Epilepsy Detection Using Artificial Neural Network and Grasshopper Optimization Algorithm (GOA)

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Abstract — **Epilepsy affects about 1 % of the contemporary population and sternly reduces the wellbeing of its patients. It is a neurological disorder of the central nervous system that is usually characterized by sudden seizure. The possibility of detecting and predicting epileptic seizure has engrossed mankind already for over 35 years. One of the main tools in detecting and predicting the Epilepsy seizures are the Electroencephalograms (EEG), which record the brain activity by measuring the extracellular field potentials due to neuronal discharges. This EEG is quite difficult and complex to interpret even by an expert neurologist, even so, it is time-consuming, often challenging, sets in human error as well as delay in treatment. In this research, a hybrid classification model using Grasshopper Optimization Algorithm (GOA) and Artificial Neural Network (ANN) for automatic seizure detection in EEG is proposed called GOA-ANN approach. Nine parameters (mean value, variance value, Standard deviation value, energy value, entropy value and maximum value, RMS value, kurtosis and skewness) were extracted and used as the features to train the ANN classifiers. GOA was used for selecting the best features in order to obtain an effective EEG classification. In comparison with other research, the result was able to detect epilepsy and enhance the diagnosis of epilepsy with an accuracy of 98.4%. The research was also compared with Artificial Neural Network using Feed-Forward network, the result shows that GOA_ANN approach performed better.**

Keywords: Epilepsy Seizure Detection, EEG, ANN-GOA.

I. INTRODUCTION

Epilepsy affects about 1 % of the contemporary population and sternly reduces the wellbeing of its patients. It is a neurological disorder of the central nervous system. Due to its unpredictable and sudden nature, everyday activities such as driving, cooking, swimming, hiking etc. suddenly become a challenge. It has the ability to alter consciousness, behaviour, sensation, body movement and perception [1]. Hence, epilepsy patients could take precaution and extra care if seizure could be predicted a reasonable period of time before its manifestation, thereby improving patient safety and worth of life. The possibility of detecting and predicting epileptic seizure has engrossed mankind already for over 35 years. One of the main tools in detecting and predicting epilepsy seizures are the Electroencephalograms (EEG), which record the brain activity by measuring the extracellular field potentials due to neuronal discharges. Epilepsy and seizure are not the same; while epilepsy is the disease, the seizure is the neurological disorder in the brain. This seizure is often unpredictable, sudden, brief and recurrent and it depends on the part of the brain that is involved [1]. The human brain is said to have comprised of billions of neurons, which are in the form of electrical signals working in parallel to solve complications (reasoning) [1]. The occurrence of seizure is irregular, sudden and unpredictable and it spreads over all ages.

Years back, only the expert neuroscientific researchers and clinicians were able to set up records of EEG signals and then examine them under an organized laboratory condition. Electroencephalogram (EEG) is a test or tool for measuring and recording the neurological or electrical activities of the brain. This is done using a special sensor called electrodes that are placed on the scalp of a patient according to the 10-20 International system of EEG electrode positions. The EEG signals are non-linear in nature. These non-linear methods are often used to study EEG signals to provide automatic monitoring of epileptic activities in the brain. The visual inspection of electroencephalogram (EEG) signals for detection of epileptic activities is often strenuous and also time-taking due to large volumes of EEG segments that need to be studied [1, 2].

Detecting epileptic seizure through visual analysis of the EEG signals by the neurologists often takes a long time and leads to human error. Therefore, the application of the grasshopper algorithm for feature selection and ANN for epilepsy detection can significantly help in effective and efficient epilepsy detection. This will reduce false detection or missed detection. Also, less computational feature selection methods. Therefore, the need to develop a system capable of detecting epileptic seizures is much necessary. GOA was used for selecting the best features in order to obtain the EEG classification. In comparison with other research, the result was able to detect epilepsy and enhance the diagnosis of epilepsy with an accuracy of 98.4%. The research was also compared with Artificial Neural Network using Feed-Forward network, the result shows that GOA-ANN approach performed better.

The remaining sections of the article are divided into three. Section two provides a review of related baseline works, Section three shows the methods and materials selected for the developed epilepsy detection using ANN-GOA and Section

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