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Feature Weighting for Parkinson's Identification using Single Hidden Layer Neural Network

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ABSTRACT The diagnosis of Parkinson has become easier with the existence of machine learning. It includes using existing features from the biometric dataset generated by the person to identify whether he has Parkinson or not. The features differ in their discrimination capability and they suffer from redundancy. Hence, researchers have recommended using feature selection for Parkinson's identification. The feature selection aims at finding the most important and relevant features to produce an efficient and effective model. In this article, we present entropy-based Parkinson classification. The goal is to select only 50% of the most relevant features for Parkinson prediction. Two variants of neural networks are used for evaluation, the first one is a feed-forward Extreme Learning Machine ELM and the second one is Fast Learning Machine FLN. Also, the K-Nearest Neighbor KNN algorithm is used for evaluation. The results show the superiority of ELM and FLN when the model of feature selection is used with an accuracy of 80% compared with only 78% when the model is not used.

KEYWORDS Parkinson; feature selection; fast learning machine; feature weighting; extreme learning machine; identification.

I. INTRODUCTION

PARKINSON is regarded as one of the major diseases that affects the population with a percentage of 2-3% for people over 65 and older [1] as it is provided by Parkinson Disease (PD) foundation, about 7-10 million people worldwide suffer from Parkinson's. The reason for Parkinson is the depletion of dopaminergic nigrostriatal neurons [2, 3]. It affects not only the articulators but also the voice and speech of the users. Some of the symptoms of Parkinson disease are tremors, gestures loss while talking or communicating, non-capability of doing fast movements, independent joint control, dragging in walking or small steps, and others. Also, it leads to effects on language, cognition, and mood. This disease is classified as neurodegenerative that is caused by a genetic mutation. Diagnosis of this disease is essential to avoid its major development. The voice signal is the most important element for doing early Parkinson diagnostic [4].

The diagnosis of Parkinson disease is becoming easier with the existence of Neural Network (NN) models that are trained on existing datasets of the disease [5-7]. The datasets can be built from various types of biometric signals recorded from the patients. Considering that voice signals play an important role in the discrimination of the diagnostic disease [8-10], it is possible to build models for training on this data and using it for prediction. The features differ in their level of discrimination and they have an issue of redundancy. Hence, selecting the most powerful features is more effective for building an accurate model and assuring more efficiency in terms of computation. The research of feature selection has been applied in many fields for the goal of identification or classification such as Intrusion Detection System (IDS) [11], ear recognition [12, 13], face recognition [14-16], and gait classification [17,18]. In the area of Parkinson disease, applying feature selection for increasing accuracy is promising.

Single Hidden Layer Feed-Forward Neural Network (SLFN) is a neural network combined with an input layer, output layer, and single hidden layer. At the output of the hidden layer, various types of activation functions can be used. This NN has two forms, namely, a simple form without connections between the input and output layers and a parallel form with connections between the input and the output layers [19]. The former is trained using Extreme Learning Machine (ELM) [20-23] and the latter is trained using Fast Learning Machine (FLN) [24, 25]. The two training approaches are more effective than the classical Back-Propagation (BP) training algorithm that uses the error gradient.