SCENE AND OBJECT CLASSIFICATION USING BRAIN WAVES SIGNAL

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ABSTRACT
This study aims to classify the scene and object using brain waves signal. The dataset captured by the electroencephalograph (EEG) device by placing the electrodes on scalp to measure brain signals are used. Using captured EEG dataset, classifying the scene and object by decoding the changes in the EEG signals. In this study, independent component analysis, event-related potentials, and grand mean are used to analyze the signal. Machine learning algorithms such as decision tree, random forest, and support vector machine are used to classify the data. This technique is useful in forensic as well as in artificial intelligence for developing future technology.

Keywords: Support vector machine, Electroencephalograph, Independent component analysis.

INTRODUCTION
In today’s world, technology is developing very rapidly day by day; on the other side, crime also increases. To tackle this problem, Hans Berger’s invented the electroencephalograph (EEG) machine which is used to record the electrical activities happen inside brain within the scalp of the human [1]. These EEG signals are very useful in artificial intelligence, medical as well as in forensic laboratory. Scene and object classification are useful in artificial intelligence and forensic laboratory. In scene classification, I have taken the dataset of the individual on whose scalp we placed the electrode for capturing the signals, and then I show moving squares on the screen as object. The scene is accepted to the individual; seeing these objects, EEG signals are acquired and named as square as reaction of individual. This analysis is useful in many aspects such as if any person is suspect in some crime activity like murder. Then, we can tell whether the suspect knows about the crime or not by analyzing the suspect’s brain waves signals. If he/she knows or if he/she present at the moment of crime, his/her brain signals differ from normal signals [2].

METHODS
Preprocessing
The acquired EEG signal is filtered to remove linear trends using linear finite impulse response filtering. To get the desire signal, the signal is referenced from fixed or common reference to average reference. After extracting the epochs, a reference point was used to check with time. After applying the time-frequency domain method like WT feature extraction technique can be expressed as an infinite series of wavelet functions. A wavelet is a waveform of limited duration which is scaled and translated as part of derived functions through translation and dilation on shifting, compression, and stretching operations on the time axis.

Feature extraction
Fourier transform is one of the extracting methods for EEG signals [9]. EEG signal is non-stationary; the most suited feature extraction from the raw data is to apply the time-frequency domain method like WT feature extraction technique which can be expressed as an infinite series of wavelets. The original EEG signals are represented as secured and simple blocks known as wavelets. A big or mother wavelet gives rise to these wavelets as part of derived functions through translation and dilation on shifting, compression, and stretching operations on the time axis.

ICA
Due to many disturbances, unwanted signals such as movement of eyes and breathing get recorded. To improve the result, we choose to remove the “unwanted noise” from signal using ICA [10].
useful to produce good result of reduction in noisy data from EEG signals. The independent component filters are used to separate signals from multivariate signals available in the channel data.

Classification
Machine learning algorithms are used to classify the signal data and provide efficient result [7]. Decision tree (DT) is one of the supervised algorithms which is used to classify the data in a tree structure manner. Continuous signals are decided as splitting measure for the branches in DT. Similar to DT, random forest is more advance classification algorithm which generates many trees; on the basis of majority output, result will be decided. It is more precise than DT algorithm; another classification algorithm is support vector machine used to arrange the data as it is derived from statistical learning theory. It uses the hypothesis space of linear function [11]. It classifies the data using the hyperplane by finding the Euclidean distance between the vector points and hyperplane; the line which has the maximum distance from vector point is considered as hyperplane.

RESULT
This study is carried to check the object shape detection using EEG signal and filtered reference. The data divided into two parts and compared together to find the grand mean which provides more accurate data. ICA used to separate signals from multivariate signals and reduce the noisy data using the feature extraction and its algorithms. By setting event-related potentials (ERP) signals of each channel with their mean values, we can see the changes according to the object changes.

Fig. 3 shows the analysis of signals. Fig. 3 shows the ERP signal per channel and Fig. 4 shows the signal compared the mean of a particular channel. In future, we can compare other signals with unknown scene and object so that we can classify the known and unknown events.

CONCLUSION AND FUTURE WORK
This paper aims to analyze the EEG signal of an individual which has shown the known objects. First, filtered the data and then extracted the required signal using features extraction so that noisy data get removed to perform the grand mean operation on it so that we can analyze the signal. ICA is performed to separate signal from multivariate signals.

In future, we will record the two different EEG signal dataset with known and unknown scene objects and then analyze and compare the signals so that we can classify the scene and objects using brain waves signals.

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