Artificial neural networks for medical diagnosis using biomedical dataset

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Abstract: Artificial neural networks are a promising field in medical diagnostic applications. The goal of this study is to propose a neural network for medical diagnosis. A feed-forward back propagation neural network with tan-sigmoid transfer functions is used in this paper. The dataset is obtained from UCI machine learning repository. The results of applying the proposed neural network to distinguish between healthy patients and patients with disease based upon biomedical data in all cases show the ability of the network to learn the patterns corresponding to symptoms of the person. Three cases are studied. In the diagnosis of acute nephritis disease; the percent correctly classified in the simulation sample by the feed-forward back propagation network is 100% while in the diagnosis of heart disease; the percent correctly classified in the simulation sample by the feed-forward back propagation network is approximately 88%. On the other hand, in the diagnosis of disk hernia or spondylolisthesis; the percent correctly classified in the simulation sample is approximately 82%. Receiver operating characteristics (ROCs) curve are used to evaluate diagnosis for decision support.

Keywords: artificial neural networks; ANNs; medical diagnosis; feed-forward back propagation network; receiver operating characteristic; ROC curves; artificial intelligence; decision support systems.

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1 Introduction

The clinical applications of computers include anything that has to do with direct patient care, such as diagnosis, monitoring, and treatment (Burke and Weill, 2005). Artificial neural networks (ANNs) provide a powerful tool to help doctors to analyse, model and make sense of complex clinical data across a broad range of medical applications. Most applications of ANNs to medicine are classification problems; that is, the task is on the basis of the measured features to assign the patient to one of a small set of classes (Dybowski and Gant, 2007).

Uğuz (2012) developed a biomedical-based decision support system for the classification of heart sound signals, obtained from 120 subjects with normal, pulmonary and mitral stenosis heart valve diseases via stethoscope. Classification results have shown that, dimension reduction, being conducted via PCA, has got positive effects on the classification of the heart sounds.

Dehariya et al. (2011) presented a medical decision support system based on the neural network architecture for medical diagnosis. The system is trained by employing an improved BP algorithm. The hidden layer of a neural network plays an important role for detecting the relevant features. Due to the existence of irrelevant and redundant attributes, by selecting only the relevant attributes, higher predictive accuracy can be achieved.

Er et al. (2010) presented a comparative chest disease diagnosis which was realised by using multilayer, probabilistic, learning vector optimisation, and generalised regression.