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Tsallis Entropy And Wavelet Transform Base EEG Signal Classification.

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Abstract: This paper presents Electroencephalogram (EEG) signal comparison using entropy value and wavelet transform based classification. The signal after entropy calculated can be classify using k nearest neighbour classification. Feature vectors belonging to separate signal segments are classified using neural network in case of wavelet transform. After classification wavelet transform proves to be more accurate method for EEG signal analysis.

Keywords: EEG, Entropy, Wavelet Transform, K Nearest neighbour, Neural network.

I. INTRODUCTION

Electroencephalogram (EEG) remains the most immediate, easy and rich source of information for accepting phenomena related to brain electrical activities. [1] Important information, about the state of patient under observation, must be extracted from calculated DSD (Decimated Signal Diagonalization) bispectrum.[2] For this aim, it is useful to delineate an assessment index about the dynamic process associated with the analysed signal. This information is measure by means of entropy, since the degree of order or disorder of the recorded EEG Signal will be reflected in the obtained DSD bispectrum.[3] Tsallis entropy is better than Shannon one because it maximizes the probabilities of the events of the interest through the selection of the entropic index, and so it permits to detect in more perfect way, spikes related to epileptic seizure. Then, the signals are classified using k nearest neighbour classifier.

Segmentation, feature extraction and classification of signal components are very common problems in different engineering, economical and biomedical applications. The uses of discrete wavelet transform (DWT) both for signal pre-processing and signal segment feature extraction as an option to the commonly used Discrete Fourier Transform (DFT).[4] Feature vectors of the separate signal segments are then classify by a neural network. Then by comparing entropy value based and wavelet transform based classification, we can find out which method is more accurate for EEG signal analysis.

II. RELATED WORK

Methodology

The EEG signal can be classify using Entropy and wavelet transform. The estimate of entropy index proposes a multidimensional approach with decimated signal diagonalization (DSD). From this calculation it is possible to find appropriate signal windows for revealing predictable information as well as overcoming signal processing limitations encounter in quantitative EEG. [1]

The EEG signals of interest are first pre-process using DWT. The method of Discrete Fourier Transform (DWT) is chosen because this transform has dominance of capturing the details of non-stationary signals. The frequency and rapid changes in the biomedical signals can be trace and study effectively using DWT. So that comparing entropy values that are classified using k nearest neighbour and wavelet transform based classification using neural network. We can get more accurate method for EEG signal analysis. [5]

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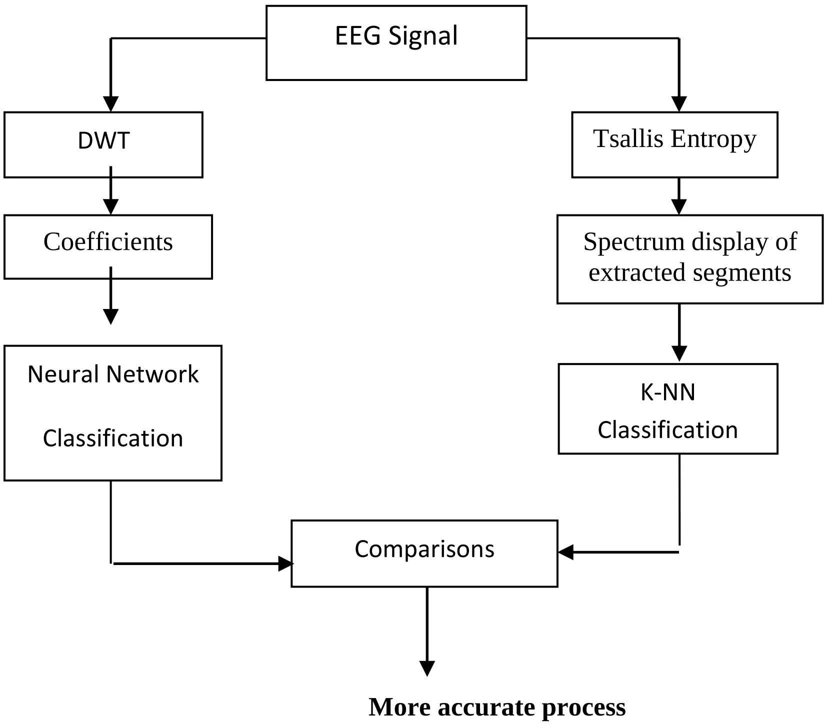

Fig: Methodology of proposed system

E. EEG Signal

Electroencephalogram (EEG) signals are brain activities recorded using electrodes that placed on the scalp. In this case, the EEG signals are obtained from the benchmark dataset.

F. Tsallis Entropy

Entropy is measure of order or disorder in a dynamical system according to information theory Tsallis entropy is better than Shannon entropy. [6]

G. Spectrum Display Of Extracted Signal

After calculating entropy values the extracted signal will be display in the form of spectrum.

H. K-NN Classification

The spikes of extracted signal can be distinguishing using K nearest neighbour classifier. The algorithm decides the points from the training set are similar enough. The class are choosing to predict for a new observation and to take the most common class among these.

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I. DWT

The use of discrete wavelet transform (DWT) for signal pre-processing as well as signal segment feature extraction as replacement to the commonly used Discrete Fourier Transform (DFT).[7]

J. Coefficients

The discrete wavelet transform (DWT) algorithm decomposes a given signal into approximation of detail coefficients to obtain a first level of decomposition. The estimated coefficients in every level are further decomposed into next level of approximation and detail coefficients.

K. Neural Network Classification

Feature vectors belongs to separate signal segments are classified by a neural network in case of wavelet transform.[8]

L. Comparisons

EEG records is presented based on the DSD method. From the obtained bispectrum it is possible to extract features very important to define the physiologically state of the patient as entropy. A measure of the distribution of the power of the signal in the bispectrum is calculated. If the signal is random, the entropy is high because the probability to have a maximum value of power is uniformly distributed on all frequencies component, while, if the signal is not very random the entropy value is low because, in bispectrum, peaks are present only at frequencies related to leading brain activity. Therefore, the use of a sliding window to select the part of EEG signal to analysis and so to apply DSD method allows detecting transient event such as spikes on the base of the entropy value calculated.

Contrary to entropy, wavelet transform provides a more flexible way of time-frequency representation of a signal by allowing the use of variable sized windows. In wavelet transform, long time windows are used to get a finer low frequency resolution and short time windows are used to get high frequency information. This makes the wavelet transform suitable for the analysis of irregular data patterns, such as impulses occurring at various time instances.

III. CONCLUSION

The purpose of this research is to find out best method for EEG signal analysis by comparing Tsallis Entropy and wavelet based classification of signal. On the basis of accuracy performance and time complexity parameters wavelet transform proves to best method.

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