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Efficient Mechanism for Human Stress Detection using Machine Learning

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Abstract*— Human stress is a prevalent main problem in today's society and it can lead to negative physical and mental health outcomes. Traditional methods of measuring stress, such as self-report questionnaires, can be subjective and time-consuming. Machine learning techniques have the potential to provide a more objective and efficient approach to stress detection. In this project, aim to develop a machine learning model for detecting stress using a dataset on Kaggle that contains 116 columns of various physiological , and demographic features. The dataset was collected from participants who completed a stress-inducing task, such as a speech or a math test, and also completed self-reported stress levels. In this project use machine learning techniques support vector machines (SVM) to design a stress detection model. Finally, the trained model to predict stress levels for new participants based on their physiological and demographic features. In conclusion, study shows that machine learning can effectively detect stress in individuals and has the potential to be a valuable tool in early stress detection and prevention. Future research should focus on further improving the accuracy and scalability of the proposed approach to enable real-world applications.

Keywords : Stress detection, Machine Learning, Support Vector Machine (SVM), Classifier.

I. INTRODUCTION

Stress is a common issue that affects numerous people in moment's society. While some position of stress can be normal and indeed helpful in certain situations, dragged stress can have negative impacts on physical and internal health. thus, the capability to descry and cover stress situations is pivotal for both individualities and healthcare providers. Machine literacy algorithms have shown promising results in detecting stress situations grounded on colourful physiological and behavioural measures. These measures can include heart rate variability, skin conductance, facial expressions, and speech patterns, among others. The thing of an effective medium for mortal stress discovery using machine literacy is to directly adnoun-invasively measure stress situations in real- time, with minimum stoner input or intervention. Such a medium can be useful in a variety of settings, including workplaces, seminaries, and healthcare installations. In this design, we aim to develop a stress discovery system using machine literacy ways that can directly prognosticate stress situations grounded on physiological and behavioural data. We'll use a dataset of stress- related measures, including, facial expressions, and speech patterns, to train and estimate our models. The final affair of this design will be a stress discovery system that can give real- time stress position prognostications. Such a system can be used to cover stress situations in individualities and give timely interventions to help or manage stress-related health issue.

II. METHODOLOGY

The methodology section provides a detailed of the experimental setup, including the data collection process, the feature extraction methods, and the machine learning algorithms used for stress classification. The section also discusses the performance evaluation metrics and the statistical analysis methods used to compare the results. This paper using 116 line file name Stress.csv on Kaggle dataset. For these tasks only need to use text and symbol. The data used in this paper consisted of information published in mental health subdirectories. This document contains many of the mental health issues that people deal with in their lives. This data is labelled 0 and 1; where 0 represent no stress and 1 represent stress.

In this project require some installing the necessary Python libraries and files to make this project. The word cloud of the text and look at the words people use when sharing life's problems on social media. This Project use the Bernoulli Naive Bayes algorithm, which is one of the algorithms below Optimal Algorithms for Binary Problem classification. This model tested on some random health based sentences.

III. BERNOULLI NAIVE BAYES ALGORITHM

Bernoulli Naive Bayes is a Naive Bayes algorithm for binary classification functions. It is often used for language processing such as sentiment analysis, spam filtering, and text clation. The algorithm is based on Bayes' theorem, which **says** that when evidence is given (words in a document)**,** the probability of the hypothesis (in this case, the data category) is proportional to the probabity that the given evidence will be tested. with. hypothesis is multiplied by the previous

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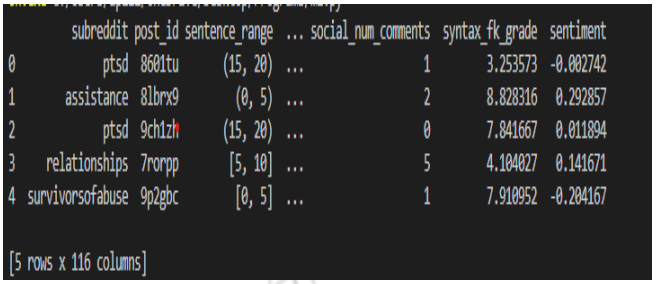
probability of the hypothesis..
P(Xi \mid Y) = P(Xi = 1 \mid Y) Xi + P(Xi = 1 \mid Y)) (1 - Xi)

IV. RESULT

In this Project are using Stress.csv on Kaggle dataset. This Project are using Python language. There are some important Library used in this project. First of all the all dataset are read than clean the unwanted error in dataset.



	subreddit	post_id	sentence_range	...	social_num_comments	syntax_fk_grade	sentiment
0	ptsd	8601tu	(15, 20)	...	1	3.253573	-0.002742
1	assistance	8lbrx9	(0, 5)	...	2	8.828316	0.292857
2	ptsd	9ch1zh	(15, 20)	...	0	7.841667	0.011894
3	relationships	7rorpp	[5, 10]	...	5	4.104027	0.141671
4	survivorsofabuse	9p2gbc	[0, 5]	...	1	7.910952	-0.204167

[5 rows x 116 columns]

Table 1. Literature.

Ref	Title	Dataset	Result
[1]	Stress Detection with Machine Learning and Deep Learning using Multimodal Physiological Data	WESAD dataset	Achieved accuracy 95.21%
[2]	Stress Detection through Speech Analysis using Machine Learning	Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS) dataset	CNN93% Accuracy
[3]	Introducing WESAD, a Multimodal Dataset for Wearable Stress and Affect Detection	WESAD dataset	Accuracy of 80%
[4]	A Machine Learning Approach for Stress Detection using a Wireless Physical Activity Tracker	Collected own dataset using FITBIT device and analysis using ANOVA	AIC- 782.8842 (Logit model)
[5]	Machine Learning and IoT for prediction and detection of stress	Collected own dataset and classified using Python	SVM-68%
[6]	Machine Learning-based signal processing using physiological signals for stress detection.	Collected own dataset based on heart rate, EMG, GSR hand and foot data, respiration and classified using WEKA	Achieved accuracy 92.06%

V. FUTURE SCOPE

The future scope of stress detection using machine learning (ML) is quite promising. ML algorithms can be trained on large datasets to identify patterns and indicators of stress, enabling real-time detection and personalized interventions. Here are some potential areas of advancement in stress detection using ML

- Multimodal Data Analysis: ML models can be developed to analyze multiple data modalities simultaneously, such as physiological signals (heart rate, skin conductance), speech patterns, facial expressions, and activity levels. By combining these modalities, more accurate and robust stress detection models can be created.

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- Deep Learning Architectures: Deep learning techniques, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), can be used to automatically extract complex features from raw data, enabling more accurate stress detection. For instance, CNNs can analyze physiological signal patterns, while RNNs can model temporal dependencies in sequential data.
- Transfer Learning and Pretrained Models: Transfer learning allows ML models to leverage knowledge from pretraining on large-scale datasets. By fine-tuning pretrained models on stress-specific data, it is possible to achieve better performance with limited labeled stress data, making stress detection more accessible and practical.
- Longitudinal Monitoring and Predictive Analytics: ML models can be used to analyze long-term trends and changes in stress levels. By considering historical data, predictive analytics techniques can forecast stress levels and identify triggers, enabling proactive stress management and prevention.
- ML models can provide personalized recommendations and interventions based on an individual's stress profile. By analyzing user-specific data, preferences, and contextual information, ML algorithms can suggest tailored stress management techniques, such as breathing exercises, meditation, or activity suggestions.

These advancements will require collaboration between researchers, data scientists, psychologists, and healthcare professionals. Additionally, ethical considerations, privacy protection, and consent-based data collection must be prioritized to ensure responsible and secure deployment of stress detection using ML techniques.

VI. WORDCLOUD

The dataset has some most used words by the people sharing about their life problems on social media. The most common words are used that are show on figure 2 that are shown word cloud. The figure 2 are Generated word cloud image using Kaggle dataset.

In this dataset the result shown in Boolean.

```
subreddit                 0
post_id                   0
sentence_range            0
text                      0
id                        0
                         ..
lex_dal_avg_pleasantness  0
social_upvote_ratio       0
social_num_comments       0
syntax_fk_grade           0
sentiment                 0
Length: 116, dtype: int64
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\ap222\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
                                                text      label
0  said felt way sugget go rest trigger ahead you...     Stress
1  hey rassist sure right place post goe  im curr...  No Stress
2  mom hit newspap shock would know dont like pla...     Stress
3  met new boyfriend amaz kind sweet good student...     Stress
4  octob domest violenc awar month domest violenc...     Stress
```

For testing this project take some user input to verify the result.

In this dataset the result shown in Boolean form as 0 and 1. If result is 0 then No stress detected and if the result was 1 then the stress was detected.

```
subreddit                 0
post_id                   0
sentence_range            0
text                      0
id                        0
                         ..
lex_dal_avg_pleasantness  0
social_upvote_ratio       0
social_num_comments       0
syntax_fk_grade           0
sentiment                 0
Length: 116, dtype: int64
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\ap222\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
                                                text      label
0  said felt way sugget go rest trigger ahead you...     Stress
1  hey rassist sure right place post goe  im curr...  No Stress
2  mom hit newspap shock would know dont like pla...     Stress
3  met new boyfriend amaz kind sweet good student...     Stress
4  octob domest violenc awar month domest violenc...     Stress
```

VII. CONCLUSION

In conclusion, stress detection is a crucial area of research with significant implications for personal and public health. Through the use of various physiological, behavioral, and self- world settings. Additionally, more research is needed to explore the relationship between stress and various health outcomes, including mental health, cardiovascular disease, and immune system functioning. Such research will contribute to the development of more targeted and effective stress management strategies and interventions, ultimately improving individual and societal well-being.

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