Chapter 6

Intelligent Computing in Medical Imaging: A Study

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ABSTRACT

Biomedical imaging is considered main procedure to acquire valuable physical information about the human body and some other biological species. It produces specialized images of different parts of the biological species for clinical analysis. It assimilates various specialized domains including nuclear medicine, radiological imaging, Positron emission tomography (PET), and microscopy. From the early discovery of X-rays, progress in biomedical imaging continued resulting in highly sophisticated medical imaging modalities, such as magnetic resonance imaging (MRI), ultrasound, Computed Tomography (CT), and lungs monitoring. These biomedical imaging techniques assist physicians for faster and accurate analysis and treatment. The present chapter discussed the impact of intelligent computing methods for biomedical image analysis and healthcare. Different Artificial Intelligence (AI)

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based automated biomedical image analysis are considered. Different approaches are discussed including the AI ability to resolve various medical imaging problems. It also introduced the popular AI procedures that employed to solve some special problems in medicine. Artificial Neural Network (ANN) and support vector machine (SVM) are active to classify different types of images from various imaging modalities. Different diagnostic analysis, such as mammogram analysis, MRI brain image analysis, CT images, PET images, and bone/retinal analysis using ANN, feed-forward back propagation ANN, probabilistic ANN, and extreme learning machine continuously. Various optimization techniques of ant colony optimization (ACO), genetic algorithm (GA), particle swarm optimization (PSO) and other bio-inspired procedures are also frequently conducted for feature extraction/selection and classification. The advantages and disadvantages of some AI approaches are discussed in the present chapter along with some suggested future research perspectives.

INTRODUCTION

Medical image analysis has a major role in detecting and diagnosis of different diseases. Recently, researchers are interested with biomedical image analysis (Doi, 2007). Mainly, techniques based on machine learning including artificial neural networks (ANNs), and bio-inspired algorithms have drawn the attention of several researchers. Computer aided diagnosis (CAD) is considered a promptly developing active areas with the help of modern computer based methods, and new medical imaging modalities. Decision-support tools and intelligent analysis frameworks are significant in biomedical imaging for CAD, detection and evaluation where accuracy is one of the major issues. CAD helps physicians by the results obtained from a computerized system for detecting and diagnosing different diseases, such as lesions, and tumors as well as measuring the extent and effect of specific disease. One of the foremost goals of these artificial systems is to improve the consistency and accuracy of diagnosis in such a way that the rate of false negative will be reduced. Generally, CAD systems involve initial selection of samples for training, image pre-processing for enhancement, selection of region of interests (ROI), features extraction, feature selection, classification and segmentation. The CAD system generally tries to localize and to identify the disease for diagnosis. CAD systems consist of two most important processes, namely image segmentation and image classification. During the image segmentation, pixels are grouped into some domains based on some feature of the image producing a set of distinct regions or objects that can be studied and quantified separately, representing specific ROC (Receiver Operating
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