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# Hybrid Dragonfly Optimization-Based Artificial Neural Network for the Recognition of Epilepsy

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**ABSTRACT**

Epilepsy can well be stated as a disorder of the central nervous systems (CNS) that brought about recurring seizures owing to chronic abnormal blasts of electrical discharge on the brain. Knowing if an individual is having a seizure and diagnosing the seizure type or epilepsy syndrome could be hard. Many methods were developed to recognize this disease. But the existing techniques for detection of epilepsy are not satisfied with accuracy, and cannot identify the diseases effectively. To trounce these drawbacks, this paper proposes an approach for the recognition of Epilepsy as of the electroencephalography (EEG) signals. This is implemented as follows. Primarily, the Kalman filter (KF) is utilized for pre-processing to eradicate the impulse noise present in the EEG signals. This filtered signal is then decomposed utilizing variable modes decomposition (VMD). Feature extraction (FE) is performed by computing 7 features. The dimensionality of this signal is then lessened using Modified-Principal Components Analysis (M-PCA). Finally, classification is conducted utilizing the artificial neural networks (ANN) that is optimized using the hybrid dragonfly algorithm (HDA). Disparate performance metrics such as sensitivity, accuracy, and false discovery rates (FDR) are ascertained and as well weighted against with the existent works.



## 1. INTRODUCTION

The word "Epilepsy" is the rifest neurological disorders in human. Epilepsy is found to affect numerous patients all through the earth [1–3]. This disorder is a member of the shortcoming in the central nervous systems (CNS) which has consequences like recurring, un-provoked epileptic seizures owing to chronic abnormal blasts of electrical discharge [4].

There are circumstances when patients might not be conscious that they are a prey to seizures owing to the random nature of its occurrence. Such seizures are detected by the brain's electrical action [5–7]. The electrical action of a normal brain is much different from the electrical action of epilepsy affected persons.

It is monitored by utilizing the electroencephalography (EEG) [8–10]. It stands as a non-invasive system that gauges the voltage fluctuations resultant from the ionic current in the brain neurons. These signals can well be employed as an instrument to identify epilepsy as it brings abnormalities on the readings. Various variations on the EEG signal imply the occurrence of an abnormality in that particular individual.

The disparate stages of this disorder can as well be detected. It is employed to identify the preictal step that is the stage earlier than the actual seizure happens. This stage remains for fewer minutes to over a day. The subsequent stage is the ictal [11] stage that is when the seizure occurs. The tertiary stage is postictal stage [12–14] that is the stage subsequent to the seizure has seized. The stage betwixt the postictal and preictal stage is termed interictal stage [15]. This paper tackles an automatic and accurate methodology aimed at diagnosing epilepsy utilizing EEG signals.

The remaining section of the paper is pre-arranged as; Section 2 tackles the review of the associated works. Section 3 detailed the techniques involved in the proposed method, Section 4 gives the experimental outcomes and also Section 5 deduces the paper.

## 2. RELATED WORKS

Numerous existing works are associated to the epilepsy detection utilizing EEG signals. A few works are detailed in this section.

Alickovic *et al.* [16] suggested a prototype for the automatic seizures detection & prediction by utilizing the EEG signals. The signals as of 2 databases were processed. This model was defined utilizing four components. The preliminary component was the multi-scaled principal component analysis (PCA) for de-noising the signal. Signal decomposition (SD) was the second component. Then, the statistical traits of the relevant features were obtained and the fourth component was the employment of machines learning algorithm.

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