Chapter 6
Automatic Detection of Lung Cancer Using the Potential of Artificial Intelligence (AI)

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ABSTRACT

The histopathology images are effective in identifying the location and level of cancer. In this chapter, a novel model is implemented for an automatic classification of histopathological images related to lung tissues. Initially, the color normalization technique is applied for improving the contrast of the histopathological images, which are acquired from the LC25000 lung histopathological image dataset. Additionally, the cancer segmentation is accomplished utilizing saliency driven region edge-based top-down level set (SDREL). Further, the feature descriptors—Alexnet and Gray Level Co-Occurrence Matrix (GLCM) features—were used for extracting the feature vectors from the segmented histopathology images. Lastly, the enhanced grasshopper optimization algorithm (EGOA) and random forest classifier were used for optimal feature selection and lung tissue classification. The simulation result shows that the EGOA-random forest model obtained 98.50% of accuracy on the LC25000 lung histopathological image dataset.

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INTRODUCTION

Lung cancer is a common deadly disease and is the cause of death throughout the world. The early diagnosis of lung cancer can increase survival among people. (Bansal et al., 2020). There are a handful of imaging techniques, and the comparison of the existing imaging techniques for the digital pathology systems produces higher-resolution histopathology images that show the actual cause of the patient illness (Lakshmanaprabu et al., 2019; Sun et al., 2019). Using the existing techniques, it is very difficult to identify the presence of lung disease in the imaging techniques (Chehade et al., 2022). Now-a days, the Computer Aided Diagnosis (CAD) system is used for effective diagnosis and detection in the medical fields, because it improves the classification accuracy and speed of histopathological lung cancer diagnosis (Saif et al., 2020). The CAD system uses machine-learning techniques for improving early diagnosis, detection, prediction, and accuracy. Image feature extraction is needed for machine-learning techniques to utilize medical images in the CAD system (Toğaçar, 2021). Tumor heterogeneity is an essential factor for evaluating tumor aggressiveness. Texture analysis is employed in image feature extraction for assessing the tumor heterogeneity in the CAD system (Suzuki, 2014; Wang, Yang, Rong et al, 2019). In this research work, a novel model is implemented to improve histological lung cancer detection by addressing two major problems a meaningful gap between the features that are extracted and the non-linear vector images (Wang, Chen, Gan et al, 2019). The major findings in this manuscript are as follows:

- The images from the LC25000 lung histopathological image dataset are collected, and a superior pre-processing technique: color normalization is applied for enhancing the contrast of the images. Color normalization makes the classification of cancerous and normal regions much easier.
- In addition to this, the SDREL technique is employed for segmenting the cancerous and normal regions from the de-noised histopathological images. Then, the feature extraction is carried out using GLCM features and AlexNet for extracting discriminative feature vectors.
- EGOA feature selection technique is used to reduce the curse of dimensionality concern. In this chapter, the EGOA is applied for selecting the optimal feature information from the extracted feature vectors.
- Enhanced random forest classifier for improving the disease classification accuracy. The classifier reduces the false positive rate: which usually refers to the probability of falsely rejecting the presence of the patient's disease. The development of a random forest with self-paced learning bootstrap showed improvement in lung cancer classification and prognosis based on lung histopathological image data.

Histopathological Image Analysis in Medical Decision Making: Classification of Histopathological Images Based on Deep Learning Model

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