Chapter 10
Automatic Heart Disease Diagnosis Based on MRI Image Using Deep Neural Network: Adaptive Bacterial Foraging Optimization Algorithm–Based Feature Selection

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ABSTRACT

In this chapter, the authors propose an adaptive bacterial foraging optimization (ABFO) algorithm for selection of features to increase the classification accuracy of heart disease diagnosis. In this approach, noises contained in the cardiac image are removed using median filter initially. Then, GLCM features are extracted from the cardiac image. Among the extracted features, optimal features are chosen using the ABFO algorithm. These selected features are then input to the classifier, which is a support vector neural network (RBNN). The classifier classifies the image into normal and abnormal. Simulation results show that the ABFO-based RBNN performs better than the conventional RBNN, ANN, KNN, and SVM in terms of accuracy.

INTRODUCTION

Cardiovascular disease shows how it impacts the heart. The term cardiovascular is used interchangeably with cardiovascular disease (CVD). Blood reaches the heart through the coronary arteries and narrowing of the arteries is the main reason of heart failure. Predictors of CVD are considered a fundamental issue in the field of data analysis. Obesity is the leading cause of heart disease in the United States. There are

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several main reasons for heart disease. Some include high cholesterol, high blood sugar, CVD, smoking, physical inactivity and alcohol consumption.

Heart disease describes a range of condition that affects the heart. The term cardiac disease is regularly utilized with CVD. The blood to the heart is supplied by coronary supply routes and narrowing of coronary arteries is the major cause of heart failure. In the data analysis, cardiovascular disease is significant task. The major cause of heart attack in United States is coronary artery disease. Cardiac disorder is widespread in male than that of female. A survey conducted by the World Health Organization (WHO) estimated that 24% of people died in India due to cardiac disorders. (WHO, 2017). In 2015, over 30% of global deaths were due to CVD, leading to over 17 million deaths, a global health burden. Of those deaths, over 7 million were caused by heart disease, and greater than 75% of deaths due to CVD were in developing countries. In the United States alone, 25% of deaths were attributed to heart disease, killing over 630,000 Americans annually. Among heart disease conditions, coronary heart disease is the most common, causing over 360,000 American deaths due to heart attacks in 2015. Lot of people die experiencing symptoms that were previously undiscovered or simply ignored. It is time to predict heart disease before its actual occurrence as suggested by Hajar et al., (2017). There are several main causes of health disease such as high cholesterol level, blood pressure, smoking, use of alcoholic drinks, high sugar, lack of physical activities, CVD, and a hypertensive heart (Ali et al., 2019).

Feature utilization and selection are important steps in delineating the heart (Hajar et al., 2017; Ali et al., 2019). A good technique focuses on the refinement of features having interesting and varied features, eliminating the problems of underfitting and overfitting on both the datasets, i.e., training data and testing data, inappropriate network configuration and irrelevant features that usually slow down the scenery to avoid the "embarrassing sides" issue. Selection methods are often used to perform the impacts of fuzzy features on the expression of classification structures (Gu et al., 2018; Suganya et al., 2016; Liu & Tang, 2013). Currently, a set of positive groups is selected accordingly. Different selection addresses the correct algorithm by reducing dimensionality and eliminating unnecessary features (Singh et al., 2015; Jeong et al., 2012; Shen et al., 2012; Ramola et al., 2020; Rodriguez et al., 2019; Baggan et al., 2019; Rajakumar & George, 2013). An optimum feature set should have effective and discriminating features, while mostly reducing the redundancy of features selection pace to avoid the "curse of dimensionality" problem as explained by Gu et al. (2018). Feature selection strategies often are applied to explore the effect of irrelevant features on the performance of classifier systems (Suganya et al. 2016; Liu & Tang, 2013). In this phase, an optimal subset of features that are necessary and sufficient for solving a problem is selected. Feature selection improves the accuracy of algorithms by reducing the dimensionality and removing irrelevant features as discussed by Shen et al. (2012) and Singh et al. (2015). The orientation histogram feature provides the histogram of orientation of edges in the image as demonstrated by Jeong et al. (2012). Textures are one of the important features used by many applications. Texture features have been widely used in heart disease classification. The texture features help to distinguish abnormal and normal cases as illustrated by Shen et al (2012). There are two types of texture measures, first order and second order. In the first order, the texture measure is calculated using statistics from an individual pixel. In the second order, the texture measure considers the relationship between neighbours as shown by Pham et al. (2020) and Esteva et al. (2019). Texture features has been extracted and used as parameters to enhance the classification result.