Abstract

In recent years, there is a huge scope for research in the domain of automatic disease detection, characterization, and classification using image processing and pattern recognition techniques. This is a result of the rise in various diseases around the world. Cancer is a disease that has several manifestations and it is primarily associated with abnormal cell groups. These cancer cells continue to divide and grow to produce tumors. Among all types of cancer, lung cancer is the most life- threatening disease all over the world. Appropriate detection and characterization of lung nodules using High Resolution Computed Tomography (HRCT) images helps in early-stage recognition of lung cancer. However, due to structural similarity and smaller size, manual detection and characterization of lung nodules is a time-consuming and error-prone process. Doctors and radiological specialists must physically inspect, analyze, and make subsequent decisions based only on a visual assessment of each slice to find nodules. This process is subjective and significantly depends on the radiologists' experience. Additionally, it might be challenging for a novice radiologist to distinguish between benign and malignant nodules based solely on visual examination. In recent years, different Computer-Aided Detection and Diagnosis (CAD) systems based on machine learning and deep learning have been developed for accurate, reliable, and early-stage lung cancer diagnosis to solve the aforementioned challenges. Therefore, by considering the present scenario, it is essential to develop an automated/semi-automated system that can act as a second opinion and aid in the quicker and more accurate detection, characterization, and classification of lung cancer by radiologists, pathologists, and medical professionals.

In a nutshell, this thesis aims to design and develop some image processing, machine learning, and deep learning algorithms for automatic detection, characterization, and subtype classification of lung cancer from HRCT and Histopathology images. In this regard, different machine learning and recent most deep learning frameworks have been invented and developed to build more sophisticated integrated CAD systems that can outperform existing state-of-the-art frameworks.