Stress Management Based On EEG Data: AReview

Srishti Gupta[1], Bipan Kaushal[2]
[1]*M.TECH Scholar, ECE Department, Punjab Engineering College (Deemed to be University), Chandigarh, India*
[2]*Assistant Professor, ECE Department, Punjab Engineering College (Deemed to be University), Chandigarh, India*

***Abstract*—** Stress is progressively inescapable and a basic explanation behind causing 60% of every single human illness and different maladies. Because of the sporadic developing pace of way of life, push has turned out to be one of the real reasons causing medical problems. In this way, it is important that individuals ought to know about the psychological feeling of anxiety, before it prompts some genuine medical problems. As indicated by past methodologies a pressure assessment technique that utilizes a novel grouping methodology to suit the individual contrasts. Research in territory of stress identification has created numerous systems for observing the human cerebrum that can be utilized to contemplate the human conduct and it will be useful to the general population about their conduct examples to very exercises which trigger high anxiety and nerves.

Keywords—EEG, Stress, Frequency, Classification, Subjects.

I. INTRODUCTION

Stress is a noteworthy issue of our circumstances and influences both physical and also the emotional wellness of individuals. Stress identification is a progressing research point among the two therapists and specialists. Different advancements are produced on human pressure identification utilizing wearable sensors and bio flag preparing. Stress can be distinguish from human bio-flags, for example, Electroencephalography (EEG), Electromyography (EMG), Electrocardiography (ECG), Galvanic Skin Response (GSR), Blood Volume Pulses (BVP), Blood Pressure (BP), Skin Temperature (ST) and Respiration. Additionally human physiological highlights are utilized to calculate the feeling of anxiety utilizing physiological signs. There is distinction between people when he/she reaction to pressure i.e. how a man's physiological element changes because of upsetting occasions. By considering different physiological highlights happen in electrical movement of the mind along the scalp. EEG measures voltage vacillations coming about because of ionic current inside the neurons of the cerebrum (Dr B.F.Momin et al, 2016)[1]. EEG is frequently used to analyze epilepsy, which causes variations from the norm in EEG readings. It is additionally used to analyze rest issue, trance like state, encephalopathy, and mind demise. EEG used to be a first line strategy for conclusion for tumors, stroke and other central mind issue. EEG is utilized as a part of more places since equipment cost of EEG is essentially lower than different systems. Additionally EEG has high transient determination, on the request of milliseconds instead of seconds. Contrast with different strategies, EEG is best since EEG can be recorded close to the patient's informal lodging long haul checking of rest stages or epilepsy[2]. EEG is a helpful device for psycho physiological research when the subject needs to play out some behavioral undertakings or is out of lab. EEG can track mind changes amid various periods of existence without exasperating a patient for e.g. EEG rest investigation and EEG stretch discovery system.

II. ELECTROENCEPHALOGRAPHY (EEG)

EEG is a standout amongst the most solid sources to record electrical action of the cerebrum along the scalp. To gauge the voltage variance coming about because of ionic current inside the neurons of the cerebrum EEG is utilized[3-4]. To analyze the epilepsy, extreme lethargies, rest issue, encephalopathy and cerebrum demise EEG is frequently utilized. Complexities which require mining are:-

- The complex nature of the wave forms - EEG typically is not just one simple rhythm but a whole set of oscillations mixed together.

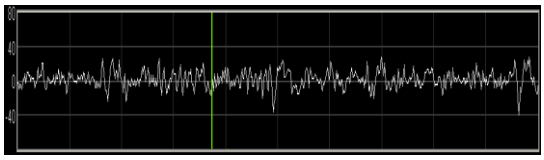

Figure 1: The raw EEG is a voltage with varying in a complex way.

- The EEG differs over the scalp. An EEG appraisal looks at changed parts of the mind (e.g. left to right, front to back) an in reality this is probably the most helpful data. There are computational measures in the EEG (e.g. intelligibility) that show how all around associated diverse cerebrum locales are, the way well they are imparting. The most developed EEG evaluations apparatuses record from several focuses on the scalp on the double.

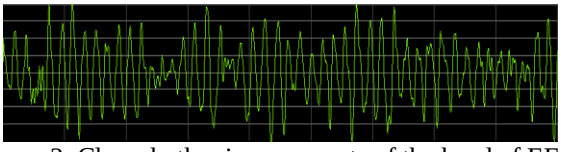

Figure 2: Clear rhythm in some parts of the head of EEG.

While the physiological starting point of the EEG is very surely knew, relating EEG data's to abnormal state cerebrum capacities, for example, consideration, inspiration and feelings is a long way from straight-forward. The examples beneath are general inclinations, not idiot proof measures. It's anything but difficult to over-translate the EEG. In some ways translating EEG resembles breaking down a motor by tuning in to the sounds it produces.

A mood can be portrayed as far as (I) recurrence - what number of cycles every second and (ii) adequacy - size of the voltage or tallness of the waveform[6-9]. In the second realistic above you can see that the recurrence, or the relative dividing of the pinnacles, is moderately steady, while the abundance varies.EEG recurrence differs between around 1 and 40 Hertz or cycles for every second. Different bands within this range have been given names, for example 8 to 12 Hz is alpha - the above rhythm is an example of alpha. Others are delta, theta, beta and gamma.

A complex EEG can be considered as a mix of different component frequencies - so much alpha, and so much beta, etc, varying over time.

Computers can analyze EEG into these component frequencies, in different ways. The result is often called a frequency spectrum, or spectral analysis. An example is shown below. One thing to bear in mind is that the calculation is always based on a window of time - it might be three seconds or three minutes or three hours. Obviously 3 secs is a snap shot of brain function, while 3 hours and even 3 mins is a more averaged picture (which for the most part is more useful)[11].

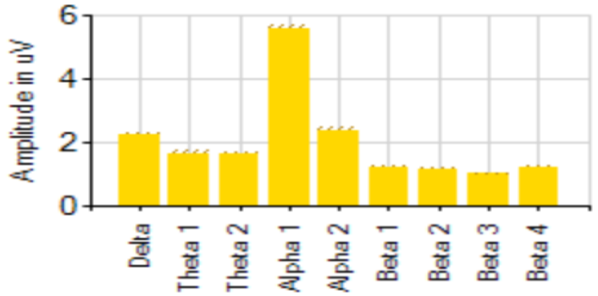

Figure 3: Output Image of Bilateral Filter.

In the above realistic you can see that the "alpha 1" recurrence part is high - meaning the cerebrum is creating an alpha cadence.

III. MIND WAVES AND MENTAL STATES

To a degree, the EEG recurrence parts or cerebrum waves relate to the mind working in certain routes, or at the end of the day they (freely) correspond to perspectives.

IV. MAJOR FREQUENCY BANDS

Delta - 1-4 Hz

- Delta is most ordinarily found in profound rest, and furthermore in specific sorts of cerebrum harm. It appears that segments of the cortex produce delta when they are disconnected, or detached from whatever remains of the mind.[18] All things considered, there's constantly some delta in the EEG.
- It's fascinating to take note of that delta tends to increment when you hold a cell phone to your set out toward a few minutes.

Theta - 5-8 Hz

- Theta is related with a fantasy like, instinctive or innovative style of cerebrum preparing. theta all the more conspicuously in the back of the head as person float towards rest (the hypnagogic state).
- There's additionally something many refer to as "frontal midline theta" which is extraordinary. It's connected to memory preparing.

Alpha - 8-12 Hz

- The cerebrum creates alpha when it's "prepared and pausing" - it's a sort of sitting mood. Alpha is related with loose sharpness. It's seen all the more unmistakably in the back of the head, particularly when the eyes are shut (when the visual handling zones at the back of the head don't have anything to do).
- In truth alpha can bounce up by as much as at least 300% just by shutting your eyes. Do you truly feel so extraordinary when you close your eyes? This is an update not to over-translate the EEG. So, a few people don't demonstrate this change, and they have a tendency to have certain issues (more on this underneath).

Beta - 13-30 Hz

- The mind indicates dominatingly more beta when it's occupied with subjective handling (in wide terms, "considering" - yet engaged, not wandering off in fantasy land). At such circumstances the cerebrum stifles the lower frequencies (delta, theta, alpha).

Gamma - 30+ Hz

- Gamma is at times known as quick beta. Maybe the thing that gamma is most well known for, is that brains appear to show synchronized gamma over the entire scalp, in a condition of clear extreme mindfulness.

V. CLASSIFICATION

The achievement of execution and advancement of the exploration anticipated that would help in decreasing time expended and human power in deciding best proposal and answer for stress management. There are following classification schemes for EEG according to previous approaches are -

A. Discriminant analysis with a diagonal quadratic function (DADF)

Numerous specialists have called attention to that for high dimensional information with little example sizes, the gullible Bayes classifier, at times known as DADF and

Diagonal Quadratic Discriminant Analysis (DQDA), has equivalent or preferable execution over SVM.

The main purpose of discriminant analysis is to assign an unknown subject to one of K classes on the basis of a multivariate observation $\boldsymbol{x} = (x_1, \ldots, x_p)^T$, where p is the number of features. For simplicity of notation, the class labels y_i are defined to be integers ranging from 1 to K. We assume that there are n_k observations in class k with

$$x_{k,1,\ldots,}x_{k,n_k} \sim N_P(\mu_k, \sum k), \text{ k=1,……,K} \qquad (1)$$

Where μ_k and Σ k are the corresponding mean vector and covariance matrix of the p-dimensional multivariate normal distribution. The total number of observations is $n = n_1 + \cdots + n_k$.[13-14].

B. k-nearest neighbor classification (knn)

Each trial was classified by knn classification with Euclidean distance metric. We applied the knn-classifier twice, with k=1 and with k=3. These two esteems were picked in light of the fact that with k=1 we delivered the exceptional instance of the closest neighbor calculation and with k=3 we picked an odd number, which stays away from tied votes in twofold characterization issues and this incentive for k is still little so the limits between classes can be very unmistakable.

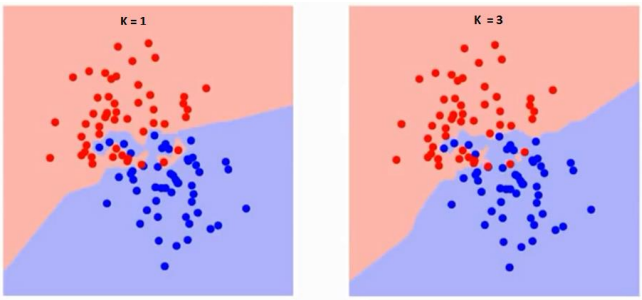

Figure 4: Different boundaries separating the two classes with different values of K.

C. Support vector machine classifier (SVM)

A SVM groups information by finding the best hyperplane that isolates all information purposes of one class from those of alternate class. The best hyperplane for a SVM implies the one with the biggest edge between the two classes. Edge implies the maximal width of the section parallel to the hyperplane that has no inside information focuses[20].

D. K-implies grouping

K-implies bunching is a kind of unsupervised realizing, which is utilized when there is unlabeled information (that is, information without characterized classifications or gatherings). The objective of this classification is to discover bunches in the information, with the quantity of gatherings spoke to by the variable K. The calculation works iteratively to allot every datum point to one of K bunches in light of the highlights that are given. Information focuses are grouped in view of highlight closeness.

VI. RELATED WORK

Bert Arnrich achieves greatest exactness of 82.8% for separating worry from intellectual load. This would permit monitoring upsetting stages amid a working day by utilizing a wearable EDA gadget. Liza et al recognized after a careful writing audit in significant databases (MEDLINE, Scopus, Science Direct), the accompanying strategies are displayed and quickly talked about like: dynamic muscle unwinding, autogenic preparing, unwinding reaction, biofeedback, passionate opportunity strategy, guided symbolism, diaphragmatic breathing, supernatural reflection, psychological behavioral treatment, care based pressure lessening and enthusiastic flexibility procedure[10].

Sasikumar Gurumurthy et al broke down that cerebrum waves assume a critical part in conclusion of various mind issue as per figure.5[9].

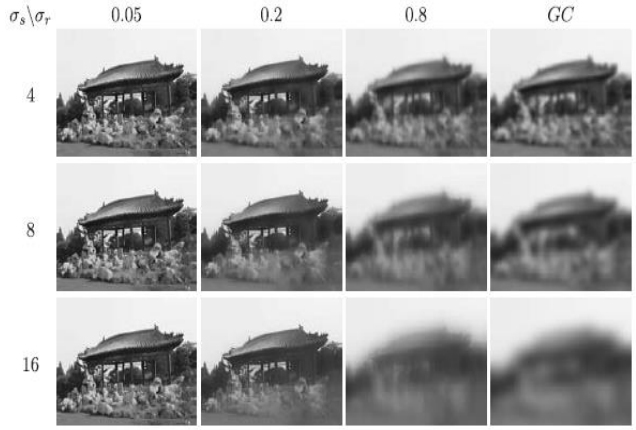

Figure 5: Framework engineering outline.

Gerhard Troster et al exhibited that how mental workload levels in regular day to day existence situations can be separated with information from a versatile ECG lumberjack by joining singular adjustment measures. They likewise exhibit a test configuration to actuate three unique levels of mental workload in adjustment sessions and to screen mental workload levels in regular day to day existence situations of seven sound male subjects[4]. Wai Chong et al demonstrated three example order calculations' – Artificial Neural Network (ANN), k-Nearest Neighbor (KNN) and Linear Discriminant Analysis (LDA). These algorithms were trained utilizing the come about 2% DCT coefficients. As per found the utilization of DCT alongside KNN offers most astounding normal characterization rate of 72% contrasted with ANN and LDA[3].

Tin Lay, a quantitative estimation of stress is created by investigating the physiological highlights in two stages as shown in fig.6) a k - implies bunching procedure to partition subjects into various classes (groups),

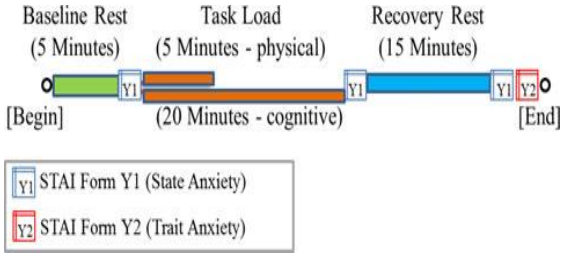

Figure 6: Test system of Cluster-Based Analysis of Data

Cluster-wise pressure assessment utilizing the general relapse neural system[12].

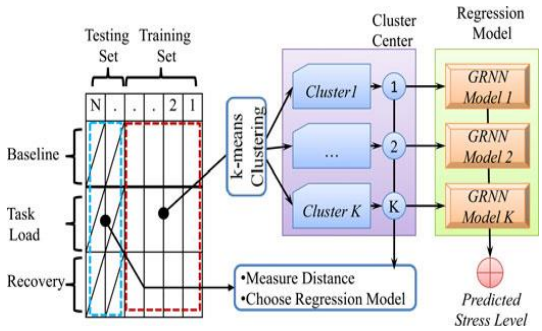

Figure 7: Standard of group based examination.

Dr. B.F. Momin proposes a novel strategy that recognizes the pressure utilizing EEG flags and decreases the worry by bringing the mediations into the framework. By using the k-mean grouping technique by eq(2), to quantify the apparent pressure which separate the subjects into various classifications and gauge the feeling of anxiety. His strategy is valuable in creating items for human stress reduction drafted as figure.7[18].

$$s_{ij} = \frac{S_{ij} - \min(S)}{\max(S) - \min(S)} \quad (2)$$

Where s_{ij} normalized stress indices of subject i.

S_{ij} Is, Average value of subject i.

$min(S)$ Is smallest value of the subject.

$max(S)$ Is largest value of the subject.

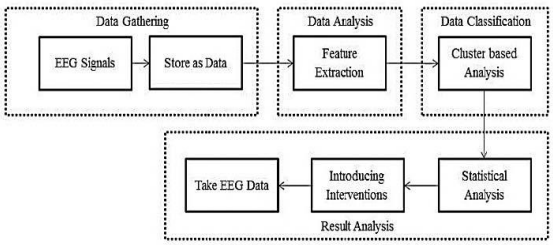

Figure 8: Engineering of k-implies bunching technique.

The studied survey of utilizing EEG for stress management depicts boom for clinical intercession and counteractive action of physical and emotional wellness issues[17].

VII. CONCLUSION

Above made survey of different literatures and studied different techniques for establishing stress. For analyzing the human stress level there are different techniques are used. In the various researches, it uses data pre-processing technique and proper classification technique to identify stress level in human. But there are fewer researches which provide the stress reduction technique. However, system can be propose which is helpful for analyze the stress level effectively and provide techniques for reducing stress among individuals for improving their performance.

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