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Stress Detection Using Deep Learning with BWT and K-SVM

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ABSTRACT: The stress classification of an infected through brain area from EEG signals by the process of the extraction is a major concern and time-consuming task performed by medical specialists by experience only this accuracy depends on consequently it is essential to overcome there by Computer- Aided Technology (CAD). This paper deals with the process to increase the performance and reduce the difficulty includes in the interface method, which has considered Berkeley Wavelet Transformation (BWT) based segmentation with k-means clustering. The proposed method first employs wavelet transform to extract features from signals is followed by applying Principal Component Analysis (PCA) to reduce the dimensions of features. The reduced features were submitted to a Kernel Support Vector Machine (K-SVM). Signal-to-noise ratio is improved to eliminate the effect of unwanted noise and combined technique is used to detect and classify stress from brain EEG signals. When compared with the manual detection performed by radiologists or clinical experts, the experimental results performed on the different signals it is clear that the study of the stress detection is fast and accurate. The proposed approach shows in the experimental results it can aid in accurate and detection of the stress in exact location on time. Moreover, to increase the accuracy and quality rate, this approach extracts the statistical features using Berkeley Wavelet Transform and the result is then given to Kernel Support Vector Machine for stress classification as Benign or Malignant.

KEYWORDS: Classification, Electroencephalography (EEG), Kernel vector support vector machine, PCA.

I. INTRODUCTION

A stress is an event that causes an abrupt surge of electrical activity from our brain, where epilepsy is the disease involving recurrent unprovoked seizures. Stress may be a normal reaction the body has when changes occur. It can answer these changes physically, mentally, or emotionally. Stress is the body's reaction to any change that needs an adjustment or response. The body reacts to those changes with physical, mental, and emotional responses. Stress may be a normal part of life. You'll experience stress from your environment, your body, and your thoughts. Even positive life changes like a promotion, a mortgage, or the birth of a toddler produce stress. The physical body is meant to experience stress and react thereto. Stress is often positive, keeping us alert, motivated, and prepared to avoid the danger. Stress becomes negative when an individual faces continuous challenges without relief or relaxation between stressors. As a result, the person becomes overworked, and stressed-related tension builds. Prolonged activation of the strain response causes wear and tear on the body — both physical and emotional. Stress that continues without relief can cause a condition called distress — a negative stress reaction. Distress can disturb the body's internal balance or equilibrium, resulting in physical symptoms. That is headache, and pain, and problems sleeping. Emotional problems also can result from distress. These problems include depression, or other sorts of anxiety and worry. Research suggests that stress can also cause or worsen certain symptoms or diseases.

1.1 DEEP LEARNING

Deep learning may be a subset of machine learning in AI. It's the way the human brain filters the knowledge, this is often because the neural network can replicate the functions of the human brain. In deep learning, there's no got to program all the knowledge explicitly. Deep learning is the role of machine learning. It's supported artificial neural networks. This is often because the neural network can replicate the functions of the human brain. Deep learning is a man-made intelligence function that imitates the working of the brain in processing data and creating patterns for using deciding it also referred to as neural learning or deep neural network. It's commonly applied to analyse the visual imagery. In deep learning the machine solve complex tasks with images, sounds, texts, videos, etc.

1.2 DATA PREPROCESSING

Dementia is one of them. The people suffering from Dementia will have lapse of memory. Stress is one among the kinds of dementia. The diagnosis of the dataset into training and test set, feature scaling disease may be a time-consuming task. To scale back the time needed for diagnosis the medical practitioners use system based approach. Doing classification the information has got to be pre-processed. This is often an important step of knowledge mining process. It's transforming the data into a clear format. Data within the world is dirty. The main tasks in pre-processing are data cleaning, and data integration and data transformation. The method of dimensional reduction is the necessities of knowledge pre-processing are becoming the dataset, importing libraries, importing datasets, finding missing data, splitting.

1.3 WAVELET TRANSFORM

It is similar to Fourier transform. When the frequencies of signals vary, a mathematical calculation for analyzing the signals is called wavelet transformation. Wavelet analysis provides more accurate information about signals and images, compared to other signal analysis techniques. It provides information about signal data than other signal analysis techniques. It performs signal analysis when signal frequency varies over time. The wavelet transform is very popular when it comes to analysis and compression of signals and images. It is used perform single and multilevel Discrete Wavelet Transforms. It is most classified into the discrete wavelet transform and continuous wavelet transform. This is represented as square-inferable function.

1.4 EEG SIGNAL

The EEG (Electroencephalogram) signal is a test that detects the electrical activity in your brain using small and metal discs attached to your scalp. Many systems using electrodes, each of which is attached to an individual wire. Cells in the brain interact with each other through electrical impulses. The EEG signal is used to detect a related problem in this process. The EEG signal pathways and records the wave patterns in the brain. A new methodology for the body's autonomic system nervous features a built-in stresses response that causes physiological changes to permit the body to combat stressful situations. These responses become chronically activated during prolonged periods of stress. Prolonged activation of the strain response causes wear and tear on the body — both physical and emotional. Stress that continues without relief can cause a condition called distress diagnosis of Stress using EEG signals is proposed; thereby increasing the diagnostic accuracy of the EEG signals & diagnosis. The EEG activity is quite small, measured in microvolt's (mV). It is a studying of neuronal dynamics within the human brain. The EEG signal divided into four categories, they are Alpha, Beta, Gamma and Delta.

1.5 BWT (BERKELEY WAVELET TRANSFORMATION)

Berkeley wavelet transformation uses a two-dimensional triangular bandwidth. And regarding complete orthogonal, this is the best method to identify the affected stress area from the brain EEG. This is the Berkeley wavelet transformation method for brain division. It is used to analyse or process image or signal. And this BWT is used in some important properties. Berkeley Wavelet Transform is a two-dimensional triadic wavelet transform. BWT comprises four pairs of a mother wavelet. It shares many characteristics with receptive field of neurons. It is a complete orthonormal basis.

II. RELATED WORK

Worldwide, approximately 50 million people are affected by epilepsy [1] and this is one of the most common neurological diseases. Electroencephalography (EEG) is a recording of the electrical activity of the brain generated by cortical neurons. It is, typically, a non-invasive diagnostic method for the determination, and treatment of epileptic seizures [2]. The recording of EEG signal is useful for diagnosing epileptic stress[2], [4]–[5], EEG signal classification [7,8] for the reliable operation of brain-computer interfaces, detection and monitoring the activity of brain injury [3], classification of sleep stages [3], [5], detection of abnormal brain states [4], and detection of stress. Auto regressive moving average (ARMA) parameters along with values have been used as a 10-fold Support Vector Machine (SVM) based classifier that classifies EEG segments into preictal, interictal (stress free interval), and ictal (stress) signals. Classification accuracy has been tested on two widely used datasets to establish the robustness of the proposed methodology irrespective of the dataset. A new 3-level multi-rate filter bank structure is proposed that is based on discrete cosine transform (DCT) basis vectors for the extraction of delta, theta, alpha, beta, and gamma brain rhythms. It is known that EEG signals are random processes [4] that are non-stationary [1]. In general, EEG signals consist of an

intrinsic stimulus related response, also called as ongoing brain activity, and an extrinsic stimulus related response. The intrinsic stimuli related response has been known to be a zero mean signal [5]. EEG is one of the diagnostic methods to detect abnormalities of the brains electrical activity. Existence of epilepsy can be detected from EEG signals by calculating the spikes. Visual investigation of EEG is time-consuming and subjective task which makes error prone due to fatigue. Wavelet transform is used to analyse the non-stationary signals such as EEG. Currently, the general detection of stress activity requires manual scanning of EEG recordings, which commonly takes several days to complete [2].

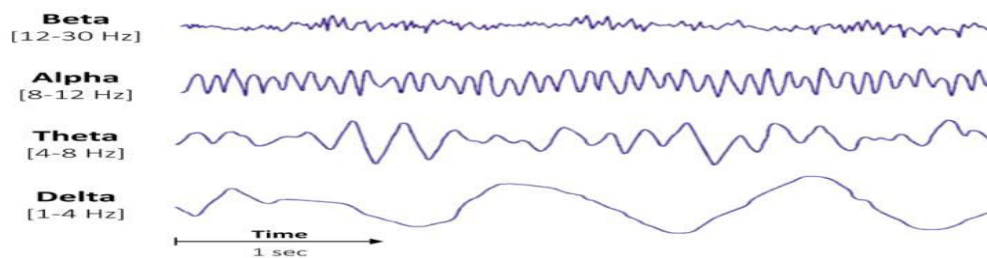


Fig. 1. Brain Wave

This epileptic activity detection method is time-consuming. As a result, it is necessary to develop robust and reliable techniques for epileptic activity detection in EEG, signals [6]. Recently, several automated methods for detecting the epileptic activity has been proposed [3,6].

Generally, physiological signals are contaminated or even distorted by the artifacts. Removing noise or artifacts (denoising) is an important step in medical signal processing and analysis. The most automated techniques for signal noise removal are based on the statistical distribution and spectrum characteristics. For discrete wavelet transform (DWT) allows the signal magnitude to be amplified as larger DWT coefficients, restricting the noise in the total time-frequency domain. In this way, the DWT coefficients of the noise are smaller than desired signals. Machine Learning is an application of AI that gives systems the power to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it. The proposed methodology has been investigated for the four well-known classification problems namely, Normal and epileptic seizure, Epileptic seizure, and seizure free, Normal, epileptic seizure, and seizure free, and Epileptic seizure and non-seizure EEG signals using publically available university of Bonn EEG database. The proposed method during this paper decomposes EEG signal into set of sub-band signals by applying Tunable-Q wavelet transform based filter-bank. In this work, we obtained ACC of 99TM% in the classification of normal, seizure-free, and seizure EEG signals using our proposed method. Stress management should start far before the strain start causing illnesses. In this paper, real-time personalized stress detection system from physiological signals is introduced. It is based on Pulse rate and temperature. That could record a person's stress levels. It proposes a wide variety of methods for stress detection, to elucidate which method is more suitable for implementation and integration in future biometric devices. In addition, methods are oriented for real-time applications, which in most cases provoke a reduction in stress detection.

III. EXISTING SYSTEM

Many studies on social media based emotion analysis are at the tweet level, using text-based linguistic feature classification. The existing system studied the emotion propagation problem in social network, and located that anger features a stronger correlation among different users than joy, indicating that negative emotions could spread more quickly and broadly within the network. As stress is usually considered as a negative emotion, this conclusion can help us in combining the social influence of users for stress detection. This existing system presents a signal modelling based new methodology of automatic stress detection in EEG, signals. The existing method consists of three stages. A multi rate filter bank structure is proposed that is constructed using the basis vectors of discrete cosine transform. The existing system filter bank decomposes EEG signals into its respective brain rhythms: delta, theta, alpha, beta, and gamma.

Traditional psychological stress detection is especially supported face-to face interviews, self-report questionnaires or wearable sensors. However, traditional methods are literally reactive, which are usually labour-consuming, time-costing and hysteric. Actually, data in social networks is typically composed of sequential and inter-connected items from diverse sources and modalities, making Traditional psychological stress detection are especially supported face-to face interviews, self-report questionnaires or wearable sensors. However, traditional methods are literally reactive, which are usually labour-consuming, time-costing and hysteric.

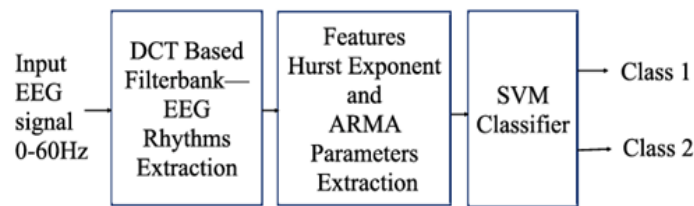


Fig. 2. Existing Architecture

Actually, data in social networks is typically composed of sequential and inter-connected items from diverse sources and modalities, making it's actually cross media data's actually cross-media data. Some user-level emotion detection studies are done, the role that social relationship plays in one’s psychological stress states, and the way we will incorporate such information into stress detection haven't been examined yet.

IV. PROPOSED SYSTEM

In Berkeley wavelet transform is used for the time-frequency analysis of EEG signal. The accuracy of stress revealing in EEG classification depending upon the feature classification, and correctly segmented out of the signals. However, the detection of current approaches is manually detected by domain experts, but this mainly relies on the limited features, which are inflexible while detecting a huge amount of EEG data and stress exaggerated patient. The Performance of the proposed system is measured using metrics like accuracy, sensitivity and specificity. A significant improvement in the metrics claims that this method will aid in diagnosing the stress rate of a person and aftermath necessary steps required to reduce the stress is of the being Kernels to classify the data. Linearly separable data is classified using a linear SVM. If the data is highly nonlinear, kernel transformation is used to transform nonlinear separable data to linearly separable in higher dimensions.

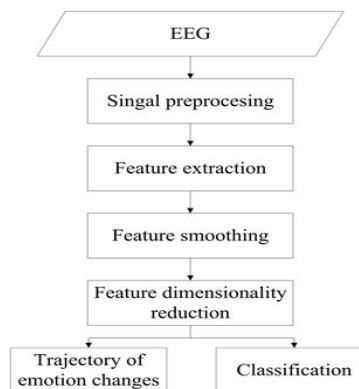


Fig. 3. Proposed System Flowchart

Removing Noisy data for providing top quality EEG signals. This indicates that the proposed attributes can function good cues in tackling the info scarcity problem. Moreover, the proposed model also can efficiently combine tweet content, and social interaction to reinforce the strain detection performance and then high rates of accurate classification and automatic classification detection of stress is done through Electroencephalography.

V. CONCLUSION

In the development of our patient specific stress detection method, the objective has been to increase both arguments and the specificity of the stress detection algorithm as well as to reduce the detection delay. We have achieved 100% correct classification with 3-6 ms delay based on the decomposition level. The proposed Berkeley Wavelet reduces the computational complexity, and the consumption. It can be concluded that the proposed. The wavelet achieves more satisfactory results and faster than other method. The classifier provides an overall accuracy of 97% in both dataset for ictal and inter-ictal EEG sets classification. EEG signal classifications on different dataset establish the proposed methodology.

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