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Analysis of Emotion: A Technical Approach.

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Abstract: This paper discusses the use of EEG waves to identify emotions. The approach used, the dataset used for simulation, the results obtained, as well as the limitations and future work/gaps are all summarized in this review paper. This allows future researchers to focus on the problems to be addressed and the methods to be provided, which might be entirely new or a combination of existing approaches or algorithms, as well as the dataset to be utilized.

Keywords: EEG, mRMR, IMF, KNN, Neural Network.

1. INTRODUCTION:

Emotion is prevalent in all people and combines intelligence and consciousness. Emotions are important in displaying effectiveness. As a result, the study of human emotions has expanded in fields such as computer science, neuroscience, artificial intelligence, cognitive science, and psychology. Because human emotions are linked to the brain, EGG may be used to classify them. The aggregate behavior of human emotions may be adequately described using EEG data.

Human emotion is exceedingly complicated, encompassing not only the psychological response to the external environment, but also the physiological reactions to the psychological reactions. The valence-arousal scale by James A. Russell, shown in Figure 1, is a 2D model that has been used to characterize human emotion.

The four main ideas may be split using the scale's quarters, with the remainder of the sentiments falling into one of three categories: good, poor, or neutral. The emotion characterized by the valence-arousal scale may be seen as a compass, with the horizontal (east to west) dimension representing the pleasant to unpleasant, or negative to positive. The vertical (south to north) component, on the other hand, represents sleep to alertness or low to high engagement. Based on the activation degree and pleasantness of the emotion, the emotion will be coordinated into the valence arousal scale.

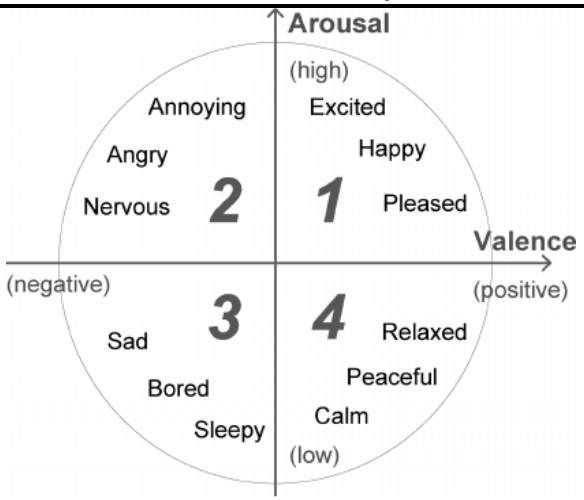

Figure 1: 2D Valance-arousal emotion space

2. LITERATURE REVIEW

Suitability in EEG-based emotion recognition. Various feature extraction algorithms have been applied, mRMR was used for feature choice and classification was done the usage of SVM and Random Forests [1]. In the research, three records are used to advocate an emotion cognizance gadget based on EMD. To decide the efficiency of the traits for emotion categorization, a thorough investigation used to be conducted. The findings demonstrate that the three characteristics are suitable for emotion recognition. The influence of every IMF element is
Sub-sequent investigated. Finally, the new strategy is tested against a number of traditional strategies & proven to be the most accurate [2]. They suggest an emotion identification device for human talent indicators based totally on EEG records in this study. They take EEG alerts that are related to emotion, split them into five frequency bands based totally on power spectrum density, then do away with low frequencies from zero to 4 Hz to dispose of EEG artefacts [3].
They advise a feature extraction approach based totally on multivariate empirical mode decomposition (MEMD) for emotion detection as high/low arousal and high/low valence states in this research. Benchmarking is performed the use of multichannel EEG recordings from the publicly handy DEAP emotional EEG data set, and the findings of past investigations are compared to the new MEMD-based technique [4].
The literature evaluation exhibits two opposing viewpoints. Using completely the EEG output, one set of researchers done negative emotion categorization accuracy. This crew believes that physiological signals such as galvanic skin resistance, heart rate, and breathing rate, among others, should be exploited to obtain excessive accuracy. Another crew believes that the EEG signal is adequate for emotion categorization, however with a lesser degree of accuracy [5]. The 3D-CNN emotion identification approach is developed in this lookup to extract spatiotemporal characteristics in order to characterize the temporal connections between EEG data. Because the 3D-CNN requires 3D inputs, a new strategy for changing multi-channel EEG facts to a 3D format has been created [6].
The frequency bands and channels employed for EEG-based emotion recognition were enhanced in this study [7]. Recognizing a person's feelings and comprehending his or her mental condition has been regarded critical. The specified future scope is boundless and has many good effects in various industries, including medical, security and surveillance, education, product marketing, and so on, with more futuristic uses on the horizon, notably in the field of security and surveillance [8].
Recognizing and comprehending a person's feelings and mental condition has been regarded critical. The future scope outlined is boundless and has several beneficial implications in a variety of industries, including medical, security and surveillance, education, product marketing, and so on, with more futuristic uses on the horizon, notably in the field of security and surveillance[9]. The emotions were classified as Low/High Arousal, Low/High Valence, and Accuracy [10]. In this work, Matlab software is used to programme and test the system. The approach does not require radiologists to identify the cancerous region of the image. Following the execution of the programme, the geometry and intensity characteristics are received as output. If the nodule's area and perimeter are both big, the nodule is confirmed to be malignant [11].

Table 1. Authors, techniques and result obtained in comparative analysis

Sr. No.	Author	Title of paper	Techniques	Conclusion
1.	Pascal Ackermann	EEG-based Automatic Emotion Recognition: Feature Extraction, Selection and Classification Methods	IMFs, mRMR,	Suitability in EEG-based emotion recognition. Various feature extraction algorithms were applied, mRMR was used for feature selection and classification was done using SVM an Random Forests.
22.	Ning Zhuang	Emotion Recognition from EEG Signals Using Multidimensional Information in EMD Domain.	empirical mode decomposition (EMD), Intrinsic Mode Functions (IMFs), fractal dimension (FD)	In this research, three statistics are used to suggest an emotion recognition system based on EMD. To determine the efficiency of the characteristics for emotion categorization, a thorough investigation was conducted. The findings demonstrate that the three characteristics are appropriate for emotion recognition. The impact of each IMF component is next investigated. Finally, the new approach is tested against various traditional methods and shown to be the most accurate.
33.	Kwang-Eun Ko	Emotion Recognition using EEG Signals with Relative Power Values and Bayesian Network.	Bayesian network, QEEG-8, FFT	They propose an emotion identification system for human brain signals based on EEG data in this study. They take EEG signals that are related to emotion, split them into five frequency bands based on power spectrum density, then remove low frequencies from 0 to 4 Hz to remove EEG artefacts.
44.	Ahmet Mert	Emotion recognition from EEG signals by using multivariate empirical mode decomposition.	multichannel IMFs, empirical mode decomposition (EMD)	They propose a feature extraction technique based on multivariate empirical mode decomposition (MEMD) for emotion detection as high/low arousal and high/low valence states in this research. Benchmarking is done using multichannel EEG recordings from the publicly available DEAP emotional EEG data set, and the findings of past investigations are compared to the new MEMD-based technique.
55.	Mandeep Singh	Emotion Recognition Using Electroencephalography (EEG): A Review	Functional Magnetic Resonance Imaging(FMRI),Positron Emission Tomography (PET)	The literature review reveals two opposing viewpoints. Using solely the EEG output, one set of researchers achieved poor emotion categorization accuracy. This group believes that physiological signals such as galvanic skin resistance, heart rate, and breathing rate, among others, should be exploited to achieve high accuracy. Another group believes that the EEG signal is sufficient for emotion categorization, but with a lesser degree of accuracy.
66.	Elham S. Salama	EEG-Based Emotion Recognition using 3D Convolutional Neural Networks	3D-CNN, Fast Fourier Transform (FFT), SLC, MLC	The 3D-CNN emotion identification technique is developed in this research to extract spatiotemporal characteristics in order to characterize the temporal connections between EEG data. Because the 3D-CNN requires 3D inputs, a new approach for converting multi-channel EEG data to a 3D format has been created.
77.	Mi Li	Emotion recognition from multichannel EEG signals using K-nearest neighbor classification.	KNN	This study improved the frequency bands and channels used for EEG-based emotion identification.
88.	Raheena Bagwan	Facial Emotion Recognition using	CNN, Image Processing, Facial Emotion	Recognizing a person's feeling and understanding his or her state of mind has been

		Convolution Neural Network	Recognition, Deep Learning	deemed crucial. The future scope described is limitless and has many positive outcomes in many industries such as medical, security and surveillance, education, product marketing, and so on, with more futuristic applications on the horizon, particularly in the realm of security and surveillance.
9.	V. Ramachandran	Facial Expression Classification System with Emotional Back Propagation Neural Network	PCA, LDA, LPP	The findings are compared to those of a standard feed forward neural network with back propagation. The new approach outperforms the existing algorithm.
110.	Nitin Kumar	Bispectral Analysis of EEG for Emotion Recognition.	bi-spectral analysis,	The emotion classification was done into Low/High Arousal and Low/High Valence and an accuracy of 64.84% and 61.17%.
111.	N. Malligeswari	A Novel Approach for Lung Pattern Analysis using Neural Networks and Fuzzy Interface System	ANN, ANFIS, MDC	Matlab software is utilized in this study to programme and test the system. The technique does not need radiologists to identify the malignant area of the picture. The geometry and intensity features are obtained as output once the programme has been executed. If the area and perimeter of the nodule are both large, the nodule is verified to be malignant.

3. CONCLUSION

As can be seen, several journal and conference studies on emotion detection using EEG data have been reviewed. In today's world, human emotion is a cutting-edge signal analysis, and determining validity is always a difficulty. The current state of the art techniques and strategies for identifying emotion using EEG waves have been investigated. Various datasets used for testing were studied, and it should be noted that the DEAP statistics set was formerly used as a popular reference by the majority of the researchers. Furthermore, the findings of categorization accuracy in terms of arousal and valence have been established for overall performance evaluation. As a consequence, future researchers will be able to employ or combine a variety of existing approaches to improve classification accuracy in the near future.

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