez, D., & Moreno, A. (2013). An automatic approach for ontology-based feature extraction from heterogeneous textual resources. *Engineering Applications of Artificial Intelligence, 26*(3), 1092-1106. https://doi.org/10.1016/j.engappai.2012.08.002

Vickery, B.C. (1960), *Faceted Classification*, ASLIB.

Virmani, C., Sinha, S., & Khatri, S. K. (2018). Unified ontology for data integration for tourism sector. Proceedings of the *2017 International Conference on Infocom Technologies and Unmanned Systems: Trends and Future Directions,* 152-156. IEEE. https://doi.org/10.1109/ICTUS.2017.8285995

Volkova, L., Yagunova, E., Pronoza, E., Maslennikova, A., Bliznuk, D., Tokareva, M., & Abdullaev, A. (2018). Recommender system for tourist itineraries based on aspects extraction from reviews corpora. *Polibits, 57,* 81-88. https://doi.org/10.17562/PB-57-9.

Wakahara, T., Maki, T., Takahashi, K., Yamaguchi, A., Kimoto, S., Takagi, A., Ichifuji, Y., & Sonehara, N. (2016). Tourism local community system using LOD. *Proceedings of the 2016 10th International Conference on Complex, Intelligent, and Software Intensive Systems,* 332-336. IEEE. https://doi.org/10.1109/CISIS.2016.105

Wang, B., Liu, D., & Wong, S. (2012). A context information ontology hierarchy model for tourism-oriented mobile E-commerce. *Journal of Software, 7*(8), 1751-1758. https://doi.org/10.4304/jsw.7.8.1751-1758

Wang, C. (2018). An intelligent and context-aware touring system based on ontology. In C. Stephanidis (Eds.), *Communications in Computer and Information Science: Vol. 850. HCI International 2018 – Posters' Extended Abstracts.* Springer. https://doi.org/10.1007/978-3-319-92270-6_65

Wang, W., Zeng, G., & Tang, D. (2011). Bayesian intelligent semantic mashup for tourism. *Concurrency Computation Practice and Experience, 23*(8), 850-862. https://doi.org/10.1002/cpe.1676

Wardhana, H., Mustofa, K., & Sari, A. K. (2018). Utilization of semantic web rule language for tourism ontology. *Proceedings of the 3rd International Conference on Informatics and Computing,* 1-5. IEEE. https://doi.org/10.1109/IAC.2018.8780474

Wickham, H. (2021). rvest: Easily Harvest (Scrape) Web Pages. R package version 1.0.0. https://cran.r-project.org/package=rvest

Wickham, H., François, R., Henry, L. and Müller, K. (2021). dplyr: A Grammar of Data Manipulation. R package version 1.0.7. https://cran.r-project.org/package=dplyr

World Health Organization (2001). *International Classification of Functioning*. WHO.

World Tourism Organization (2016a), Accessible Tourism for All: An Opportunity within Our Reach, UNWTO.

World Tourism Organization (2016b). *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module I: Accessible Tourism – Definition and Context.* UNWTO.

World Tourism Organization (2016c). *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module V: Best Practices in Accessible Tourism.* UNWTO.

World Tourism Organization (2016c). *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module V: Best Practices in Accessible Tourism*. UNWTO.

World Tourism Organization (2020, January 24). *UNWTO and fundación once deliver international recognition of 'accessible tourist destinations' at fitur* [Press Release]. https://www.unwto.org/unwto-and-fundacion-once-deliver-international-recognition-of-accessible-tourist-destinations-at-fitur

World Tourism Organization and Fundación ACS (2015). Manual on Accessible Tourism for All – Public-Private Partnerships and Good Practices. UNWTO.

World Tourism Organization. (2013). *UNWTO Recommendations on Accessible Tourism for All.* UNWTO.

World Tourism Organization. (2016a). *Accessible Tourism for All: An Opportunity within Our Reach*. UNWTO.

World Tourism Organization. (2016b). *Manual on Accessible Tourism for All: Principles, Tools and Best Practices – Module I: Accessible Tourism – Definition and Context*. UNWTO.

Wyckoff, M.A. (2014). Definition of placemaking: four different types. *Planning and Zoning News,* 32(3), 1-10. https://www.canr.msu.edu/uploads/375/65814/4typesplacemaking_pzn_wyckoff_january2014.pdf.

Yang, S. -Y., & Chen, K. -Y. (2020). Development of a cloud tourism supported platform with friendly interfaces based onlinked open data and big data analysis techniques. *Proceedings of the 2020 International Symposium on Computer, Consumer and Control,* 372-375. IEEE. https://doi.org/10.1109/IS3C50286.2020.00102

Yan-Guang, C., Ya-Ming, Z., Tao, Z., & Yi, Y. (2014). A hybrid ontology knowledge integration for farmbased tourism withNFC. *Proceedings of the 2014 4th International Conference on Instrumentation and Measurement,Computer, Communication and Control,* 548-553. https://doi.org/10.1109/IMCCC.2014.118

Yochum, P., Chang, L., Gu, T., & Zhu, M. (2020). Linked open data in location-based recommendation system on tourism domain: A survey. *IEEE Access, 8*, 16409-16439. https://doi.org/10.1109/aCCESS.2020.2967120

Yoo, K. H., & Gretzel, U. (2009). Comparison of deceptive and truthful travel reviews. In W. Höpken, U. Gretzel, R. Law (Eds.), *Information and communication technologies in tourism 2009* (pp. 37-47). Springer. https://doi.org/10.1007/978-3-211-93971-0_4

Yu, L., Wang, G., & Marcouiller, D. W. (2019). A scientometric review of pro-poor tourism research: Visualization and analysis. *Tourism Management Perspectives,* 30, 75–88. https://doi.org/10.1016/j.tmp.2019.02.005

Zanker, M., Jessenitschnig, M., & Stromberger, M. (2012). Harnessing geo-tagged resources for web personalization. *Proceedings of the 27th Annual ACM Symposium on Applied Computing,* 332-339. https://doi.org/10.1145/2245276.2245342

Zeng, M.L. (2019). Interoperability. *Knowledge Organization, 46*(2), 122-146. https://doi.org/10.5771/0943-7444-2019-2-122.

Zhang, L., & Sun, X. (2018). *An interactive recommender system for group holiday decision-making.* In A. Marcus, & W. Wang (Eds.), *Lecture Notes in Computer Science, Vol. 10919. Design, User Experience, and Usability: Designing Interactions* (pp. 673-683). Springer. https://doi.org/10.1007/978-3-319-91803-7_50

Zhang, P., Du, J., Fan, D., & Zhou, Y. (2015). Automatic image semantic annotation based on the tourism domain ontological knowledge base.In H. Zha, X. Chen, L. Wang, & Q. Miao (Eds.), *Communications in Computer and Information Science, Vol. 547. Computer Vision* (pp. 61-69). Springer. https://doi.org/10.1007/978-3-662-48570-5_7

Zhang, S. -m., Guo, J. -y., Yu, Z. t-., Lei, C. -y., Mao, C. -l., & Wang, H. -x. (2010). An approach of domain ontology construction based on resource model and jena. *Proceedings of the 3rd International Symposium on Information Processing,* 311-315. https://doi.org/10.1109/ISIP.2010.44

Zhang, W., Cao, H., Hao, F., Yang, L., Ahmad, M., & Li, Y. (2020). The chinese knowledge graph on domain-tourism. In J. Park, L. Yang, Y. S. Jeong, & F. Hao (Eds.), Lecture Notes

in Electrical Engineering, vol 590. Advanced Multimedia and Ubiquitous Engineering (pp. 20-27). Springer, Singapore. https://doi.org/10.1007/978-981-32-9244-4_3

Zhang, X., Zhou, W., & Zhang, Y. (2012). Semantic sensor data integration based on cloud computing. *Advanced Science Letters, 7*, 103-106. https://doi.org/10.1166/asl.2012.2112

Zhang, X., Zhou, W., & Zhang, Y. (2013). Intelligent information management of tourist attractions based on semanticsensor web. In A. Ghose, H. Zhu, Q. Yu, A. Delis, Q. Z. Sheng, O. Perrin, J. Wang, Y. Wang (Eds.), *Lecture Notes in Computer Science: Vol. 7759. Service-Oriented Computing - ICSOC 2012 Workshops* (pp. 119-126). Springer. https://doi.org/10.1007/978-3-642-37804-1_13

Zhang, Y., & Cole, S. T. (2016). Dimensions of lodging guest satisfaction among guests with mobility challenges: A mixed-method analysis of web-based texts. *Tourism Management, 53,* 13-27. https://doi.org/10.1016/j.tourman.2015.09.001.

Zhang, Z., Xu, G., Zhang, P., & Wang, Y. (2016). Personalized recommendation system based on WSN. *International Journal of Online Engineering*, *12*(10), 91-96. https://doi.org/10.3991/ijoe.v12i10.6207

Zhao, S., Potdar, V., & Chang, E. (2007). A practical image retrieval framework for tourism industry. *Proceedings of the IEEE International Symposium on Industrial Electronics*, 2928-2932. IEEE. https://doi.org/10.1109/ISIE.2007.4375079

Zhu, Q., Kong, X., Hong, S., Li, J., & He, Z. (2015). Global ontology research progress: a bibliometric analysis. *Aslib Journal of Information Management*, 67(1), 27–54. https://doi.org/ 10.1108/ajim-05-2014-0061

Zhu, Q., Kong, X., Hong, S., Li, J., & He, Z. (2015). Global ontology research progress: a bibliometric analysis. *Aslib Journal of Information Management*, *67*(1), 27-54. http://dx.doi.org/10.1108/AJIM-05-2014-0061

Appendices

Appendix A: Sample reviews about Ecopark

Component	Aspect	Outcome
(December 2018) "One thing the organizers have to work is on signages, washrooms and better eating joints inside the park" [C1,C4] (December 2016) "It's a great place to walk around, although there are no maps anywhere in the park and the staff are not exactly motivated to serve the public."[C1, C7] (September 2019) "The sunset across the lake looks beautiful. Variety of activities like boating, cycling, guided tours are there. Replicas of 7 wonders are worth a watch and photoshoot specially with lights on. Many food stalls are present across the place." [C2,C4,C5] (November 2019) "It is good for business meetings and social dining. I attended a conference here which was well managed." [C3] (May 2013) "This is an	(February 2017) "The park was exceptionally huge spread over several several acres. and only handful of electrical cars to ferry you. These cars would mostly be full and you will have to wait quite a while for your turn to board them." [A1, A3] (June 2018) "By mistake we got off at Gate 3 and did the Toy train ride but there was no way to get to Gate 4 by the golf carts as they start at different gates. So we paid entrance and parking twice." [A2] (February 2015) "The Eco Tourism park in its current form is a great place for families to enjoy fresh air, stroll on grasses for stretches, and sit or eat whatever you feel like. However, you got to be careful about snakes during summer-heat." [A4] (January 2018) "The best thing is it's very clean, lots of seating and shade." [A5]	(February 2016) "Calm, relaxing, serene, pristine are the words to describe. Far from the hustle and bustle of city its a treat for eyes and relaxation for ears…." [O1] (November 2019) "Re-visiting Eco Park after a gap of four years, my wife and I were amazed to see the new developments that have taken place. Apart from the infrastructure, the upkeep and cleanliness were far beyond our expectations." [O2] (December 2014) "We wasted an entire day for this so called attraction. Stood in the que for over 2 hours to get the entry tickets to the park." [O3] (February 2015) "Only conveyance available is a green car which cost you Rs 50 per head no matter how short you travel, and it is nearly impossible to cover the whole area on foot." [O4]

excellent place in making. A awesome water body and the amazing tree plantation and beautifully maintaining the grass lands making this place excellent. [C6] (January 2016) "Battery car service is from one fixed point to another and midway boarding is not allowed." [C8]	(December 2016) "The boat attendant simply didn't care if we could access the boat at all and made no move to help us board."[A6] (January 2018) "The day we visited there was a Food and music fest going on bang opposite the bird section...now this place has been designed well with rushes and vegetation to attract small birds...then why allow and encourage cacophony right next to it...no wonder we spotted no birds." [A7]	

Appendix B: Sample reviews about Ontario Place

Component	Aspect	Outcome
(September 2009) "after 3 of our party spent 10 minutes each trying to buy tickets on their website, none of us were able to successfully purchase tickets as it was a complete failure on all of out phones." [C1] (September 2019) "Up until the end of the 2011 season, the site was also home to a water park and amusement rides." [C2] (September 2009) "...the light show had fences up around the pieces so you couldn't really get too	(August 2009) "You will notice that their website is very short on information, and has no pictures of the rides or other attractions. I think this is deliberate." [A1] (November 2017) "I would suggest that Cinesphere relay to WAZE and Google maps how to get there as both took us to the second entrance from which we had to then backtrack and enter the parking lot." [A2] (February 2012) "if you want to attract kids, a park by the lake with nothing but grass and exhibits just isn't much	(August 2012) "It was amazing for my children they really enjoyed it." [O1] (February 2012) "what a complete shame - use to be a show case of all which was great in this province - now a mess of rust and fast food." [O2] (December 2019) "We had a great time despite feeling a little bit ripped off on the parking

close, nobody went ice skating (which was allllll the way in the back)" [C3] (December 2012) "Great food restaurants with good food and drink. Leisurely walks and just people watching." [C4] (November 2018) "Good clean well kept environment with helpful staff…." [C7] (October 2012) "in 2012 the provincial government shuttered the place, claiming that it was losing money running it. " [C8]	of a draw." [A3] (September 2019) "Lots of shows on at night but enjoyed it for scenery and boats." [A4] (August 2011) "Some rides were not working and one area in particular was a good breeding ground for mosquitoes..." [A5] (December 2019) "We also had a hard time buying online but the ticket booth person explained its actually the same cost as at the door once you include the service fees." [A6] (July 2006) "IMAx Theater line was quite long, but nowhere in the line (or view of the line) did you know when the next showing was and/or how long until the show." [A7]	cost." [O3, O4]

Appendix C: Sample competency questions

Competency question	Extracted concepts
What is the currency of the place?	<currency, location>
Which festivals will be held in Paris during the visit?	<events, location, time>
Does the tourist spot have parking spot for disabled people?	<location, parking, designation>
Are there interpreters present at the destination?	<interpreter, availability, destination>
Which activities are for disabled people?	<activity, disability>
Is the hotel room wheelchair accessible?	<room, wheelchair- accessibility>
Is Braille panel available in the lifts?	<Braille panel, availability, lift>
Are electrical sockets for recharging wheelchairs present	<hotel, electrical socket, wheelchair

at the hotel?	recharge >
Are there wheelchair accessible cloth hangers in the bathroom?	<cloth hanger, wheelchair-accessibility >
Are the hotel rooms equipped with height adjustable beds?	<hotel, bed, height adjustable>
Does the hotel have lavatories with sidewall support?	<hotel, lavatory, sidewall support>
Does the room have wardrobes with sliding doors?	<room, wardrobe, sliding door>
What are the prices of the rooms available in the hotel?	<cost, room, availability, hotel>
Are the door knobs of the room wheelchair accessible?	<door knob, room, wheelchair-accessibility>
Are emergency alarms present in the hotel rooms?	<alarm, availability, room>
What is the cost of local food?	<cost, cuisine, location>
What are the prices of the plane tickets to and from the place?	<cost, air transport, location, destination>
Which travel agents arrange tours to this place?	<travel agent, tour, location>
What is the local language of the place?	<local, language, location>
What is the checkout time of the hotel?	<hotel, checkout time>
What are must buy items from the place?	<crafts, location>
What are the prices of the train tickets to the place?	<price, train ticket, destination>
What is the currency of the place?	<currency, location>
What are the special dishes native to the place?	<cuisine, location>
What is the train fare between Kolkata and Guwahati?	<train, fare, place, destination>
Are the cruise cabins wheel-chair accessible?	<cruise, cabin, wheelchair-accessibility>
Is oxygen support available in the vehicle?	<oxygen-support, availability, vehicle>
How will be the weather of the place during the time of visit?	<weather, location, time of visit>
Which are the best nearby destinations to the place?	<location, ratings, nearby, tourist spot>
What are the amenities provided by the hotels?	<amenities, hotels>
Which are the famous restaurants of the place?	<restaurant, place, ratings, reviews>
Are ramps available inside the building?	<ramp, inside, building>
What is the allowed time of visit to the place?	<place, time of visit>
Does the stairs of the building have handrails?	<building, stairs, handrails>
Are automatic lifts available in the building?	<lift, automatic, availability, building>
What is the ticket availability of the available modes of transport that can be availed for visiting the place?	<ticket, availability, transport, destination>
What is the socio-political scenario of the place?	<socio-political, location>
Are there toilets on the highways connecting two places?	<toilet, highway, place, destination>
How is the mobile network connectivity at the place?	<mobile network, connectivity, place>
Is passport/visa required to visit the place?	<documents required, location>
Are there any concessions on tickets for disabled persons?	< disability, discount, ticket, >

What are the nearby cultural heritages places to the place?	<cultural heritage, location>
What is the economic condition of the place?	<economy, condition, location>
What is the time required to reach a nearby spot from the place?	<time, place, destination>
Which time is best to visit the place?	<visit, time, place>
How much money is required for this tour?	<cost, tour>
Which mode of transport will be cheaper?	<transport, cost>
What kind of clothes should be taken?	<clothes, location>
Does the park have designated seating area for disabled people?	<park, seating area, designation>
Are wheelchairs available for rent at the destination?	<wheelchair, availability, rent>
Are tactile strips present on the walkways?	<tactile strip, availability, walkway>
What are the medicines/drugs that may be required at the place?	<medicines, location>

Appendix D: Examples of SPARQL queries

Example of queries executed on the ontology demonstrated in section 5.2	
Prefixes	PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> PREFIX owl: <http://www.w3.org/2002/07/owl#> PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#> PREFIX xsd: <http://www.w3.org/2001/XMLSchema#> PREFIX alto: <http://www.altourismontology.owl#>

Q1	Which tourist accommodations present at Kolkata allow pets?
	
	select ?accommodation
	where {
	?accommodation rdf:type ?type.
	?type rdfs:subClassOf* alto:TouristAccommodation.
	?accommodation alto:isLocatedAt alto:Kolkata.
	?accommodation alto:petsAreAllowed ?value.
	filter(?value=true)
	}

Q2	Which are the places to eat in Bengaluru with rating more than 4? select * where { ?eatery rdf:type ?type . ?type rdfs:subClassOf* alto:Eatery . ?eatery alto:isLocatedAt alto:Bangalore. ?eatery alto:hasRating ?rating.

	filter(?rating >= 4.0) }

Q3	List the handicrafts of West Bengal.
	
	select *
	where {
	?handicraft alto:isBasedFrom ?district.
	?district alto:isPartOf alto:WestBengal.
	}

Q4	Which tourist accommodations of Kolkata are equipped with accessible bath and electrical socket for charging wheelchairs?
	
	select ?accommodation ?type
	where {
	?accommodation rdf:type ?type.
	?type rdfs:subClassOf* alto:TouristAccommodation.
	?accommodation alto:isLocatedAt alto:Kolkata.
	?accommodation alto:hasAccessibleBath ?v1.
	?accommodation alto:hasWheelchairChargeableElectricalSocket ?v2.
	filter(?v1=true && ?v2=true)
	}

Example of queries executed on the ontology demonstrated in section 5.3	
Prefixes	PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> PREFIX owl: <http://www.w3.org/2002/07/owl#> PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#> PREFIX xsd: <http://www.w3.org/2001/XMLSchema#> PREFIX tro: <http://touristreviewontology.owl#>

Q5	List reviews about Eco Park with average rating.
	
	select ?review
	where {
	?review tro:has_rating ?rating.
	?review tro:is_about tro:Eco_Park.
	filter (?rating="Average")
	}

Q6	List reviews according to decreasing order of importance score.
	
	select ?review ?content
	where {
	?review tro:states ?content.
	?review tro:has_importance_score ?score.
	}
	order by desc (?score)
	limit 5

Q7	List the aspects of time utility reviews about Ontario Place.
	
	select ?review ?aspect
	where {
	?review tro:has_rating ?rating.
	?review tro:reflects_aspect ?aspect.
	?review tro:is_about tro:Ontario_Place.
	?review rdf:type tro:TimeUtilityReview
	filter (?rating="Average")
	}

Q8	Obtain a visual graph of perspective reviews and aspects covered in them. CONSTRUCT { ?review tro:reflects ?aspect} WHERE {?review rdf:type tro:PerspectiveReview. ?review tro:reflects_aspect ?aspect. } limit 14