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Identification of seizure from single channel EEG using Support Vector Machine & Hilbert Vibration Decomposition

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Abstract— A well-known neurological brain dysfunction named epilepsy which is caused by recurrent seizures. Because of higher temporal resolution, brain activities measured by electroencephalography (EEG) are usually utilized for confinement of seizures and distinguishing proof of epileptic dysfunctions. Detection of EEG seizures by using traditional Fourier-based methods and manual interpretation is tedious and challenging because of non-linear and non-stationary dynamics of EEG. In our research, at first, we have done robust statistical analysis to detect and classify the seizure and non-seizure. But, the result was not accurate enough to detect and classify seizure effectively. For identification of ordinary and epileptic EEG measurement, we approached a novel algorithm based on Hilbert vibration decomposition (HVD). HVD accomplishes Hilbert transform demonstration of instantaneous frequency and bring out two components that have particular time-differing amplitudes and instantaneous frequencies from non-stationary signals. Least squares support vector machine (LS-SVM) is used for identifying epileptic seizures in this research. In addition, it is attracting for real-time physiological signal processing applications because of its lower mathematical complexity. The classification accuracy of 97.66% was attained on a test, which was conducted on a benchmark EEG data set. In addition, area of 0.914 under the receiver operating characteristics (ROC) curve utilizing the delta, theta & alpha rhythms.

Keywords—Electroencephalography (EEG), Epilepsy, Hilbert vibration decomposition (HVD), Least squares support vector machine (LS-SVM).

I. INTRODUCTION

A seizure is to be known as a unusual surge of electrical activity in the brain. Generally, it influences the appearance of a human or acts for a short period. Many different things can occur during a seizure. Ordinarily synapses either energize or possess other synapses from sending messages. During a seizure, there may be excessive or inadequate activity which are responsible for an imbalance between stopping and exciting activity. These chemical variations are responsible for the surges of electrical activity, which leads to seizures. Various kind of disorders which can influence the normal brain activity can be led by seizures. There are few seizures that can rarely be identified, on the other hand some of them are fully disabling. These symptoms of seizures are tragic and disturbing and as often as possible evoke dread and

misjudging. This kind of physical and mental limitation prompted significant social ramifications for sufferers and has extraordinarily added to the burden of this illness. So, seizure detection and classification methods utilizing the signal processing technique can make the diagnosis process more accurate and faster.

Long time EEG recording is needed to capture a seizure event which can be used for further diagnosis. But random signal type, involvement of multiple node and longtime of recording make it difficult to detect and classify EEG signals accurately and quickly. EEG signal vary in time and frequency domain simultaneously, so only time and only frequency domain feature is not sufficient for multi-class EEG signal classification problem. Besides, time-frequency information more precisely than conventional frequency analysis method but inherently introduces some interference which requires 14 sometime and frequency domain smoothing function to reduce these interferences. So selection of smoothing functions also affects the efficiency of the classification problem and makes the research computationally expensive [1-2]. Similarly, selection of simple feature set which can extract necessary information from the processed EEG signal is another major criterion for good and fast classification results. Since, EEG is a non-stationary signal, Hilbert Vibration Decomposition (HVD), and discrete wavelet transform (DWT) have the capability to work much better than the traditional time frequency analysis method [1-4]. However, detection and classification of multiclass EEG epilepsy originated from various regions and part of the brain in the stringent conditions is still a challenging task.

II. EPILEPSY

A. Causes of Epilepsy

Epilepsy is not infectious. The most widely recognized kind of epilepsy, which influences 6 out of 10 individuals with the disorder, is called idiopathic epilepsy and has no recognizable cause. Secondary epilepsy is the epilepsy with identifiable reason, or symptomatic epilepsy.

The causes of symptomatic epilepsy are given below:

1. Brain damage from pre-birth or perinatal wounds (for example loss of oxygen or injury during birth, low birth weight).

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Classification between normal and adventitious lung sounds using deep neural network

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