Chapter 3
Medical Image Classification

Jesu Vedha Nayahi J.
Anna University Tirunelveli, India

Gokulakrishnan K.
Anna University Tirunelveli, India

ABSTRACT

Diagnosis of diseases at the right stage with optimal accuracy is a significant requirement in the medical field. Apart from diagnosis from clinical symptoms, diagnosis based on scanned images of both internal and external organs is playing a vital role in understanding the severity of the disease. Classification is a field of study derived from artificial intelligence, and today it is widely used in medical image classification. These techniques are used to classify the different stages of a disease or different variant diseases possible in an organ from different types of input images such as magnetic resonance imaging (MRI), computed tomography (CT), x-ray, fundus images, iris images, etc. Various preprocessing techniques are used to select the relevant features from the input image to form the feature set. The classifiers are trained using the feature set to generate models. The generated models can be optimized to improve the performance. Various metrics such as accuracy, coverage, precision, recall, and FMeasure are used to measure the accuracy.

INTRODUCTION

In medical field there is a lot of challenge with regard to diagnosis of different diseases. Magnetic Resonance Imaging (MRI) (Geethu & Monica, 2005), Computed Tomography (CT) (Yang et al., in press), X-Ray, fundus images (Andres et al., 2017), iris images and other type of images are acting as an important aid for the physician

DOI: 10.4018/978-1-5225-5876-7.ch003

to diagnose a particular disease. Human processing of these images may be erroneous and varies from one person to other. Traditionally the medical images are analyzed with the help of pixel based or region based segmentation. Today medical images are processed using a branch of study in artificial intelligence namely classification in order to improve the accuracy of prediction.

Classification is playing a vital role in the diagnosis of diseases such as brain tumor and other types of tumors, glaucoma, lung diseases etc. Decision Tree classifier, Naive Bayes classifier, Neural Network classifier, Support Vector Machine, k-Nearest Neighbour (k-NN) classifier etc. are some of the classification techniques used for data classification. Recently different modified versions of neural network, support vector machine, k-NN are widely used in image classification. There are also ensemble classifier techniques such as bagging and boosting which has proved to improve the accuracy of medical image classification.

The first phase of medical image classification is feature extraction. Many of the filters and other transforms are used for feature extraction. Feature extraction will identify all the possible features and as the next step feature selection can be used to identify the most relevant features. Feature selection will play a significant role in improving the accuracy of classification by selecting the most relevant features for further classification.

The best features selected are fed to classifiers and most of the classifiers work by assigning weightage to the different features. One of the most promising techniques used for image classification is neural network classifier. Neural network classifier assigns initial weights and biases to each of the features and the edges connecting the different layers respectively. The weight and bias are adjusted based on the error in the output layer. The best weight and bias which would have very negligible error rate is fixed for future classification.

Support vector machine (SVM) classifier is also another significant technique used for image classification. This classifier is suitable for all types of linear or non linear data and hence widely used in image classification. The support vectors are identified by choosing the maximal margin hyperplane used to separate the different classes. These support vectors are then used as reference to classify the future values.

Optimization is also playing a key role nowadays in medical image classification. Different optimization techniques such as genetic algorithm, particle swarm optimization etc are integrated with the classifier to optimize the weights of the features used for classification. Neural network or SVM can be combined with optimization techniques to improve the accuracy, specificity, sensitivity of the classification.

The use of ensemble classifiers or classifiers combined with optimization techniques would improve the result of classification. Since the success of medical image classification lies in the accuracy of classification different preprocessing techniques and post processing techniques can be applied to improve accuracy.