International Journal of Advanced Development in Science and Technology
IJADST Volume : 3 Issue : 03 April 2021 www.ijadst.com e-ISSN: 2582-1059

DECISION SUPPORT SYSTEM FOR DEPRESSION DETECTION IN WORKING ENVIRONMENT

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ABSTRACT

Background: Depression has become one of the leading mental illness in the present world, especially in the IT areas. Moreover, studies show that nearly 42% private sector employees in India face depression. The analysis of brain waves plays an important role in diagnosis of different brain disorders. MATLAB provides an interactive graphic user interface allowing users to flexibly and interactively process their high-density EEG dataset and other brain signal data different techniques. **Methods:** We proposed an effective electroencephalogram-based detection method for depression classification using live input of EEG signals. Here in this project the Electroencephalogram (EEG) signals are obtained from publicly available databases and are processed in MATLAB. This can be useful in classifying subjects with the disorders using classifier tools present in it. **Conclusion**: The results show that our proposed method, employing live data of which is the amplitude of EEG signal, significantly improves the accuracy of classifying depression patients.

***Keywords:* *Depression, EEG classification, Support vector machine , MATLAB*.**

1. INTRODUCTION

Electroencephalography (EEG) are electrical signals that occur in every activity of the brain. Investigation of normal and abnormal changes that take place in the human brain using EEG signals is a widely used method in recent years. The World Health Organization (WHO) states that one of the most important health problems in today's society is depressive disorders.

Nowadays, various scales are used in the diagnosis of depressive disorder in individuals. These scales are based on the declaration of the individual. In recent studies, EEG has been used as a biomarker for the diagnosis of depression. Affective computing is one of the fast-growing areas which has inspired research in the field to detect the stage of depression of the patients. This project briefs out the related work on EEG using publicly available data and a proposed method to detect

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inner state of the person. A supervised machine learning algorithm is developed to recognize.

The current methods of depression detection are human-intensive, and the results are dependent on the doctor's experience. Furthermore, depressed individuals are less likely to seek help due to fear of stigma and the nature of the disorder. As a result, a large number of depressed patients, not diagnosed accurately, do not receive optimal treatment and adequate recovery period. Therefore, finding convenient and effective methods for the detection of depression is an emerging topic for research. With the latest advances in sensor and mobile technology, the exploration using physiological data for the diagnosis of mental disorder opens a new avenue for an objective and accurate tool for depression detection. Among all kinds of physiological data, electroencephalogram (EEG) reflects emotional human brain activity in real time.

The EEG signal is a recording of the spontaneous, rhythmic, electrical activity of brain neurons from the scalp surface. Neuroscience, psychology, and cognitive science research showed that a majority of the psychological activities and cognitive behavior could be indicated by EEG. The EEG signal is closely related to the brain activities and emotional states, and it could reflect the emotional transformation in real time. The studies on EEG could be used to understand the mechanism underlying brain activity, human cognitive process, and diagnosis of brain disease, as well as the field of the Brain Computer Interface (BCI), which has attracted much attention in recent years. For this technique, the features are extracted from frequency bands (alpha, delta and theta).

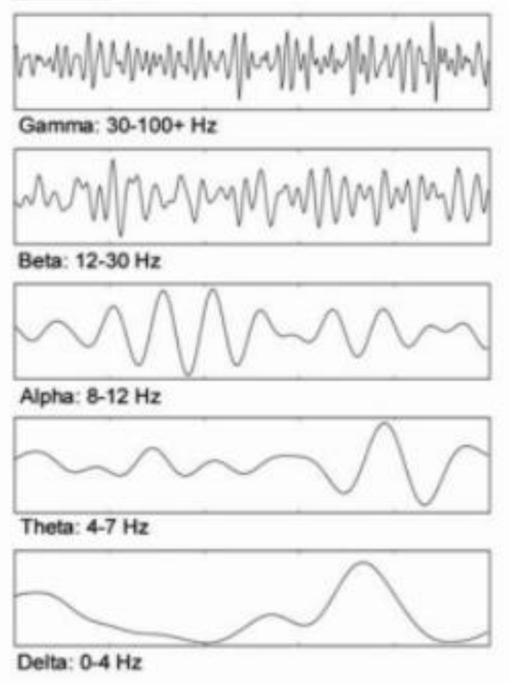

Fig 1: Comparison of EEG bands

SVM, proposed by Cortes and Vapnik in 1995, is a supervised learning model and regression method. It exhibits several unique advantages in resolving the issue of small sample data, nonlinear data, and high-dimensional pattern recognition . SVM builds a hyperplane or an infinite-dimensional space for classification and regression. The kernel function allows SVM to deal with the nonlinear classification problem by attempting to cluster a

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feature space based on the known labels, with maximum possible distance between the clusters' borders. In addition, SVM has been widely used in many fields such as text classification, image classification, biological sequence analysis, biological data mining, and handwriting

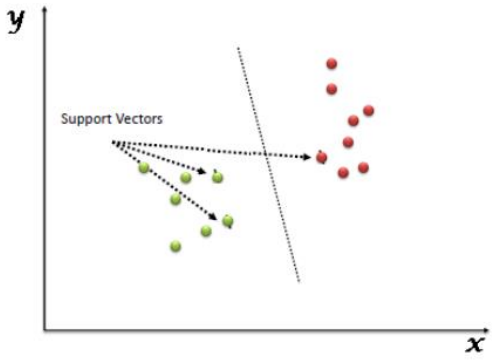

Fig 2: SVM Algorithm

Character recognition. In recent years, SVM has also been applied in the field of depression discrimination. In the present study, Gaussian Kernel functions have been implemented and evaluated in SVM classification.

2. BRAIN SIGNAL PROCESSING

Signal processing is the enabling technology for the generation, transformation, and interpretation of information. At different stages of time our brain reacts differently. These brain signals are used for various purposes so that it is possible to study the functionalities of the brain properly by generating, transforming and interpreting the collected signal. This process is known as brain signal processing.

Brain Waves and EEG The analysis of brain waves plays an important role in diagnosis of different brain disorders. Brain is made up of billions of brain cells called neurons, which use electricity to communicate with each other. The combination of millions of neurons sending signals at once produces an enormous amount of electrical activity in the brain, which can be detected using sensitive medical equipment such as an EEG which measures electrical levels over areas of the scalp. The electroencephalogram (EEG) recording is a useful tool for studying the functional state of the brain and for diagnosing certain disorders. The combination of electrical activity of the brain is commonly called a Brainwave pattern because of its wave-like nature.

3. OVERVIEW

The input EEG signals are obtained from publicly available databases. The raw data are converted into raw EEG signals, which is then used to extract EEG bands (alpha, beta, gamma, theta) from which the feature extraction is done. In this work we have chosen the Amplitude, which is the magnitude of the EEG activity which is measured in microvolts (μV). It is determined by measuring the brainwave deflection in millimeters (mm) at specified machine sensitivity after which their mean for each band is calculated, and the remaining data is written into a text file which is then analyzed to find the state of a person, since theta wave are generated during the sleep of a person it is ignored then based on the value obtained the level of depression is classified into one of the given categories. We classified level 1 as Normal, level 2 as Anxiety, level 3 as High Blood Pressure, level 4 as Cardiovascular disease.

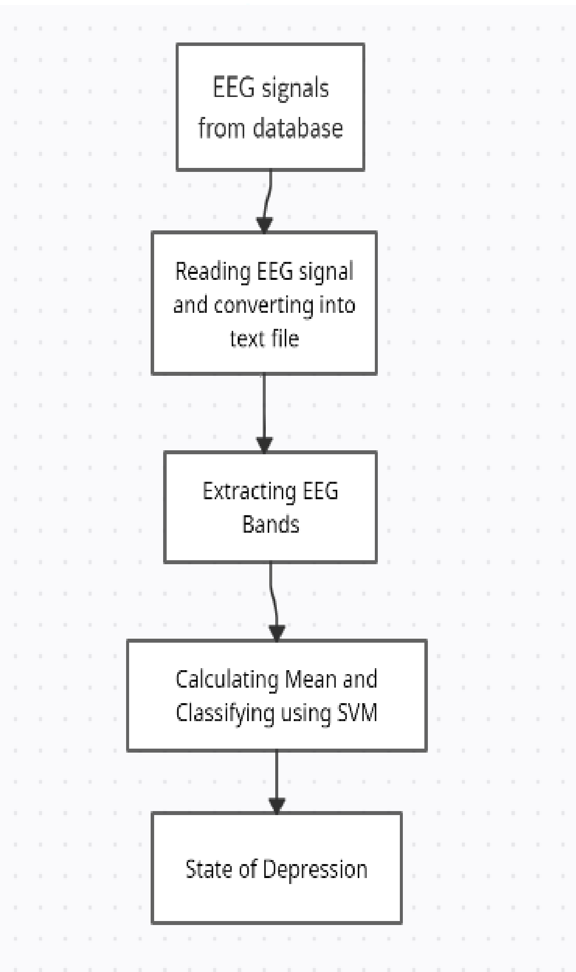

Fig 3: Block Diagram

4. IMPLEMENTATION

The first part of the code finds whether the data recorded are taken during awake state or in anesthetized state by analysing the EEG signal. Here if the person is in awake state the process continues.

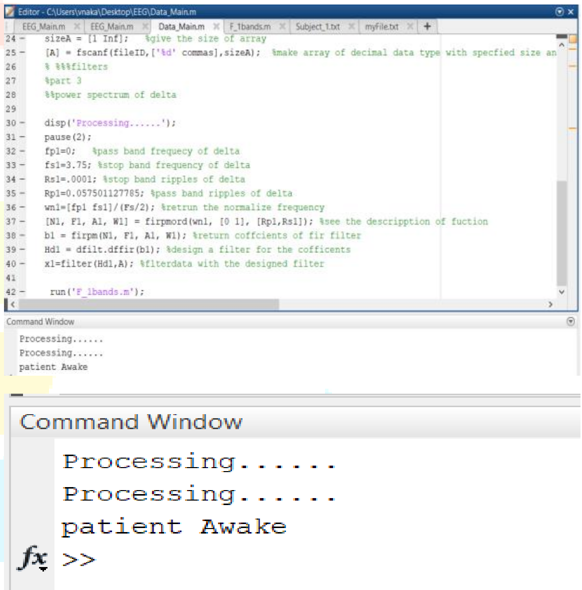

Fig 4: State of patient

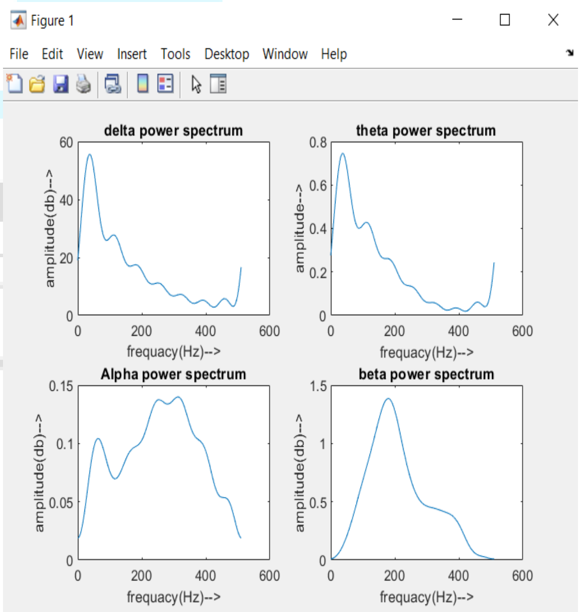

Fig 5: Extracted EEG Bands

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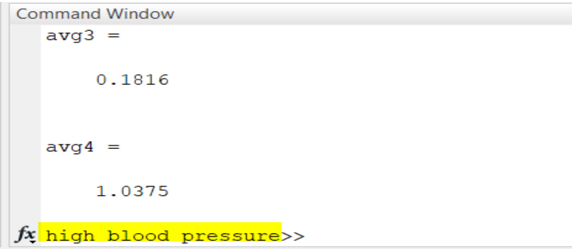

Fig 6: Level of Depression

The raw data which is given as input is converted into the raw EEG signal and then it is divided into bands of EEG signal which is then used to calculate the mean based on that the depression level of a person is classified into one of the given categories.

5. CONCLUSION WITH FUTURE WORK

During the development of the software, efforts were made to implement it in the working environment especially the IT fields where depression is one of the major concerning factors. This would allow the input of live data which is recorded at the present instead of using already obtained data. However, on attempting this, it was found that the accuracy of the software reduced when this change was made as the data is very less. However, a desire definitely exists to continue to work on this in the future, with the goal of successful automation as well as the accuracy of the software being left intact.

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