Chapter 16
Deep Neural Network With Feature Optimization Technique for Classification of Coronary Artery Disease

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ABSTRACT

Coronary artery disease (CAD) is of significant concern among the population worldwide. The deep neural network (DNN) methods co-operate and play a crucial role in identifying diseases in CAD. The classification techniques like deep neural network (DNN) and enhanced deep neural network (EDNN) model are best suited for problem solving. A model is robust with the integration of feature selection technique (FST) like genetic algorithm (GA) and particle swarm optimization (PSO). This research proposes an integrated model of GA, PSO, and DNN for classification of CAD. The E-DNN model with a subset feature of CAD datasets gives enhanced results as compared to the DNN model. The E-DNN model gives a more correct and precise classification performance.

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INTRODUCTION

Coronary Artery Disease (CAD) is the largest and most widespread form of the disease in the world, especially in developing countries and is the main cause of heart attacks. This harms mostly the common people because of its costly diagnosis. They often neglect the initial symptoms and signs of the CAD problem. This also affects the economic and psychological capacity of a person. The disease requires early and timely diagnosis for favorable treatment. Hence, it is important to establish a CAD screening system that can recognize the initial symptoms and reduce the financial burden. Computer science researchers working in the field of health sciences use DNN technique for the early identification and diagnosis of CAD (Alizadehsani et al., 2012). The DNN is based on the Traditional Artificial Neural Network (ANN). The ANN is based on the human brain working architecture and processing system. A new ANN based learning dimension, namely Deep Learning Network (DL) or Deep Neural Network (DNN), has also been developed and used. It is the same as the ANN learning system, but the internal architecture is changed with an increased number of the hidden layers. It has enhanced the computation speed of the learning algorithm (Sahu, S.K., & Verma P., 2022).

DNN and E-DNN have been proposed for the classification of CAD. Several physical and clinical tests are performed to identify the problem of CAD, but the number of tests can be decreased using the feature selection or feature optimization technique. The initial CAD dataset is chosen by the GA, which utilizes C4.5 as the learning classifiers, and PSO, which utilizes Ensemble learning of C4.5 and Random Forest as the learning classifiers or objective function, making CAD features more prominent (Verma, P., Awasthi, V.K., Shrivas, A.K., & Sahu, S.K. (2022).. The GA-J48 and PSO-EM (J48+RF) have reduced the unimportant features of CAD and also defined the vital features of CAD. All features of the CAD dataset have been used before feature selection to the classifier DNN and E-DNN for classification. Later, the selected features of CAD are used for the classification. The classifiers DNN and E-DNN have classified the CAD dataset with selected feature subsets. So, FST helps to reduce the time to identify CAD issues. So, less feature-subset enhances the operational efficiency of the proposed model.

RELATED WORK

A comprehensive literature review is necessary to understand the background of the problem. So, an in-depth literature study was carried out.

Verma et al.(2021) worekd Deep Belief Network (D.B.F.), H2OBinomial-Model-Deep Neural Network (H-DNN) to classify the Coronary Artery Disease (CAD) with selected components .Also used the PCA to reduce the components of CAD datasets.The Models gives the improved outcomes with select components of CAD.Amarbayasgalan, Park, Lee & Ryu (2019) used a reconstruction error (RE) based deep neural networks (DNNs) method and utilized the concept of the deep Autoencoder (AE) model for estimating RE. They used Coronary Heart Disease (CHD) benchmark dataset for the experiment and obtained 86.3371% accuracy. Verma & Mathur (2019) used the deep learning model and applied correlation-based feature subset selection with PSO search for detection of CHD and obtained 85.481% accuracy. Swain, Pani & Swain (2019) proposed a Dense Neural Network for the classification of Cleveland Heart disease data. They obtained a classification accuracy of 94.91% during testing, whereas83.67% accuracy was achieved by Miao & Miao (2018) by using the enhanced DNN learning with regularization and dropout model for heart disease diagnosis. Caliskan & Yuksel (2017) proposed the Deep Neural