2.International Conference on
Theoretical and Applied Computer Science and Engineering
(ICTACSE, 2018)
Istanbul, Turkey, June 29-30, 2018

Improving the performance of Multi Layer Perceptron-Back-Propagation Neural Network to Diagnose Parkinson's Disease

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Abstract:

There has been active research going on in recent years to diagnose Parkinson's Disease (PD) employing features extracted from the subject's speech. Numerous machine learning approaches have been used for this purpose namely Support Vector Machines (SVM), k-nearest neighbors (k-nn) and Artificial Neural Networks (ANN) etc. Among these, ANNs are characterized by inherent parallelism, a property which enables their efficient implementation in parallel processing environments.

In this study, a type of ANN called Multi-Layer Perceptron-Backpropagation Neural Network (MLP-BPNN) is chosen for classification due to its relative ease of implementation. A previous study employed MLP-BPNN to classify PD patients but the error rates they obtained lied in the range of 40-55%. The target of this study is to improve the performance of MLP-BPNN for diagnosing Parkinson's Disease. The performance of MLP-BPNN is improved for PD detection by modifying the architecture, activation functions and training techniques. The MLP-BPNN with three layers being input, hidden and output layer. The network had twenty-six input neurons (unitary activation function) and two output neurons (softmax activation function). Whereas the number of hidden layer neurons (sigmoid activation function) was varied from 10 to 50 to find the optimized result.

A total of twelve extensively used backpropagation training algorithms were compared considering the accuracy of classification. The accuracy is highest for Bayesian Regularization (89.7%) and is followed by Levenberg-Marquardt (79.9%).

Keywords: parkinson's disease (pd), speech signals, artificial neural networks (ann), multi-layer perceptron-backpropagation neural network (mlp-bpnn)