STRESS DETECTION AND ANALYSIS USING FGM WITH CNN METHODOLOGIES

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ABSTRACT

Stress is a feeling of emotional or physical tension, it is an ordinary piece of life. Stress ends up negatively when a man faces persistent difficulties, without relief. Every individual is used to social media and they impart their everyday exercises and interact with friends via web-based networking media platform. In this paper, user's mind state is identified through his posts in the online platform. Timely help, if not provided to the stress problems of any individual, can cause adverse results. With the growing use of social media, the amount of emotions which an average person shares online has also risen swiftly. The person's stress level can be detected through Sentiment Analysis based on the user's posts. Factor graph model combined with a convolutional neural network is used to analyze the tweet substance and detect the stress level. By analyzing a person's social media feed, we can identify the state of mind of the person and take immediate actions like informing to the user's family via mail which would avoid any harmful situation. This system would be successful in determining the stress level of a social media user.

Key Words**:** *stress level, sentiment analysis, FGM, CNN, Social emotions*

I. INTRODUCTION

Conceptual stress can be considered as the root cause to many health problems and mental illness. Chronic stress increases the risk of developing health problems such as inability to sleep, obesity, heart diseases, cancer etc. Most of the people come across a reasonable amount of stress in their lives. Even though the stress is regular in our life, increase in stress can be harmful to individuals' physical or emotional health. Stress should be recognized before it transforms into serious issues. Nowadays Social media users [1] are increasing rapidly and they tend to share the details of his/her life online. This can be considered as a mine shaft for Sentiment Analysis [2]. An active user will express the emotions on social media platforms which accounts for a large database on which algorithms can be applied for stress analysis. There are various social networking sites these days namely Facebook, Twitter, LinkedIn, Instagram, Tumblr, Reddit, Snapchat, WhatsApp, Quora etc. The posted tweets can be used for performing the Analysis and the sentiment of the particular tweet can be extracted. Since the inception of the internet, a greater number of people are using websites and services to express their opinion. With social media channels such as Facebook, LinkedIn, and Twitter, it is becoming feasible to automate and gauge what public opinion is on a news story, any product, or a brand [14]. Opinions that are mined from such services can be valuable. Datasets that are gathered can be analyzed and presented in such a way that it becomes easy to identify if the online mood is positive, negative or even indifferent. This allows to be proactive as opposed to reactive when a negative conversational threat is emerging. Though stress itself is non-clinical and common in our life, excessive and chronic stress can be rather harmful to people's physical and mental health. All these reveal that the rapid increase of stress has become a great challenge to human health and life quality. Thus, there is significant importance to detect stress before it turns into a severe problem. Traditional psychological stress detection is mainly based on face to face interviews, self-report questionnaires. With the development of social networks, more and more people are willing to share their daily events

and moods, and interact with friends through the social networks. Information is conveyed by tweets and texts. These short messages are used to share opinions and sentiments that people have in their mind. To maximally extract the tweet-level content, a hybrid model is proposed which uses a factor graph model combined with a convolutional neural network [11].

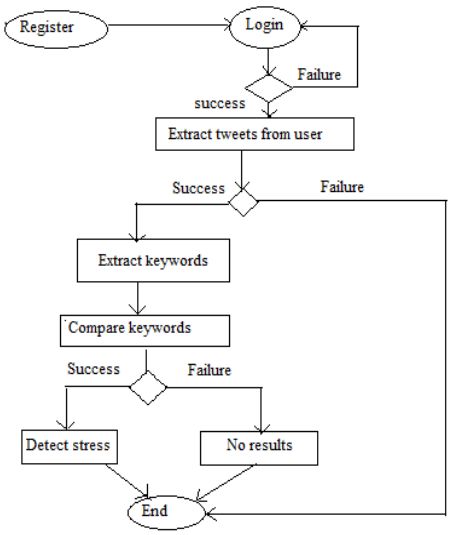

Fig.1: Flow of Stress Detection

The Fig. 1 shows the flow diagram for stress detection and analysis. The admin has to login to access the user tweets. The keywords extracted from the posts will be compared with the dictionary words. Then the fetched words will be detected for stress level using the proposed model. Based on the stress level the information will be sent to the user's friends or family to avoid the further complications because of the depressed mind state.

II. LITERATURE SURVEY

In the work[1] a novel hybrid model combined by a factor graph model and Convolutional Neural Network is proposed to compare tweet content and social interaction information for stress detection. Individuals encounter the stress because of a few personal issues. Because of the notoriety of web-based social networking, individuals share their day by day exercises and associating with companions via web-based networking media, making it possible to use online informal organization information for stress detection.

The two novel words-based sentiment analysis methods [2], named NWLB and NWSA are proposed in this paper, which utilizes the distinctive role of new words to improve the effectiveness of sentiment analysis in social media. Open feeling from public taken through web-based social networking is considered as a critical measure for specific occasion identifying, strategy making and hence forth numerous government and intelligence organizations have been propelling different activities to encourage speculations, advances and frameworks towards checking its change. Massive new words are made and generally spread in online networking, and they force an extraordinary act on sentimental analysis. In this paper, creator gives careful consideration to the help of new words. Experiments on web-based networking media dataset shows the effectiveness and execution of this strategy.

A replacement methodology [3] is proposed to conduct sentiment analysis on social news feed which are supported by social media. A Levenshtein algorithm is used to together order its semantics and feelings, that impacts for the event of opinion examination. The proposed strategy utilizes Nave Bayes and Levenshtein calculation to decide the feeling into various classifications from given online networking news information. This strategy gives the best execution to continuous social news information via web-based networking media. It likewise gives the better consequence of precision.

The social sensing and analysis methods [4] are introduced in this paper. Everything that the individuals share online might be considered as the useful and valuable substance of social or human sensors. The particular structure, in which data originating from interpersonal organizations are taken for distinguishing the extremity of the estimation with a content, is named as notion investigation. In this work, it additionally demonstrates two real-world applications of both sentimental analysis and social detecting.

The objective is to extract knowledge from social media [5], identifying the sentiments and behavior of individual to make specific decisions. These objectives are accomplished by recovering valuable data from twitter information and perform sentiment analysis. Social media has given a superior method for communication for individuals to share their opinions, conclusions, and assessments.

The work in paper [6] proposes a method that is mainly based on analyzing sentiments of the users. Machine Learning approach is utilized for the greater part of the sentiment or emotional mining for better outcomes. The fundamental thought behind this paper is to draw out the procedure engaged with sentiment examination. Likewise, the examination thinks about the different strategies or systems for performing sentimental investigation. It explains the different methods which are used to show the procedures engaged with sentimental examination.

The picture tags are introduced in the research work [7]. Learning tag relations from visual semantic sources studies the use of everyday words to describe images. Techniques to better incorporate multi-word terms and out of-vocabulary words also advanced NLP techniques for learning word relations from freeform text are explained.

The author in [8] presents 'we feel fine', an emotional search engine and web based art work to collect the world's emotions to help people better understand themselves and others. This search engine extracts some commonly used sentences, gender, age and location from blogs and social networking sites.

An automatic stress detection method from cross-media micro blog data is introduced in the work of paper [9]. By combining a Deep Sparse Neural Network to incorporate different features from cross-media microblog data, the framework is quite feasible and efficient for stress detection. The proposed method can help to automatically detect psychological stress from social networks.

A method is proposed [10] to use CNN to achieve accurate and fast detection of acute cognitive stress from heart rate variability (HRV). This study demonstrates the possibility of super short windows and the advantage of CNN on acute cognitive stress detection. Its outcome would benefit practical applications of real-time stress detection via HRV.

A hybrid approach is proposed in the work [11], which consists of FG model and CNN to analyze the textual contents in social media user's posts to detect the level of mental state of a user. The messages of a user is taken from Twitter platform which is preprocessed and passed to the cross auto encoder embedded CNN Model which outputs user level stress. Then they are input to the Factor Graph model that detects the stressed tweets.

A deep neural network (DNN) model is proposed which incorporates the user scope attributes to detect users' psychological stress [12]. The trained model is tested on different datasets from major micro-blog platforms Experimental results show that the proposed model is effective and efficient on detecting psychological stress from micro-blog data.

A study on benefits of expressive features for recognizing the sentiment of twitter message is carried out in the paper [13]. Analysis is done on the effectiveness of existing lexical resource and features that take information about the casual and innovative language used in twitter. A supervised classification approach is proposed in this paper

The work proposed in the paper [14] analyses the twitter posts about the online products like electronic gadgets using machine learning approach. By doing sentiment analysis in a specific domain it is possible to identify the effect of domain information in sentiment classification. A new feature vector is presented for classifying the tweets as positive, negative and extract people's opinion about products.

The author in [15], explains the comparative analysis on the state of the computational personality recognition methods, on a varied set of social media data from face book, twitter and you tube which is used for emotion detection.

III. METHODOLOGY AND ARCHITECTURE

The rapid increase of stress has become a great challenge to human health and life quality. It is very crucial to have a reality check about how stressed a person really is. It is because of this reason that timely detection and prevention of stress [10] is a need. In the proposed system the machine learning [6] is used and the concept of Sentiment Analysis is applied. This project aims in detecting the user stress by extracting the user uploaded content and social interaction information using the hybrid model which combines the Factor Graph and a Convolutional Neural Network. Traditional psychological stress detection is mainly based on face-to face interviews, self-report questionnaires or wearable sensors. However, traditional methods are actually reactive, which are usually time-consuming. When the user tweets in the social media, the raw data is collected and analyzed and is sent to the stress detection tool, where the user stress is detected using CNN-FGM algorithm.

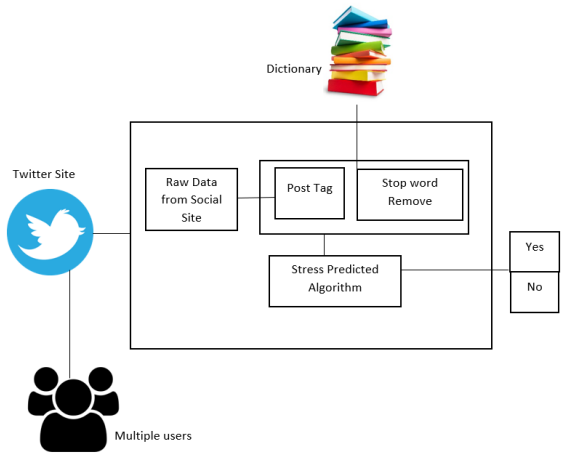

Fig. 2: Architecture for Stress Detection

Convolutional networks are very effective in areas such as image recognition and classification. It is a type of neural network that specializes in computer vision tasks. It forms the backbone of multiple modern computer vision systems. Image classification, object detection can be handled by CNNs. The main advantage of CNN is that it automatically detects the important features without any human supervision. Factor graph model is mainly used to maintain filtered data like positive, negative and neutral words. The Fig. 2 shows the architecture for the analysis of the stress. It has some specific units for particular tasks such as collecting the raw data from the sites, stop word removal, post tag, stress prediction algorithm.

Multiple users tend to post regularly on social media. The extracted keywords from the user inputs are compared with the dictionary words. By considering both the tweets both positive and negative [14], the linguistic attributes are extracted. Twitter adopts Unicode as the representation for all emojis which can be directly extracted. Stress detection over social media is usually affected by the noisy nature like abbreviations and irregular forms of tweets. So to reduce the noise of a textual data stop words should be removed. Stop words are filtered out before or after processing of the text. These are the frequently occurring words that does not carry much information. The detected stress level is then represented in the form of a graph. Once the results are generated, it is then given to the admin.

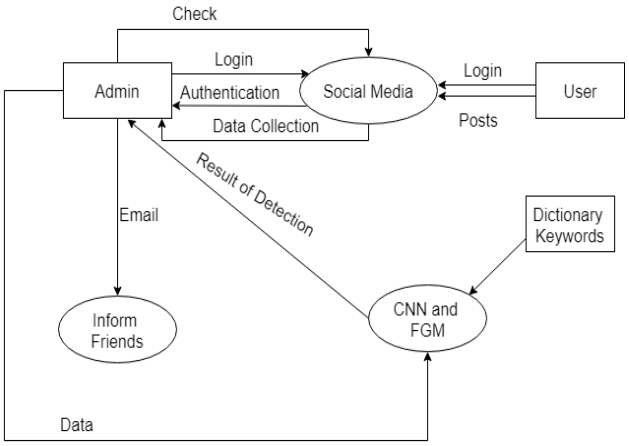

Fig.3 Data flow diagram for stress analysis

The Fig 3 explains the data flow diagram. The admin has to login with the valid id and password. Once the authentication is successful, the user's tweets can be collected for further process. The user also has to login with the valid id and can use any social platform for posting the content. The data collected from the user posts or tweets from the social media

will be detected for stress with the hybrid model and the results will be passed to the admin. Then the admin informs it to the user's family if the stress is detected. The admin then logs out of the system. Admin logins to the social media for the purpose of data collection. The required data is checked and the obtained information is analyzed, and it is fed into CNN and FG model. This method is responsible for comparing the detected keywords with the dictionary keywords. Listing 1 explains the steps for stress detection.

Input: user tweets tw.
Output: stress level of each user S_{L1}.

Begin
if admin login is successful,
then collect the raw data of user tweets, tw.
Preprocess the tweets tw, to obtain
preprocessed data, t_p
Apply test user data t_D, to stress detection model and perform the following steps
i) Collect test data tweets, t_D
ii) Compare tweets t_D with Dataset keywords, kw
Where kw = {abnormal, stressed, sad…} to
check if they match.
iii) if they match, then the selected tweets are
stressed tweets Stw
else
the selected tweets are normal tweets Ntw
iv) calculate the average stress level, S_l
$S_l = \Sigma$ Stw. / number of tweets, tn
check the user stress level and obtain the graph
if Average stress level, S_l > threshold, tsh
then, inform to the stressed user's family via mail.
Admin logout
End.

Listing1: Pseudocode analyzing stress level

User tweets are taken as inputs when the admin logs in. The tweets are preprocessed which includes the steps like data tokenization, stop word removal. Data tokenization is the method of substituting a sensitive data element with a non-sensitive equivalent referred to as a token that has no extrinsic or exploitable meaning. Stop words are filtered out before or after processing of natural language data. Once the preprocessing is done, the data tp is obtained. Further this data is used in stress detection model to know the stress level. The model is trained with the preprocessed data to form the stress detection model. Test data tweets are collected and the keywords are extracted from each post and is compared with dataset keywords to check if they match. The selected tweets are considered as stressed if they match else they are normal tweets. Next the average stress level is calculated and the graph is obtained. If the average stress level is more than then admin will inform to the user's family via mail.

IV. RESULTS AND ANALYSIS

The factor graph model is used to show the results based on the user inputs. The uploaded posts are distinguished as normal and stressed based on the user inputs. If the user posts stress free comments, then they are normal else they are considered as stressed. The results are represented through graphs where each user stress level is given and the stress level values are depicted by percentage. The admin can login to the account and can view all the user details and necessary actions can be taken. The admin can obtain all the details like user names, place etc. and can check the stress rate of any user.

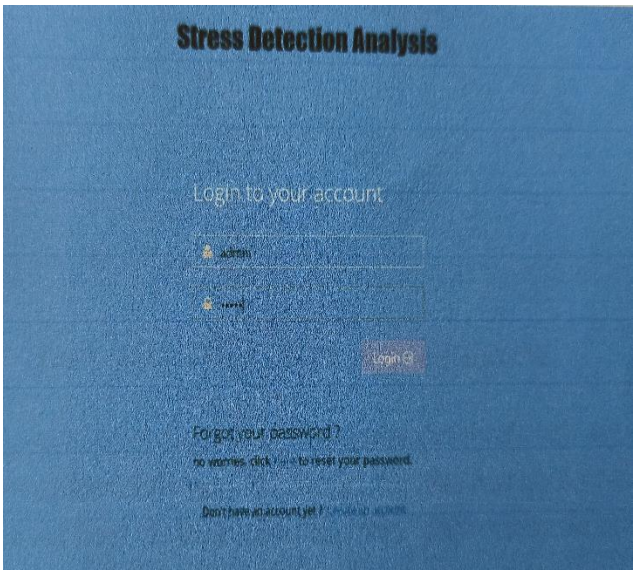

Fig. 4. GUI of tool developed representing the sign in page

The Fig. 4 shows the sign in page, where the admin logs in with the required username and password and if it is successful then the user posts can be viewed and can take the necessary actions based on the posts. The graphs below depict the different stress levels of the users based on their posts in the social media.

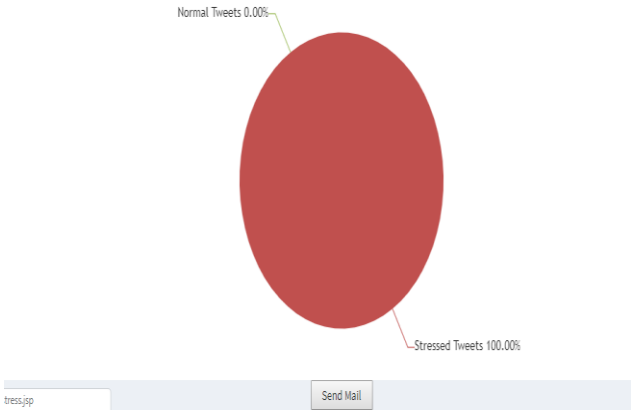

Fig.5: Completely stressed.

The Fig. 5 gives the stress level of the user. It represents that the user is fully stressed. The graph shows that the user has given stressed emotions as his social media tweets and the state of mind is expressed as completely stressed. This information is mailed to user's family.

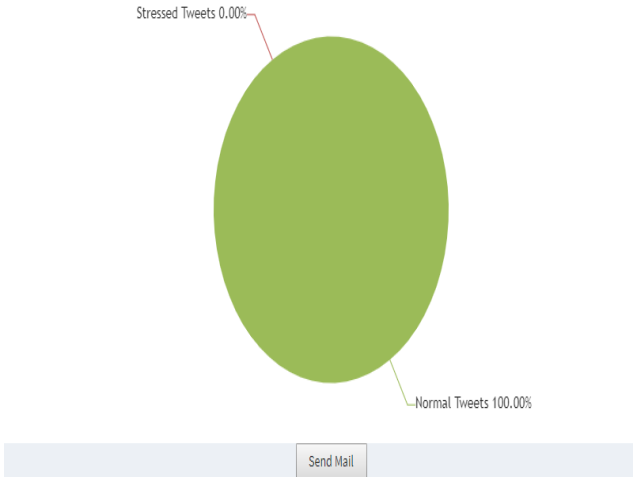

Fig. 6: Normal Level Representation

The Fig. 6 represents the normal mind state of the user. Here the stressed tweets are zero and the normal tweets are maximum. The graph shows that the user has given maximum normal emotions through his tweet which indicates that his state of mind is happy.

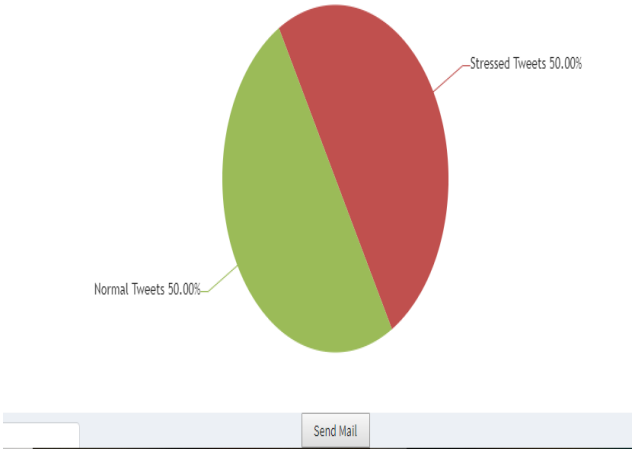

Fig.7: Stressed and Normal Level Representation

The Fig. 7 shows that the user is both stressed and normal. The posts are both happy and sad which indicates that the user here is stressed for certain level. Since the result shows the mixed emotion level the information is sent to user's family.

V. CONCLUSION

Considering the social media data as the basis, the correlation between user's psychological stress states and their social interaction behaviors is studied. To detect the sentiment of any user by his/her social media tweets, a hybrid model is proposed which is the combination of the factor graph model (FGM) and a convolutional neural network (CNN). Mental stress because of various reasons is threatening people's health. It is important to detect stress for proactive care. The proposed system detects user's psychological stress states from user's social media data, content as well as user's social interactions. The collected data is identified as stressed or non-stressed and the admin informs the user's family through email if the user is stressed. This method will surely help in identifying the people who are mentally weak and are seeking moral support. This will in turn help in reducing

suicide rates. The proposed hybrid model can be further improved to identify the mental state of a person based on the images he uploads.

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