

RECOGNIZING STRESS IN SOCIAL NETWORKS

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ABSTRACT:

Psychological Stress and Depression are considered repeatedly as important problems to the weakening of physical and mental state. Stress is taken into account because the biggest threat to individual's welfare. However stress is a positive side in our everyday life, however an excessive amount of stress will somewhat be harmful to physical and emotional physiological state wherever as managing it, is a major concern for populations around the world. Hence, there's great importance to observe stress in its early stages, before it turns into severe downside. Thus, this work analyses and brings along recent analysis studies carried for automatic stress detection perceptible over the scale dead on the four main modalities, viz., Psychological, behavioral and Social Media Interaction modalities, in conjunction with acceptable measurements, so as to allow hints concerning the foremost acceptable ways in which and it suggests that to be used for Psychological Stress Detection

I. INTRODUCTION

Psychological stress refers to the psychological awareness of affliction and the body's response to it. Hans Selye was the first person to give definition of Psychological Stress and credited as being father of stress who defined stress in the year 1936 as "the non-specific response of the body to any demand for change"[1]. In 1979 he further expanded his definition stating, "Stress is a 'perception', it is the demands that are imposed upon us because there are too many alternatives". Further, stress exists in two forms namely Acute stress and Chronic Stress Acute stress is short-lived stress exists for time being for which human body designed to recover from it. It's an instant reaction of body to new challenge or demand that activates instantly like a fight-or-flight response. This can be seen from instances such as fight with closed relation, an accident or anxiety when meeting new people. Such stress is said to be episodic type if it happens frequently. Chronic stress is one, when acute stress isn't resolved and begins to increase continuously and persist for long-term. It is considered as negative. Instances of such stressful circumstances are difficulties in interpersonal relationships, bad job, abuse and poverty. The Chronic stress leads to numerous serious health problems such as heart disease, cancer, mental problems and suicide [3].

Stress and Depression have been pinpointed again and again as significant issues contributing to weakening of mental health and class of life. However, stress can be a positive aspect for motivation and achievements. At times, too much stress can be rather harmful to physical and mental health conditions. Such as depressions, insomnia and even suicide accordingly as per statistical reports of World Health Organization (WHO) over 4.5% of India's population suffer from depression as of 2015. Whereas the corporate sector in India has reported an ascending increase of stress over the last two years. Similarly, a survey by workplace solutions provider Regus in 2015 also reported 57% of corporate India is under stress. Thus, the increase of stress has become an adverse affect on human health as per survey. Concern of health is essential for growth, development and productivity of society and is vital for a happy and healthy life in the world. Thus, there is a significant necessity to predict stress in its early stages, before it turns into severe problem. There have been many techniques developed to detect stress with the aid of data collected using physiological sensors or face-to-face interviews conducted by psychologists, which usually relies on the active individual participation hence it becomes non-trivial to detect stress timely for proactive care. With the rapid development of social networking sites (SNS), it has become a popular platform for people to express themselves. Nowadays, people are more willing to use social media as a platform to express their moods and daily life events. A Facebook's statistical report from Global social media research of 2017 shows that most popular social networks with total 1,871 million active users worldwide whereas Twitter is the fastest growing social networks with total of 317 million active users [2]. People post text, emoticons and images on social media platforms to share thoughts, express emotions, record daily habits and interconnect with friends. The observation shows that microblogs of linguistic text and visual content indicates stress related symptoms are used in social media to express their thoughts. Encoding of emotional information in text is common practice especially in online interactions.

This makes the detection of user's psychological stress through their tweets, posting behavior and social interaction from microblog or social media feasible. As studies suggest that the way of a person's write-up give windows into their emotional world [2], without nonverbal signs, writers become accustomed to the medium by permeating messages with emotion prompts e.g., emotion words or emojis to will allow for more natural or improved Communication (Walther, Loh, and Granka, 2005). This paper

surveyed that brings together the recent research carried for automatic stress detection strategies and suggests the better strategy to improve detection of stress. The rest of paper is organized as follows: The Section II elaborates the various techniques used for stress detection. In section III, discusses the comparison among different methods. The Section IV summarizes various techniques used for detecting stress and then suggests the better strategy to improve stress detection from social media.

II. RELATED WORK

Research into micro-blog contents mainly focuses on short text mining, topic detection, and sentiment analysis. Among them, sentiment analysis, a.k.a. opinion mining, is the most related work of this study. Previous work on sentiment analysis take blogs, reviews, and tweets as research objects, aiming to extract people's opinions towards some subjects or products. Usually, people's opinions are classified into two polarities: positive and negative, and sometimes including neutral, while peoples' emotions are classified into six categories, i.e., joy, fear, sadness, surprise, anger, and disgust. Techniques of natural language processing and machine learning are popularly used in sentiment analysis employed the lexicon-based strategy to obtain the overall polarity of a document by computing the number of positive words and negative words in blogs or reviews also developed a syntactic parser and sentiment lexicon to discover the semantic relationship between target and expression detected the sentiment orientations to products according to the natural language expression conventions. [4] Collected 40 emoticon classes found in Yahoo! blog articles, and utilized sentences containing these emoticons to automatically detect user's emotions from messenger logs. To overcome the limitation that the performance of natural language processing techniques in sentiment analysis relies on the domain of corpus, and thus cannot easily be extended to other application fields, the performance of three machine learning methods over movie reviews, including Naive Bayes, Maximum Entropy, and Support Vector Machines. Their experimental result showed that the performance of SVM classifier with unigram presence features is superior to others improved the precision of sentiment analysis based on unsupervised learning by analyzing features of textual contents and iteration mechanisms effective techniques of feature selection and feature combination utilized both text features and text theme such as description, comment, background, etc. in sentiment analysis. Multi-classifier fusion techniques were employed improve the performance of sentiment classification estimated the emotional tendency of a document by combining the prior lexicon-based emotional tendency and the posterior training-based emotional tendency. Most of sentiment analysis on micro-blog also makes use of [3] used emoticons as labels to reduce dependency in machine learning techniques for sentiment classification. Twitter hashtags and smileys to enhance sentiment learning. [6] Improved target-dependent Twitter sentiment classification by taking target-dependent features as well as related tweets into consideration. [7] Built a graph model for sentiment classification at the hash tag level in Twitter, where three approximate classification algorithms were investigated. [8] Presented a two staged SVM classifier for robust sentiment detection from biased and noisy data on Twitter. In terms of application areas, most research in sentiment analysis aims at offering techniques to business domains by detecting users' opinions towards a product or proposal sampled and analyzed users' reviews to specific brands of products on micro-blog, and extracted users' emotion polarities using an automatic classification method. [9] Predicted the direction of stock markets by analyzing the micro-blog data. [5], [2] provided a lexicon-based natural language processing method to investigate the debate performance of candidates in the 2008 US president election. To our knowledge, this paper is the first to detect and analyze adolescents' psychological pressures from micro-blog, aiming to combine traditional adolescent mental education with micro blog media and turn micro-blog into a new kind of adolescent mental education mode and platform.

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 unflinching 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].

1. Psychological Evaluation

Psychological responses comprises of strong increase in the negative emotions, such as rage, nervousness, Annoyance or melancholy [11].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

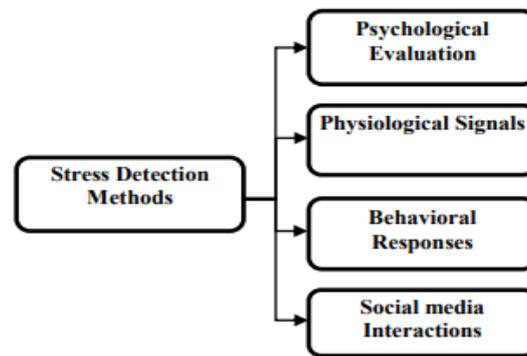


Fig. 1: Taxonomy of Stress Detection Methods

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)[16, 17] 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" [30], 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.

2. Physiological Signals

Physiological sensors can offer data regarding the intensity and quality of a person's internal affect experience [36]. 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 [12, 36]. 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: "electro dermal activity (EDA) and galvanic skin response (GSR)".
- Muscle activity: "electromyography (EMG)".
- Respiratory response: "electromagnetic generation".
- Pupil Diameter (PD), eye gaze and blinking: "infrared eye tracking systems".

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

1.1. Electrocardiogram(ECG)

The electrocardiogram (ECG or EKG) is "the recording on the body surface of the electrical activity produced by heart" [5, 6, 21, and 22]. 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 [18]. 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. [19], 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 Discriminate Analysis (LDA) [20] classification. ECG has been contemplated for extracting features like the mean, standard deviation, power and vitality of the pre-processed 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.

1.2. *Electro dermalActivity (EDA)*

The Electro dermal 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 [5, 18, 20]. 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 [19]. De Santos Sierra et al. [20] 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 [19], Electroencephalogram (EEG)[13], accelerometer [4], Skin temperature [18], Blood Pressure [10]. 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 [18] 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 [16] 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.

3. *Behavioural Responses*

Behaviour is interpreted as, how an individual or a group act in a given circumstance in light of set up protocols, standards of behaviour or acknowledged social practices [12]. Stress influences in people's behaviour. 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 behavioural 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 behavioural responses in contrast with physiological estimations, they can usually be done in an absolutely unpretentious manner without the requirement of costly additional hardware. The Behavioural 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.

3.1. *Speech analysis*

The fact that stress changes human vocal production is agreed by many researchers [6, 14]. 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 [15]. 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 [14], 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.

3.2. *Mobile phone usage*

Nowadays, a gigantic measure of data identified with clients' behaviour can be extricated from Smart phones. 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 [18]. Muaremi et al. [26] 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 they 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 [16]. Behavioural 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.

4. 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 [14, 15].

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 [17]. Advocates of the Darwinian camp, including Ekman (1971), Izard (1971) and Plutchik (1984), have based on Darwin's hypothesis of feeling by postulating a set of universal emotions, also known as basic or prototypical emotions, and Characterizing the examples related with this arrangement of feelings. Figure 2, demonstrates the degree of overlap between what (Ekman et al., 1987), (Izard, 1971, 1994) and (Plutchik, 1962) consider to be "fundamental" feelings. Ekman's six fundamental feelings are happiness, surprise, sadness, fear, disgust, and anger. 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 labels to illuminate investigation on emotion detection in text, in this way making automatic detection of the fundamental emotions in text conceivable.

IV. COMPARISON OF DIFFERENT METHODS

There are numerous physiological signs that have been utilized as a part of stress identification and some of them have appeared to give solid data about people real time stress levels. Sadly, the downside of the majority of them is that additional hardware is essential for the estimations, turning into a prominent technique for the genuine living. Regardless of some researches [26] focused on making wearable physiological assessing frameworks to make them more straightforward, the client is compelled to wear constantly those equipment's, which remains being inconspicuous and even not affordable for a few people. Behavioural 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. H. Lin, et al [14], 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. H. Lin, et al [15], its results are effective, but the role that social associations' plays in individual's stress states and how it can be incorporated into psychological stress detection have not been examined yet. Table 1 shows a summary of overall literature.

V. CONCLUSION

In this paper, we have presented various measures and techniques used to detect psychological stress which is an increasing problem in the world, in this day and age of job issues, including lots of assignments and necessity of adjustment to constant changes, complicates this issue. Therefore, it is essential to monitor and control individual's stress levels constantly in order to detect stress in its primary phase and avoid the harmful long-standing consequences. Most of Psychological evaluations of stress are based on subjective Questionnaires that need individual's response which may not be accurately used for real time analysis. Numerous physiological signs that have been utilized as a part of stress identification and some of them have appeared to give solid data about people real time stress levels. But, the drawback is, it requires additional hardware for estimating the stress which are costly and labour consuming [5, 20]. The above disadvantage is overcome by Behavioural Estimation, which reduces system development cost. It is inconspicuous to the user as no equipment's are needed [36]. But these methods compromise the accuracy of stress recognition which leads to inefficient results. Inefficiency of the above methods motivates to adopt a novel technique which is transparent and inexpensive. Thus, many researchers are focusing on leveraging social media interactions to improve the effectiveness of social media analysis for stress detection. Capturing of contextual attributes ascend to new research opportunities that aids in decreasing of users stress. The user's stress states need to be captured daily, weekly, bi-weekly or monthly from Social Networking Sites [38], social media data are being considered more in the stress detection systems as it is inexpensive, transparent and provides primary access to new opportunities. Hence detecting user's stress levels from user's social media data or micro blog content will improve the stress detection performance efficiently. Recent studies shows apart from

leveraging cross-media content and social interactions, Social Structure also plays a vital role in detecting stress states of an individual, which is a useful references for future related studies[15].

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