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HUMAN BRAIN SIGNAL BASED STRESS ANALYSIS USING ELECTROENCEPHALOGRAM SIGNALS

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ABSTRACT

Stress &Emotion plays an important role in human and human communications in our daily life. Besides logical intelligence, emotional intelligence is considered an important part of human intelligence, which represents the ability to perceive, understand, and respond to emotion. However, the existing human-computer interaction systems still lack emotional intelligence. Affective brain-computer interactions aim to narrow the communication gap between humans and machines by developing computational models of emotion& stress.

The feeling is an expression that exhaustively addresses human inclination, thought and conduct hence plays a significant job in relational human correspondence. Stress and Emotion assessment expects to consequently separate distinctive passionate states by utilizing physiological and non-physiological signs procured from humans to accomplish compelling correspondence and communication among humans and machines. Brainwaves-Based Stress and Emotion Estimation is perhaps the most widely recognized utilized and effective technique for Stress and feeling assessment research. The innovation uncovers an incredible job for human Stress and passionate problem treatment, mind PC interface for incapacities, amusement, and numerous other exploration territories. In this work, different techniques, plans, and structures are introduced for Electroencephalogram (EEG) based on human Stress and feeling assessment.

Keywords:*Brain-Computer Interface (BCI), EEG,*Stress, *Emotions, Valence, Arousal*, Stress *detection*.

I. Introduction

Stress is a piece of the standard everyday presence, and it is extensively recognized that pressure that prompts less incredible states, for instance, anxiety, dread, or on the other wrath is creating stress for people and society. The human cerebrum is a significant organ answerable for different passionate exercises which incorporate pressure. Stress can be identified utilizing a strategy like Electroencephalography (EEG), which catches the electrical sign delivered in the cerebrum. In this exploration, a human feeling investigation dependent on the benchmark DEAP dataset is performed. DEAP dataset was made by showing 40 recordings as outer boosts to 32 members. This is pre-prepared dataset were created utilizing 32 channels put on scalp and member rating were recorded. Theinternational10-20electrodeplacementsystemwasfollowedindatabasecreation. (Patil, 2016),(Science, Hosseini, Khalilzadeh, Naghibi-sistani, 2010), reported that in

psychology,basedontheresearchitwasfoundthatpositiveemotionassociatedwiththe leftbrainandnegativeemotionsassociatedwiththerightbrain.Also,thecurrentsurvey tells us that out of all 32 channels of EEG signal acquisitions only prefrontal channel1 (FP1), and channel 17(FP2) gives comparatively more information aboutstress.

Objectives

This research work pertains to the following specific research objectives:

To identify and implement the suitable EEG channels and bands for feature extraction and classification algorithms on benchmark DEAP (Dataset of Emotion Analysis for Physiological signal) dataset.

To investigate and propose novel feature extraction algorithms for human stress recognition.

To implement an automated stress recognition system using Neurosky single-channel device.

Implement the automatic notification system, if stress crosses the threshold value sends the automatic notification, so can take preventive action.

II. RELATED WORK

There is substantial research on the classification of emotions from human brain activity, in large part due to studies conducted by several researchers around the globe. Their extensive work has discovered the ways of EEG signal processing using different feature extraction and classification techniques. The majority of published works include a plethora of machine learning algorithms directed toward analyzing speech signals, face images, and EEG signals. While these previous studies offer valuable insight into marking the predominant factors governing human stress, it presents only partial solutions to the contemporary human stress framework. This chapter highlights the preeminent contribution of researchers in the modern era from the perspective of the Electroencephalography signal processing tool as well as illuminating the associated methodologies.

Figure1 demonstrates the number of reactions from every nation. In every one of the countrywide stress by the individuals. These outcomes show that controlling for socioeconomics, saw employment conditions, and employment disappointment doesn't clarify the majority of the variety between nations in saw danger of word related stress. Figure1 demonstrates the evaluated quantity of stress side effects for every relapse model among nations and the position of every country on these assessments. From the viewpoint of the Indian mainland, a critical extent of the working individuals is tormented with various types of stress.

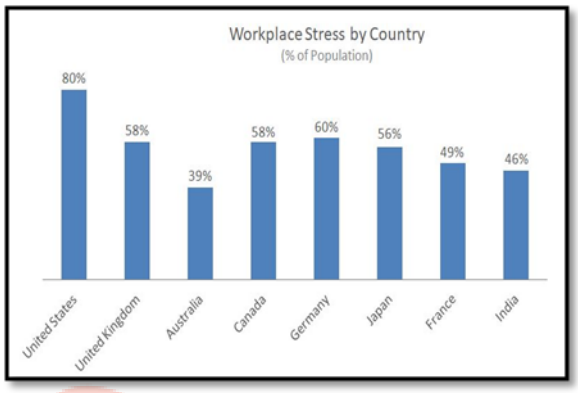

Figure 01: Motivational Graph for Approach Selection

Several intriguing and worrisome factors emerge from this study, which shows almost 80% of people suffering from stress related to work. Almost 60% of the workers abandon due to job-relevant stress. More than 90% of employees exercise their option of enrollment to corporate stress management programs.

In general, the objective of using EEG methodology is to employ a single-channel stress detection mechanism to lead the successful formulation of an efficient approach. Traditional stress detection methodologies result in inconsistent outcomes obtained at a high cost of constituent devices. EEG methodology incorporates an automated system to identify the human emotional pattern. Some of the significant research that happened in the last two decades towards stress identification and its methods are outlined in the following sections.

Swati Mishra1 et al. (2015) a survey on facial expression recognition techniques: These human facial expressions pass on a ton of data outwardly as opposed to articulately. Outward appearance acknowledgment assumes an urgent job in the region of human-machine association. Acceptance of facial expressions by PC with a high acknowledgment rate is as yet a challenging errand. The facial expressions Recognition is

usually performed in three phases comprising of face location, highlight extraction, and demeanor grouping. This work introduces a study of the present work done in the field of facial expressions acknowledgment strategies with different face detection, feature extraction, and classification methods used by them and their performance.

C. Lin et al. (2018) examined the work stress of individual respondents based on the keystrokes on the keyboard. They ascertained the presence of distinct genuine ailments plaguing the subjects over a short-term and long-term period. A few methodologies with various techniques have been recorded in writing for distinguishing pressure. N. Sulaiman et al. (2011) and C. Viegas et al. (2018) observed the facial expressions to detect stress, and J. Zhang et al. (2017) investigated the presence of stress levels using a temperature of the finger, human gestures, and eye blink as the primary modalities.

Hyeon-Jung Leeet al. (2017): has investigated on emotion recognition technique and its application utilizing face image. In this Work, they present seven emotions and positive and negative feelings acknowledgment techniques using facial pictures and the advancement of applications dependent on the strategy.

In the past investigations, they used deep-learning development to create models with emotion-based facial appearances to saw emotion. There are existing applications that express six emotions, anyway not seven feelings and positive and negatives in graphs and rates. we saw seven feelings, for example, Angry, Disgust, Fear, Happy, Sad, Surprise, and Neutral what's more assembled the chose feelings affirmation scores into positive, negative, and unbiased feelings. At that point, we finished an application that gives the patient seven feelings scored with positive and negative feelings.

Fatemeh Noroozi et al. (2018) overview on emotional body gesture recognition: Automatic emotions acknowledgment has turned into a slanting exploration theme in the previous decade. While works reliant on facial appearances or discourse proliferate, perceiving influence from body signals stays a less investigated point. It presents another complete overview wanting to lift a look into the field. It initially performs enthusiastic body motions as a part of what is ordinarily known as "non-verbal communication" and remarks general perspectives as sexual orientation contrasts and culture reliance. It presents individual identification and remarks static and dynamic body present estimation strategies both in RGB and 3D. In this remark, the ongoing writing identified with portrayal taking in and emotions acknowledgment from pictures of sincerely expressive motions. They examine multi-modular methodologies that consolidate discourse or face with body motions for improved emotional acknowledgment. While pre-handling approach (for example human discovery and posture estimation) are these days adult innovations entirely created for compelling huge scale examination, we demonstrate that for feeling acknowledgment the amount of named information is rare, there is no concurrence on unmistakably described yield spaces, and the depictions are shallow and generally dependent on naive geometrical representations.

As observed from the last two decades of an extensive study spearheaded by Uwe G et al. (2003), Jin Z et al. (2005), Parham G et al. (2006), Bong et al. (2007), Shin-ichi I et al. (2010), Reza K et al. (2010), diverse feature extraction procedures have been employed for the examination of EEG signal, like Adaptive Auto-Regressive parameters (AAR), Fast Fourier Transformations (FFT), PCA, ICA, Genetic Algorithms (GA), Wavelet Transformations (WT), and Wavelet Packet Decomposition (WPD). Patil, Panat, and Ragade (2015)enumerated FFT, ICA, AR, WT, WPD, PCA as other predominant utilization methods in the resurgent sector of emotion detection. S. Koldijk et al. (2016), B. S. Zheng et al. (2013) employed the above methods for the feature extraction process before the data is fed to the respective classifier. Khalid et al. (2014) exemplify the advantage of Feature extraction processing developing the classification accuracy as well as in simplifying the classification activity.

Table 2.1: Survey on Feature extraction methods for identifying influential features

Author	Techniques/ Method	Observations	Identified Issues
Swati N. Moon et al. (2015)	Genetic Algorithm (GA)	Showcased GA as an optimization tool applicable to the large data set. These features are then given to the Neural network classifier.	Working on dynamic data sets is difficult.
M R Lakshmi et al. (2014)	Independent Component Analysis (ICA)	It is an efficient methodology with high performance on the broad decomposed data	More computations are encompassed in decomposing signals.
T. V. Prasad et al. (2014)	Wavelet Transform (WT)	Able to assess signals both in time and frequency domains. Can take out energy, distance, or clusters.	Heisenberg Uncertainty limits performance.
V. Chandra Prakash et al, (2014)	Autoregression (AR)	With the shorter duration of data records, spectral loss problems are eliminated, and better frequency resolution is produced.	It encounters a challenge while establishing the model properties for EEG signals. Ineligible for non-stationary signal attaining classification accuracy of 83%.
Lakshmi et al. (2014)	Principal Component Analysis (PCA)	An efficient tool for evaluating and dropping the dimensionality of data without loss of crucial information.	Based on the hypothesis of linearity and continuity of data, it turns out to be quite complicated to process data.
Ales Prochazkaet al. (2010)	Discrete wavelet transform (DWT) and Discrete Fourier Transform (DFT).	Signal de-noising, evaluation of the principal components and segmentation is derived from DWT and DFT.	Stationary signals and linear random processes can only be processed with emerging large noise sensitivity.
Wu Ting et al. (2007)	Wavelet Packet Decomposition (WPD)	Empowered to analyze non-stationary signals with Experimental result denoting that WPD is superior to the AR model.	Enlarged computation time.

III. Research Gaps

Lack of a simple and cost-effective system for stress detection using a single-channel device.

Keeping the above issue as motivation, it is decided to design a real-time human stress recognition framework for brain signals using suitable feature extraction and classification techniques to improve accuracy.

Hence there is a lot of scope for developing efficient feature extraction techniques involving robust EEG single preparing and significant emotion investigation to give a solid decision about human stress recognition. The framework focused on finding appropriate feature extraction and classification technique for emotion detection. The system included two new feature extraction techniques which give comparatively better performance than the existing one.

4.METHODOLOGY

In this work, we mainly explore the theoretical basis, implementation methods, and experimental validation.

The contributions and achievements of the current work can be summarized in the following items:

We are attempting to research the stable neural examples after some time for pressure and feeling acknowledgment from EEG. The exploratory outcomes uncovered those neural marks for three feelings (glad, pitiful, and unbiased) do exist and that EEG designs at basic recurrence groups and cerebrum districts are generally steady inside and between meetings.

5. Conclusion

In rundown, the principle research design is to sort out the most reasonable and compelling structure to make the EEG-based Stress and feeling acknowledgment frameworks with unequivocal execution, and afterward, a definitive objective is to assemble the applications dependent on the frameworks to take care of the viable issues. Among all the Stress and feeling acknowledgment plans, EEG-based is one of the hardest to accomplish yet with the potential to acquire the critical accomplishment which gives it high exploration esteem.

In the future, we are trying to implement the particle approach to get maximum accuracy with an automatic stress detection system.

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