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## Stress Detection Among Students using various Techniques

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**Abstract--**The presence of depression among any individual has been a serious problem in personal as well as public health. A large amount of people including students are suffering from the depression but not all are getting overcome by adequate treatment. This depression, commonly known to people by the word Stress is a psychological condition which reduces the amount of sleep and affects almost each and every aspect of life. Thus this paper is proposed to provide an effective method able to detect the cognitive stress levels amongst students using various techniques.

Though not every stress is harmful, sometimes it can be used for constructive purpose; the high level of stress among the student generation can lead to adverse impact on them which cannot be useful for their personal development. Thus, it became necessary to study the techniques by which the presence of stress can be known.

**Keywords—**stress detection, Depression, Classification algorithm, data.

### I. Introduction:

Stress is a very common psychological condition that has been as an embedded part of our daily life. Not only psychological, but the stress

Can also be termed in terms of neurological conditions, such that we can adapt the change happening in our surroundings and environment whenever needed [1]. Few health surveys are carried out for detecting the stress level on the basis of age factor. In some of the surveys, it is found that people belonging to the category of young people ranging from 12 to 25 years are suffering from the insufficient psychological health level due to some

reasons. Besides this, it is often seen that students who are in learning phase have more psychological problems [2]. For any student, lower ranking in academics, failure in sports, health as well as financial issues, anxiety, sleeping disorders can be the causes for the rise in the stress or depression level. In a general survey from a French University, it is studies that 3% of the overall students are detected to suffer from mild, moderate and severe depression. Approximately near about 83% of students from the University of Lodz are suffering from the negative effects of fatigue. Moreover, because of the depression 15% of the total students had suicidal thoughts in their mind whereas 3% students have a suicidal tendency. Furthermore, according to the study of Humphris et al. (2002), we came to know that more than 30% of the students from dental sector from European Universities are suffering from significant psychological distress and nearly 22% students are having a high level of emotional exhaustion[3][4]. Excessive amount of stress can have an adverse impact on both, the physical as well as the psychological health conditions of the students. Certain methods has been searched to detect the mental stress using the data from social media, using Digital Signal Processing, Virtual Reality Techniques, Questionnaire surveys and many others.

Stressors cause the stress in one's life and the events that make the stress to occur are referred to as Stressors.

## Related work for detection of Stress:-

Sr No	Title	Authors	Description	Focus Group
1	The Impacts of physical exercise on stress coping and well-being in university students in the context of leisure	Jong-Ho Kim, Larry A. McKenzie	A method of investigation was proposed by the authors using the social life of college students and the impact of physical exercises is highlighted which helped in reducing the stress levels.	physical exercise on stress Source: Interviews and questionnaire
2	Automatic stress Detection in working environments from smartphones' accelerometer data: A first step	Enrique Garcia-Ceja; Venet Osmani; Oscar Mayor	Smartphones are used as a tool for behavior detection correlated with various stress levels	Occupational stress Source: Sensors from smartphones
3	Automatic detection of perceived stress in campus students using smartphones	Martin Gjoreski ; Hristijan Gjoreski ; Mitja Lutrek ; Matja Gams	In this paper, machine learning approach for continuous stress detection is used with the help of a wearable wrist device using the real-life data as well as physiological measurements	Adult Stress Source: Sensors from wrist watches
4	Stress detection using smart phone data	PanagiotisKostopoulos, Athanasios I. Kyritsis, Michel Deriaz, Dimitri Konstantas	Authors proposed the design of a stress detection system namely StayActive, which uses sleep patterns, physical activities and social interactions for detection of the stress	Stress in Professionals Source: Sleeping pattern and data from smartphone sensors
5	Stress detection using low cost heart rate sensors	Mario Salai, Istvan Vassanyi and Istvan Kosa	Heart Rate Variability known as HRV was used for detection of stress level automatically. They used a low cost heart rate sensor along with a chest belt and the technique of Galvanic Skin Response, Electromyography, ECG and skintemperature as well as conductance Were used as a medium for stress detectors.	Stress in Volunteers Source: Chest belt, heart rate sensor
6	Detection of Stress Using Image Processing and Machine Learning Techniques	Nisha Raichur, Nidhi Lonakadi, Priyanka Mural	A monitoring system is developed for emotional stress detection	Stress in working professionals Source: Image Dataset
7	A Machine Learning Approach for Stress Detection using a Wireless Physical Activity Tracker	B. Padmaja, V. V. Rama Prasad and K. V. N. Sunitha	The work on behavioral symptoms of stress has been carried out using a wireless physical activity tracker developed by FITBIT.	Stress in working professionals Source: Questionnaire, Fitbit data

## II. Motivation:

The concept of Artificial Intelligence, machine learning as well as neural networks is continuously becoming more and more popular having their applications in almost every field. Also, the regular increase in the stress and depression level with respect to the students is becoming a serious issue. Hence, this paper is proposed with the study of detection of the stress level among the students.

## III. Objectives

The main objective of this research is to investigate the stress levels of the students so that the growth and development that has been paused among the

students due to presence of the depression can be avoided and helps them to reach the goal.

## IV. Methodology:

For the purpose of stress detection among the students that can help to improve themselves in developing their skills keeping aside the reasons that make them stressed and focusing on their primary goals, we are proposing two different approaches as follows:

- A. Using Image Processing and Deep Learning Technique.
- B. Using the data from Social media.

A. *Using Image Processing and Deep Learning Technique:*

Below steps shows the detection of stress presence by means of image processing – processing the image detected by camera through eyebrows pattern and then applying deep learning technique to it.

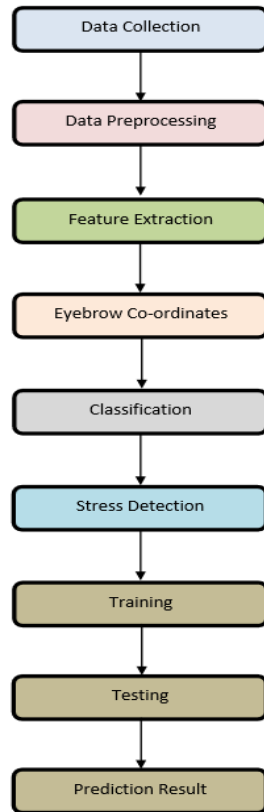


Fig. Stress Detection Steps

**Data Collection:**

The first step for processing any type of data is the collection of data. The data can be collected into a dataset or database. This collected data will be then used for processing and getting the desired output based on the given inputs. Sensors, camera and data based on various questionnaires can be used to collect and store the data.

**Data Preprocessing:**

Data Processing in the context of Machine Learning means the transformation of data that is applied to actual data before providing it to any program or algorithm. The data is originally collected in the form of raw data which cannot be used for analysis and hence, it has to be preprocessed. Similarly, we have to preprocess the raw data for the proposed approach. The data in our approach would be the image which we need to process.

**Feature Selection:**

The process of Machine Learning where we can automatically or manually select only those features that can be used in our prediction model is Feature Selection. If the data contains irrelevant or inaccurate data or the data with irrelevant features then the accuracy of the model might get decreased [12].

Camera will collect different samples of face recognized. The preprocessed image can give two variations of transformations: one in the form of pixel transformation and other in the form of binary data transformation. The binary transformation is done just after the pixel transformation. The pixel transformation to binary transformation means the transformation of RGB values to a proper Gray scale. The transformation is done as – if pixel values > threshold values, then the pixel value is set to 1, but if pixel values < threshold values then the pixel value is set to 0.

**Detection through the study of eyebrow pattern:**

Thereafter, the eyebrow detection is made with the help of the modules that uses camera. As the values are converted to binary form, there would be only two possible values for representing black and white as 0s and 1s. The black color would be represented as 0 and white as 1. Thus, after the completion of eyebrow detection, stress detection is the next step. Though not every individual has a unique eyebrow pattern but for the detection of the presence of stress, variance of the eyebrow patterns can be used to judge the presence of stress. The coordinates of eyebrows are taken into consideration with the help of previously preprocessed data image available. The offline displacement calculation, variation of displacement and stress classification is done. Thereafter, calculation of variance is done which is used to calculate the variability in eyebrow transformation and then compared with the threshold values[11].

**Deep Learning:**

Deep learning also known by the name deep structured learning is an active member of Machine Learning family. Deep Learning is a machine learning technique that makes use of building pieces of car that drive itself, also able to make the computers having vision, able to translate various languages automatically, and many more. It Deep Learning can be done either in supervised way or in unsupervised way. Deep Learning is a combination of two words Deep and learning in which Deep refers to the layers that can be processed in order to represent the available data in separated layers of abstraction[13]. In this proposed approach, it is the final module which includes output of above processes applied to various algorithm and tests that can be used for prediction. Here, we can use the supervised type of deep learning and different algorithms can be used for example Linear Regression Algorithm. Considering the X and Y coordinates, X would represent the numerical values for eyebrow movements and Y will give the corresponding emotions. Hence, training and testing will be done using these values [11].

In this way, the threshold value will decide whether the student is stressed or not.

**B.Using the data from social media**

Considering all the challenges happening to the students, the potential or the power of social media can be used for the proper examining and prediction of the stress level of each individual. The Major Depressive Disorder known by the acronym MDD, causes the people to suffer from low esteem and bad mood along with lack of concentration and unhappiness.

Day-by-Day, every individual is moving towards the net of social media. People often share their views, thoughts with others by the means of various social media apps available with us like Facebook, etc. Based on some researches, these characteristics can be trapped for judging the behavioral factors of a student. The language used by them as well as the emotions expressed shows the behavioral characteristics of the person such as happy, sad, guilt, helpless, etc and this may be helpful for us to distinguish the measures of depression.

The crowdsourcing is a concept of obtaining the information into any sort of tasks by the means of Internet that can gain access to behavioral data of the students. The people who work

for this crowdsourcing are referred to as crowdworkers. They are very active on social applications like facebook, Twitter, etc and make sure that they acknowledge people that the data provided by them can be used for the purpose of studies such as data mining and analysis, prior to the collection of information.

The Center for Epidemiologic Studies Depression Scale (CES-D) questionnaire was used as a basic method to determine the crowdworker's depression levels. The CES-D is generally a 20-item scale that can measure depressive symptoms in the general population and generates report automatically and is one of the most common screening tests for various purposes.

For example, the test seeks responses to questions such as: "I want to quit"; "I am very alone"; those who were interested in this test were told to make a choice one of the response:  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days);  
Occasionally or a moderate amount of the time (3-4 days); and  
Most or all of the time (5-7 days).

Based on the responses, the minimum score could be zero and the maximum could be 60. The noisy responses can be confronted for the correct results.

The self generated report consists of some factors as follows:  
The past history about their treatment of depression is asked. If the response is positive, then the question arose is when?  
The estimated time of its commencement is asked if they were clinically depressed  
Whether they were using any antidepressant medications or not?

After the above procedure, Social Media Analysis came into existence. Twitter feeds of all users were collected to explore behavioral prediction.

From the depression onset date of each participant belonging to the positive class, the Twitter posts in the past one year were collected, going back from the date of reported depression onset. Consider a participant with depression onset date of January 10, 2019, their complete posts are trapped made between January 10, 2018 and January 09, 2019. For users belonging to the negative class, all data related to their posts was collected from the past one year prior to the date after taking this survey.

### Depression Language

Participants with positive response are classified into two subgroups based on their language and what they might be talking about.

(a) Depression lexicon. The first subgroup is the collection of the feature measures of the usage of depression-related terms that is defined broadly obtained from their Twitter posts. For this purpose, a lexicon of terms that seems to appear in postings are built from individuals classified according to their discussion of the depression or its symptoms in online settings. This data is mined about a 10% sample of the snapshot of the "Mental Health" category of their responses. Moreover, these posts are separated into questions and answers and made available readily on Twitter. After mining and processing of this data, the questions and the best answer for each question is extracted. After processing the data and gathering the information in terms of Pointwise Mutual Information (PMI)

and Log Likelihood Ratio (LLR), the generated tokens are then used for determination of the frequency of using the depression terms.

Antidepressant usage: After generation of the Depression Lexicon, another feature is to measure the degree of use of the antidepressants that are commonly used for the treatment of clinical depression, if the student is suffering from clinical depression. In this way the lexicon and antidepressants are taken as a measure of the depression.

In this way, the algorithms for data mining can be used for classifying whether the student is under stress or not. Based on the result, further treatment can be carried out if the student is under stress [14].

Based on the generated results, Naive Bayes algorithm and support vector machine algorithm can be used to classify the students as stressed and non stressed student. Their posts will be taken into consideration for the same purpose.

### Naive Bayes Classification Algorithm:

Naive Bayes algorithm learns the actual probability of an object with selected features that belongs to a particular subgroup. The Naive Bayes theorem is a theorem that provides us with the calculation of posterior probability which can be calculated as  $P(c|x)$ , from  $P(c)$ ,  $P(x)$ , and  $P(x|c)$ . Naive Bayes classifier comes into existence which makes an assumption that considering a given class ( $c$ ), the effect of the value of a predictor ( $x$ ) is not dependent of the values of other predictors which in general is termed as class conditional independence.

$$P(c|x) = P(x|c)P(c) / P(x)$$

Where  $P(c|x)$  is the Posterior probability as defined above,

$P(x|c)$  is the likelihood

$P(c)$  is the class prior probability and

$P(x)$  is the Predictor prior probability.

Following is the execution flow of Naive Bayes Algorithm:

- Step 1: data set needs to be converted to frequency table
- Step 2: Create Likelihood table by finding the probabilities
- Step 3: Use the Naive Bayesian equation given above for calculating the posterior probability for each class. The class with the highest probability is the outcome of prediction.

### Support Vector Machine

Support vector machine is based on the supervised learning algorithm of deep learning that is often used for data classification and regression. Support vector machine provides the samples as correct and incorrect instances. It can be used to find root mean squared (RMS) error, mean absolute error of the training data[15].

The performance, overall accuracy and error rate are determined on the basis of posts, posted on the social media based on the behavior, images, videos, text and language. Also the Convolutional Neural Network can be used with Naive Bayes Algorithm for more accurate detection.



Sr. No.	Factors	Observations
1	Symptoms	Poor ranking, low concentration, anxiety, bedwetting, sleep disorders, negative thoughts, mental imbalance, suicidal thoughts, headache
2	Detection of behavior	Hatred, love, happy, sad, sorry, greet, guilt, talk, extreme silence, groups, discussions, caring, rude, enjoying, depressed, addicted
3	Relationships	Religion, politics, son, daughter, music, boy, girl, sexual, mental, physical, party, gangs, movies, relatives, socially active
4	Treatment	Doctors, Practitioners, medications, therapies, high dose antidepressants, drugs
5	Language	"I am alone in the world", "No one loves me", "Just let me take a sip of drug", "I want to drink a lot", "I want to quit", "Revenge will be taken surely"

Table: Observations of various factors with positive depression feedback

Above two images are the samples of the questions selected for questionnaire and below mentioned is the output which is basically based on the answers chosen.



V. Results (based on Questionnaire):

Physical Indicator

1. My body feels tense all over.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

2. I get severe or chronic headaches.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

3. I feel nervous.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

4. I feel short of breath after mild exercise like climbing up four flights of stairs.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

5. I lack physical energy.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

Personal Habit

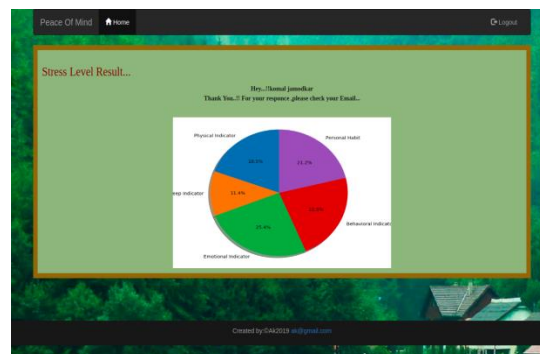
1. I lack time to read the daily newspaper  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

2. I spend less than 30 minutes a day working toward a life goal or ambition of mine.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

3. I spend less than three hours a week working on a hobby of mine.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

4. I watch television for entertainment more than one hour a day.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always

5. When I feel stressed, it is difficult for me to plan time and activities to constructively release my stress.  
 1.Never  2.Almost Never  3.Some Time  4.Most Time  5.Always



Above image shows the calculated result of the stress detected based on questionnaire for the individual calculated using the above mentioned formula. High level of stress detected warns the user by giving some natural and feasible solution to get back to normal routine and lead a happy life.

VI. Conclusion:

In this paper two ways to detect stress level among the students that can be the reason for the obstacle in their personal growth and development. Thus, as we know that not only students but everyone is using social media and hence we have tried to go ahead for the detection using data mining techniques.

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