

Writer verification plays a pivotal role in various domains, including forensics, document analysis, and biometrics. This study addresses the challenges posed by the complex structure and diverse writing styles of the Bangla script, proposing novel solutions. The system combines advanced image pre-processing techniques with machine learning algorithms to enable precise writer verification. Utilizing a new dataset of handwritten Bangla samples, the model demonstrates promising accuracy rates, highlighting its potential for real-world applications.

The introductory chapter outlines the significance of writer verification and sets the research objectives. Chapter 2 provides an exhaustive review of existing literature, covering both online and offline features and introducing a multi-level scripting approach. The need for accurate biometric applications in fields such as historical document analysis, behavioral biometrics, forensic science, access control, graphology, and copyright management is emphasized. The chapter also addresses the challenges of writer identification and verification in offline and online handwriting recognition analysis.

Chapter 3 delves into dataset analysis and creation, identifying gaps in existing resources and introducing a new dataset tailored for the research. Chapter 4 explores the crucial role of features in determining authorship, focusing on linguistic, stylometric, and structural traits within the Bangla script. This chapter discusses the importance of feature extraction in recognizing patterns, examining shapes and textures through methods like the Radon Transform and various texture-based descriptors. Additionally, a Genetic Algorithm is employed to identify the most significant features, enhancing the model's performance. The study also explores auto-derived features using models such as AlexNet, VGG, ResNet, and Vision Transformer.

Subsequent chapters detail the use of classification algorithms for identifying writing styles. Methods like Multilayer Perceptron (MLP), Support Vector Machine (SVM), Simple Logistic, Sequential Minimal Optimization (SMO), Radial Basis Function (RBF) Networks, and K-Nearest Neighbor (KNN) are explored. The effectiveness of these classifiers in distinguishing different writers based on features such as word frequencies and sentence structures is analyzed.

Experimental results are discussed in the final chapters. The first experiment focuses on offline Bangla handwriting content, evaluating specific hand-crafted features with various classifiers and achieving a 94.54% average verification accuracy on a 100-writer database. The second experiment integrates techniques at the page, line, and word levels to enhance writer verification performance, achieving a notable 97.62% accuracy across 101 writers using an ensemble of classifiers.

The study introduces a novel tri-script approach, achieving a peak verification accuracy of 91.50%. The Vision Transformer (ViT) model is also employed, demonstrating superior performance in writer recognition using tri-level block images. The concluding chapter summarizes the thesis's contributions and suggests potential avenues for future research in Bangla script writer verification.