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# Psychological Stress Analysis based on Machine Learning Network stream Usage

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**Abstract**
Psychological stress is threatening people's health. It is non-trivial to detect stress timely for proactive care. With the popularity of social media, people are used to share their daily activities and interact with friends on social media platforms, making it feasible to leverage online social network data for stress detection. We find that users stress state is closely related to that of his/her friends in social media, and we employ a large-scale dataset from real-world social platforms to systematically study the correlation of users' stress states and social interactions. We first define a set of stress-related textual, visual, and social attributes from various aspects, and then proposed a plot .Experimental results show that the proposed model can improve the detection performance .With the help of enumeration for the users to identify their stress rate level and can check other related activities.
**Keywords:** Stress detection, Keywords – Stress, Facial Expression, Deep Learning, Framework.

## I. Introduction

Mental illness and stress are not a local problem, it can be considered a global public health problem. The World Health Organization (WHO) has formed strategies and has developed documents to decrease mental problems worldwide. However, depending on where individuals live, the exposure to risk factors is different. Therefore, in the perspective of public health, to monitor indicators is important to reduce ill-health. Consequently, if indicators and risk factors are monitored, it is possible to solve and prevent instead of managing problems afterwards, thus, social cost is decreased. According to previous research, the use of social media was associated with stress. Social media usage has increased, and new behavioural patterns have been formed. In terms of public health, social media is not of interest unless the well-being of individuals is affected. Harmful usage of social media can be prevented, since it is a habit. Therefore, investigations in this subject are valuable in order to increase knowledge about hazardous habits that can potentially be prevented.

## II. Related Work

Andrey Bogomolov, Bruno Lepri [1] has demonstrated that stress influences the personal satisfaction and it might cause numerous maladies. Because of this reason, different scientists presented stress detection frameworks dependent on physiological parameters. In any case, for such frameworks it requires sensors which should have been completed by the client. Assist the framework depicts an elective methodology with every day stress acknowledgment from cell phone information, climate conditions and individual qualities. It very well may be dependably perceived dependent on behavioral measurements, got from the client's activities on mobiles and social media, for example, the climate conditions (information relating to short lived properties of the earth) and the attributes of individual (information concerning changeless miens of people). The framework depicts Multifactorial measurable model, or, in other words, gets the precision score of 72.28% for a 2-class day by day stress acknowledgment issue. The model is productive to actualize for the majority of interactive media applications due to profoundly decreased lowdimensional include space. Additionally, the framework distinguishes and talks about the markers which have solid prescient power. Glen Coppersmith, Craig Harman, and Mark Dredze [2] exhibited a novel strategy to acquire a PTSD classifier for social media utilizing straightforward hunts of accessible Twitter information, a critical decrease in preparing information cost contrasted with past work. This technique exhibit its utility by analyzing contrasts in dialect use among PTSD and arbitrary people, building classifiers to isolate these two gatherings and by identifying hoisted rates of PTSD at and around U.S. army installations utilizing our classifiers. Fan, Jichang Zhao, Yan Chen, and KeXu [3] have depicted that, Weibo a Twitterlike benefit, has pulled in excess of 500 million clients in under five years in China. With the assistance of online social sites the diverse clients may have comparative full of feeling states. The relationship of outrage among clients is fundamentally higher than that of delight can be recognized effectively. While the relationship of trouble is shockingly low. In addition, there is a more grounded estimation connection between's a couple of clients on the off chance that they share more collaborations. What's more, clients with bigger number of companions have more noteworthy estimation relationship with their

neighborhoods. The discoveries could give bits of knowledge to demonstrating notion impact and proliferation in online social networks. Golnoosh Farnadi, Geetha Sitaraman, [4] have proposed a similar examination of best in class computational personality acknowledgment strategies on an alternate arrangement of social media information from Facebook, Twitter and YouTube. The contrasts among univariate and multivariate models were not critical however. In general the best performing models for this assignment are the multi-target stacking rectified (MTSC) demonstrate and the group of regressor chains revised (ERCC) display by utilizing a choice tree as a 0base student used distinctive content-based highlights (e.g., phonetic highlights, for example, LIWC) and setting based highlights (e.g., sound and video highlights removed from video blog recordings) in each dataset, and gathered the regular connected highlights with characteristics among three datasets. From 166 normal highlights for five qualities, just 15 regular connections were found. These outcomes recommended that it may not be conceivable to sum up the relationship among's highlights and the personality qualities, as it might fluctuate contingent upon the hidden information. What's more, directed six cross-media learning tests in which Expanding a model with preparing precedents from another source has not enhanced the execution of the student.

## III. Different Stress Detection Methods

These days, Psychological Stress is turning into a risk to individual's wellbeing. It is of critical significance to recognize and oversee the stress before it transforms into serious issues. Figure 1 illustrates four methods for psychological Stress Detection.

Major physiological activities are controlled by Autonomic Nervous System (ANS) that includes the circulatory strain, organ emission, heart's electrical movement, and breath. The ANS has two divisions, the sympathetic nervous system (SNS) and the parasympathetic sensory system (PNS). Under unpleasant conditions, SNS is in charge of preparing the body's assets for activity. As opposed to SNS, the PNS is in charge of unwinding the body and balances out the body into unfaltering state [5, 6].

The Sympathetic Nervous System (SNS) incites the stress response in human being [5], carrying psychological, physiological and behavioral symptoms [6]. All through this paper, the accompanying definitions are considered for these gatherings of reactions. *Psychological* is comprehended as "of or identifying with the brain or mental action" [7] and they don't include the execution of an activity. *Physiological* reactions are a piece of the ordinary working of a living creature or substantial part [8], subsequently, they are non-deliberate activities or reactions, and hard or difficult to see by outer perception. *Behavioral* is interpreted as "the way of acting" [9], which are, dissimilar to physiological reactions, they include an activity that could be controlled or changed moderately and can be remotely watched. Social Interaction is defined as "a dynamic procedure of exchanging succession of acts between people or gatherings"[8]. *Social Media Interaction* is comprehended as "an online podium which individuals use to build social relations with other individuals who share similar personal or career interests, activities, backgrounds or real-life connections"[10].

**Psychological Evaluation**

Psychological responses comprises of strong increase in the negative emotions, such as rage, nervousness, Annoyanceor melancholy [10].The assessment of stress can be carried out by means of self-report questionnaire or by being interviewed by a psychologist. The first is a widely used ways amongst the most generally utilized approaches

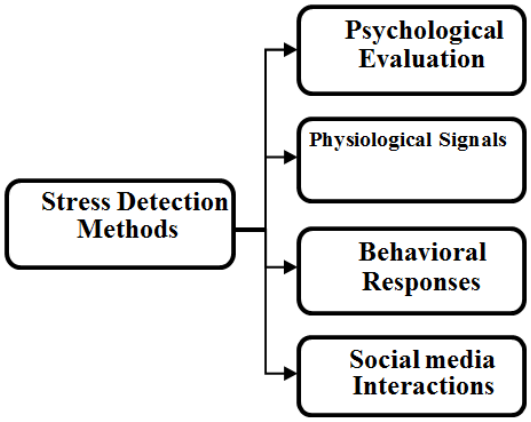


**Fig. 1: Taxonomy of Stress Detection Methods** to gauge feelings of anxiety in people and it is viewed as a reliable strategy. The Stress Self Rating Scale (SSRS), the Perceived Stress Scale (PSS) or the Stress Response

Inventory (SRI) [6, 7] are some instances. However, these questionnaires just offer data about current anxiety or stress levels of the client and not about the stressors nor about the development of the feelings of stress. These tests can be taken time to time, however may not be realistic for identifying the delicate changes which could indicate an early stage of a major issue. All things considered, they are just taken when the affected himself or the individuals around him understand or suspect about the seriousness of the circumstance, and this is too late in majority of the cases. Moreover, questionnaires are subjective and require the complete attention of the client. "Individuals can undergo lapses in memory about the emotional tone of a day in as little as 24 h" [3], which implies that we are not generally aware of our genuine stress levels and that techniques, such as, self-report questionnaire could sometimes lead to an erroneous stress level estimation.

**Physiological Signals**

Physiological sensors can offer data regarding the intensity and quality of a person's internal affect experience [6]. Stress also presents itself via biomarkers, it can be measured objectively and observed using wearable physiological sensors. When there is an increase in SNS activity, it changes the hormonal levels of the body and incites responses like secretion production, amplified heart rate and muscle activity because of which skin temperature drops and the Heart Rate Variability (HRV) falls [2, 3]. These changes act as cue and provide data through wearable sensors for stress detection .The physiological measures of stress and their equivalent technologies can be categorized as follows:

- Heart activity:"electrocardiography (ECG)".
- Brain activity: "electroencephalography (EEG), Functional Magnetic Resonance Imaging (fMRI)".
- Skin response:"electrodermalactivity (EDA) and galvanic skin response (GSR)".
- Muscle activity: "electromyography (EMG)".
- Respiratory response: "electromagneticgeneration".
- Pupil Diameter (PD), eye gaze and blinking: "infrared eye tracking systems".

The most prevalent techniques i.e., electrocardiogram and Electrodermal Activity are examined more closely in the following sub-section.

*Electrocardiogram (ECG)*

The electrocardiogram (ECG or EKG) is "the recording on the body surface of the electrical activity produced by heart" [5, 6]. It is a standout amongst the most utilized measure in stress detection research because it reflects specifically the action of the heart, which is obviously influenced by ANS changes [8]. An ECG can be effortlessly estimated setting a few electrodes on particular spots of the body and estimating the potential contrast. The quantity of electrodes and their positions can differ, however a standout amongst the most straightforward and compelling ways is the Lead-II design, which comprises of putting three terminals: one on the right arm, one on the left arm and the last one on the left leg. The most classic and valuable features processed with an ECG are likely the ones identified with the Heart Rate Variability (HRV).

Many stress researches have utilized ECG sensors effectively. An illustration could be crafted by Cinaz et al. [9], who considered a 3 class characterization issue to isolate office laborers' psychological workload into low, medium and high gatherings utilizing just an ECG signal and nine HRV features (eight time area features and the LF/HF proportion), accomplishing right predictions for 6 out of 7 subjects utilizing Linear Discriminant Analysis (LDA) [10] classification. ECG has been contemplated for extracting features like the mean, standard deviation, power and vitality of the preprocessed crude information, however it is more commonly used to extract data about Heart Rate (HR) and Heart Rate Variability (HRV). HR is considered as the quantity of heartbeats every moment. HRV is the temporal difference between successions of sequential heart beats [5, 36], is likely the most regularly utilized feature in stress recognition. Nonetheless, the developed framework requires an offline study to be completed by a professional. Nonetheless, the created framework required an offline study to be completed by a professional.

*Electrodermal Activity (EDA)*

The Electrodermal Activity (EDA), otherwise called Galvanic Skin Response (GSR), is defined as variation in the electrical properties of the skin [5]. Under emotional stimulation, lengthened mental workload or physical activity, the level of sweat production increases changing the skin properties, i.e. increasing conductance and diminishing resistance. EDA can be estimated placing two anodes on the skin surface near to each other and passing a weak current between them. EDA is a standout amongst other sensors in stress and emotion detection [2, 1]. De Santos Sierra et al. made individual stress formats for 80 people utilizing EDA and HR signals and a fuzzy logic algorithm. Exactness of 99.5% was accomplished for a two class classification issue, proposing that the two signals have the potential for identifying stress levels precisely.

ECG and EDA are the commonly utilized biomarkers for stress recognition. A few different less common markers can likewise be utilized to detect stress such as, Electromyogram[29],Electroencephalogram

(EEG)[1], accelerometer [4], Skin temperature [8], Blood Pressure [3].It is likewise regular to utilize a mix of different biomarkers but at the same time is costly. Helawaret al.
utilized GSR and BP markers [8] for identifying stress.

As it has been found in this section, there are numerous physiological signals that have been utilized as a part of stress identification and some of them have appeared to give solid data about people's real-time stress levels. Sadly, the downside of the majority of them is that additional hardware is essential for the estimations, turning into anobtrusive technique for real-life. Regardless of some researches [6] focused on making wearable physiological estimating frameworks to make them more straightforward, the user is compelled to wear continuously those equipment's, which remains being inconspicuous and even not affordable for a few individuals.

**Behavioral Responses**

Behavior is interpreted as, how an individual or a group act in a given circumstance in light of set up protocols, standards of behavior or acknowledged social practices [2]. Stress influences in people's behavior. A portion of the prompted changes are well-known, for instance, being substantially more aggressive or irritated, however these are not quantifiable effortlessly. Other plausible behavioral changes can be examined by investigating individuals' interaction with gadgets keeping in mind the end goal to confirm their association with stress and to make a dependable method to gauge it. The benefit of estimating behavioral responses in contrast with physiological estimations, they can usually be done in an absolutely unpretentious manner without the requirement of costly additional hardware. The Behavioral measures of stress and their equivalent technologies can be categorized as follows:  Speech analysis: "Voice Stress Analysis".

- Mobile phone usage: "Information related to users".
- Facial expression: "automated facial expression analysis (AFEA)".
- Body gesture: "automated gesture analysis (leveraging AFEA)".
- Typing rhythm: "Keystroke and mouse dynamics".

The most prevalent techniques i.e., speech analysis and mobile phone usage are examined more closely in the following sub-section.

*Speech analysis*

The fact that stress changes human vocal production is agreed by many researchers [6]. More appropriately, it has been discovered that under stressful circumstances, changes in pitch and in the speaking rate are natural, together with variation in energy and spectral qualities of the glottal heartbeat [5]. Speech analysis has caused curiosity primarily in light of the fact that it can be effortlessly estimated in an inconspicuous manner. Nevertheless, voice-based stress examination can be inadequate both in calm and noisy spaces [4], because of the absence of speech recordings and presence of too much noise. The greater part of the investigation done in stress detection from voice, has been conducted in research laboratories or in calm surroundings, however there exists exceptions and downsides.

*Mobile phone usage*

Nowadays, a gigantic measure of data identified with clients' behavior can be extricated from Smartphones. Call logs, SMS, messages, web perusing, application's utilization, area information and numerous other learning can be effectively gotten without the client notwithstanding seeing it. As of late, explore on stress location has assessed the likelihood of exploiting this inconspicuous data gathering strategy[8].

Muaremi et al. [6] utilized iOS Smartphone information gathered amid the day and HRV information enlisted when resting, to characterize individuals in low, medium and high business related pressure gatherings. Highlight choice methods were utilized to bring about a seven highlights' gathering where 4 had a place with HRV and 3 to Smartphone information, proposing that HRV highlights were more imperative than the extricated Smartphone includes for this situation. The best outcomes were accomplished in the client particular model case, with an exactness of 55% with just Smartphone information, 59% with just HRV information and 61% with the mix of both. This arrangement comes about likewise demonstrate that the chose HRV highlights were superior to the Smartphone highlights chose for the expressed grouping problem. Mobile telephone utilization highlights. The quantity of calls (nCalls), the total of all call term (tCalls), mean, fluctuation and middle of call length, and the proportion amongst approaching and active calls have been acquired from cell phones [6].

Behavioral estimations for stress acknowledgment are considerably less continuous than the physiological ones in the cutting edge. They have not presumably been sufficiently still contemplated, and along these lines, stress recognition results are not as precise as with physiological methods. All things considered, some of them look exceptionally encouraging, on one hand on account of their outcomes and on another, in light of the fact that they don't require any additional hardware.

**Social media Interactions**

Online networking has turned into a famous stage for individuals to convey what needs be. These days, with the quick improvement of informal communication locales, individuals are all the more eager to utilize online networking as a stage to express their inclinations and everyday life occasions. Individuals post content and pictures via web-based networking media stages to share musings, express feelings, record every day propensities and interconnect with companions. We can acquire etymological and visual substance that may demonstrate pressure related side effects. Encoding passionate data in content is a typical practice particularly in online connections. This makes the recognition of clients' mental worry through their tweets, posting conduct and social cooperation from small scale blog or online networking plausible [4, 5].

Stress recognition in text is concerned about utilizing natural language processing (NLP) strategies to perceive stress communicated in composed text message. The need is to comprehend the different feelings responsible for the stimulation of stress. As Stress is a feeling of emotional or physical strain. It can originate from any occasion or thought that makes one feel a wide range of emotions, for example, nervousness, fear, outrage, dissatisfaction, pity and misery. Feeling Theories discussion of what feelings can be distinguished in text, and how they are estimated should first begin with an investigation of the hypothetical perspectives on feeling drawn from the psychology writings.

The Darwinian Perspective characterizes feeling as being "articulations". more conspicuously his viewpoint emphasizes that there is a reliable arrangement of examples related with the expression of every one of a kind feeling (Cornelius, 1996).This infers that there is an arrangement of universal emotional articulation that people would show and could recognize regardless of culture and language [7]. Plutchik's model is an extension of Ekman's essential feelings through the expansion of trust and anticipation in his eight fundamental feelings, while Izard's ten fundamental feelings likewise incorporate guilt and shame.

The Darwinian point of view has contributed an arrangement of fundamental feeling lables to illuminate investigation on emotion detection in text, in this way making automatic detection of the fundamental emotions in text conceivable. ***Cross Media Data***

*Linguistics*

The way an individual composes his writing can vary depending upon his stress levels. On one hand, some pressure can upgrade the composition capacities of a man, improving works of value, utilizing a more differing vocabulary and so on. On the other hand, mood can be

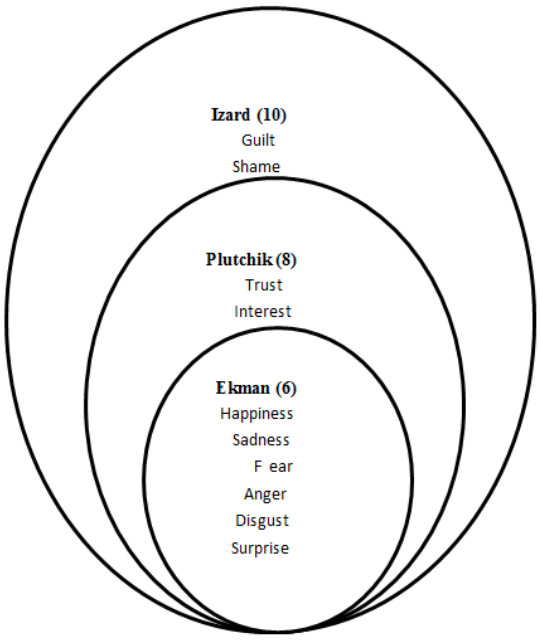


**Fig. 2 Ekman, Plutchik, and Izard's basic emotions** explicitly reflected in the content being composed particularly, in free messages. Along these lines, breaking down text linguistics can be an additional incentive for a stress recognition framework.

As of now, there exist many instruments that permit to automatically analysis features of text, for instance, LIWC, SentiStrength, which can be utilized for estimating writing execution in clients by means of lexical measures, or straightforwardly examining the "emotions" of the content, which is their primary reason. Researcher used this technology to analyze online posts and detect user stress levels from them.

*Linguistics + Visual*

A study says the way that an individual's compose give windows into their enthusiastic world [7]. As mention above, the way an individual composes his writing can reveal his stress levels. Incorporating visual content with textual message can increase the accuracy of stress detection model. Visual feature includes Saturation, Brightness, Warm or cool color, Clear or dull color. Low brightness and saturation makes individuals feel negative and vice versa.

Social Commitment gives the numbers of @-mentions, reposts, and replies in postings, representing individual's communal activeness with contacts. Collaborating Linguistic, visual and social attribute H. Lin, et al [4] propose an automatic method for stress detection from cross-media data. These attributes are fed into Deep Sparse Neural Network which is proposed to learn the stress categories. Testing results show that the method is effective.

But linguistic and visual attribute termed as low level attribute reflects the instant emotion expressed in a single post, which is inefficient in detecting psychological stress states are usually more changing over different time periods.

***Social Behavior***

*Posting Behavior*

H. Lin, et al defines a set of posting behavior measures, based on the weekly tweet postings such as posting time and posting types. Posting time is average number of tweets posted in a day and posting type gives the category of the post taking a sample period of a week. Author categorizes posts of users into four types: a) Post containing images b) original post c) query posts d) Info sharing post. H. Lin, et al proposes a convolution neural network (CNN) combine with deep neural network (DNN) model which incorporates posting behavior attributes with linguistic and visual attributes to detect stress. Exploratory results show that the proposed method is effective and efficient on detecting psychological stress from micro-blog data. Though its results are effective, the role that social associations' plays in individual's stress.

## IV. Proposed Method

We proposed a hybrid model which combines the factor graph model (FGM) with a convolution neural network (CNN). In this work, we also discovered several intriguing phenomena of stress. We found that the number of social structures of sparse connection (i.e. with no delta connections) of stressed users is around 14% higher than that of non-stressed users, indicating that the social structure of stressed users' friends tend to be less connected and less complicated than that of non-stressed users. These phenomena could be useful references for future related studies.

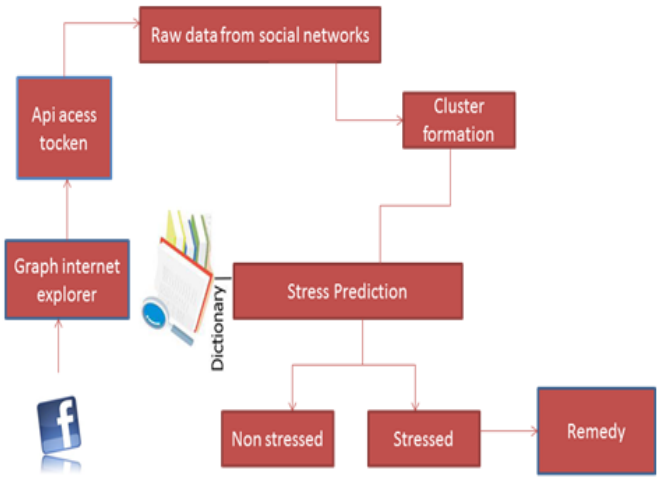


**Fig 3. Proposed Architecture diagram**

## V. Conclusion

In this system, we displayed a system for distinguishing users,, psychological stretch states from clients' week after week online networking information, utilizing tweets' substance and additionally clients' social associations. Utilizing true online networking information as the premise, we contemplated the connection between client mental anxiety states and their social communication practices. To completely use both substance and social communication data of clients' tweets, we proposed a half and half model which joins the factor diagram display (FGM) with a convolution neural system (CNN).

**Future Enhancement**

We can make use of image for their detection of stress as it is posted by a user. Using these images we have to calculate the user Stress level.

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