



MACHINE LEARNING FRAMEWORK FOR DETECTION OF MENTAL STRESS

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Abstract: Mental stress is becoming a common issue among students and individuals due to factors such as workload, lack of sleep, screen time, deadline pressure, financial concerns, personal responsibilities, and limited relaxation time. Identifying stress levels can be difficult because different factors can affect each individual differently. This research presents a machine learning framework for the detection of mental stress using questionnaire-based data. Data was collected from 51 respondents through a Google Form and included factors such as sleep hours, screen time, workload, physical activity, socialization, sleep quality, deadline pressure, financial concerns, personal or family responsibilities, and social support. The collected data was processed and used to calculate a stress score, based on which respondents were classified into Low, Moderate, and High stress levels. The dataset contained 17 columns and the stress-level distribution included 10 Low, 37 Moderate, and 4 High stress responses. A machine learning classification model was developed using Python to identify stress-level patterns. The model achieved an accuracy of approximately 81.82%. The study also used data visualization to understand the distribution of stress and the relationship between different factors and stress levels. The proposed framework shows how data analysis and machine learning can be used as a preliminary approach for detecting and understanding mental stress patterns.

Keywords: Mental Stress, Machine Learning, Stress Detection, Stress Level, Data Analysis, Python, Classification

1. INTRODUCTION

Mental stress is a common issue in today's life. Students and working individuals may experience stress because of studies, work, deadlines, workload, lack of sleep, financial problems, family responsibilities, and other daily activities. Continuous stress can affect a person's concentration, sleep, productivity, and daily routine. Social media can be useful for students. But using social media too much can affect study time and concentration. Using social media at night can also affect sleep. This may affect the academic performance of students.

Different people experience stress because of different factors. Therefore, it is important to study multiple factors together instead of considering only one factor. In this research, factors such as sleep hours, screen time, workload, physical activity, social interaction, sleep quality, deadline pressure, relaxation time, financial concerns, and personal responsibilities are considered. For this research, data was collected from students using Google Forms. The data was cleaned and analyzed. Machine learning models like Logistic Regression, Decision Tree, and Random Forest were used.

For this research, data was collected using a structured Google Form questionnaire. The collected responses were analyzed and a stress score was calculated. Based on the score, individuals were classified into Low, Moderate, and High stress categories. Machine learning was then applied to the collected data to develop a framework for detecting stress levels.

The main aim of this research is to use machine learning and data analysis techniques to understand different factors related to mental stress and classify individuals according to their stress level. Power BI was also used to present the collected data and results through simple graphs and visualizations.

1. PROBLEM STATEMENT

Mental stress can be caused by different factors such as workload, lack of sleep, screen time, deadline pressure, financial concerns, and personal responsibilities. It can be difficult to identify the stress level of an individual by considering only one factor. Therefore, there is a need for a data-driven approach that can consider multiple factors together and classify individuals according to their stress level. This research aims to develop a machine learning framework that uses questionnaire-based data to calculate and predict mental stress levels as Low, Moderate, or High.



2. OBJECTIVES

The main objectives of this research are:

- To study different factors that may be related to mental stress.
- To collect primary data through a structured questionnaire.
- To calculate a stress score from the collected responses.
- To classify individuals into Low, Moderate, and High stress levels.
- To use machine learning techniques for stress-level prediction.
- To analyze the collected data using graphs and Power BI.
- To develop a simple framework for detecting mental stress using data-driven techniques.

3. LITERATURE REVIEW

Sr. No.	Author & Year	Research Topic	Main Finding
1	Ahuja & Banga (2019)	Mental stress detection in university students using ML	SVM achieved 85.71% accuracy for detecting student mental stress.
2	Acikmese & Alptekin (2019)	Stress prediction using LSTM and mobile sensors	LSTM was used to predict stress from passive mobile-sensor data and achieved 62.83% accuracy.
3	Rois et al. (2021)	Perceived stress prediction among university students	Random Forest performed strongly in predicting stress using academic, lifestyle and health-related factors.
4	Gedam, Dutta & Jha (2025)	Mental stress detection using ML and wearable technologies	XGBoost achieved 96.17% accuracy using physiological signals such as ECG, GSR and skin temperature.
5	Shinde & Ghotkar (2025)	Questionnaire-based ML for mental stress detection	An ensemble model using questionnaire data achieved 95% accuracy.
6	Ladkat & Gavhane (2025)	Student stress prediction using ML	Google Form data from 1,000 MCA students was used; XGBoost performed strongly for stress prediction.

4. RESEARCH GAP

Previous studies have examined mental stress using different factors such as academic pressure, workload, sleep, lifestyle, and psychological conditions. However, many studies focus on specific factors or use datasets that may not include a combination of lifestyle, workload, social, and personal responsibility-related factors.

In this research, multiple factors are considered together, including sleep duration, screen time, workload, physical activity, social interaction, sleep quality, deadline pressure, relaxation time, financial concerns, personal responsibilities, and social support. The collected data is converted into stress scores and classified into Low, Moderate, and High stress levels. Machine learning is then used to study the collected responses and predict stress levels. Therefore, this research provides a simple framework that combines questionnaire-based data, stress scoring, machine learning classification, and Power BI visualization for mental stress detection.

5. METHODOLOGY

This research was conducted to develop a machine learning framework for detecting mental stress. The study follows a quantitative data analysis approach. Primary data was collected from respondents using a structured questionnaire through Google Forms.



The collected data was organized and prepared for analysis. Different questions related to sleep, screen time, workload, physical activity, social interaction, sleep quality, deadline pressure, relaxation, financial concerns, personal responsibilities, and social support were considered. A stress score was calculated from the relevant responses and respondents were divided into Low, Moderate, and High stress categories.

The prepared dataset was then used for machine learning classification. The model was trained using the available data and evaluated using test data. Accuracy and classification results were used to understand the performance of the model. Power BI was also used to create visualizations for better understanding of the collected data and stress-level distribution

6. DATA COLLECTION

This research mainly uses Primary Data collected from 51 respondents through a Google Form. The questionnaire included factors such as sleep, screen time, workload, physical activity, social interaction, deadline pressure, financial concerns, and personal responsibilities.

The collected data was organized in a CSV file and used to calculate stress scores and classify respondents into Low, Moderate, and High stress levels.

Primary Data: 51 responses collected through Google Form.

Secondary Data: Previous research papers and studies related to mental stress and machine learning.

7. DATA ANALYSIS

The collected data was analyzed to understand the different factors related to mental stress.

Different graphs were created using Power BI. The graphs show the relationship between factors such as sleep, screen time, workload, physical activity, and stress levels.

The study also analyzed the stress scores of the respondents and classified them into Low, Moderate, and High stress levels.

The Power BI dashboard was used to present the results in a simple and clear way.

8. MACHINE LEARNING MODELS

The machine learning-based classification approach was used in this research to identify the mental stress level of respondents.

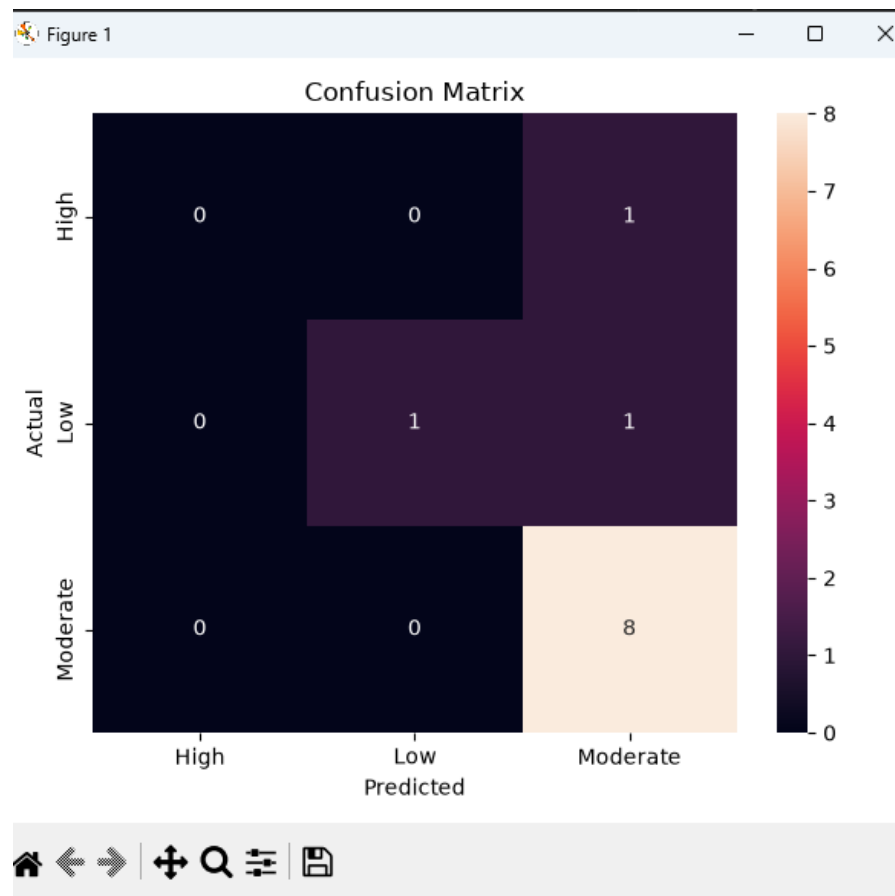
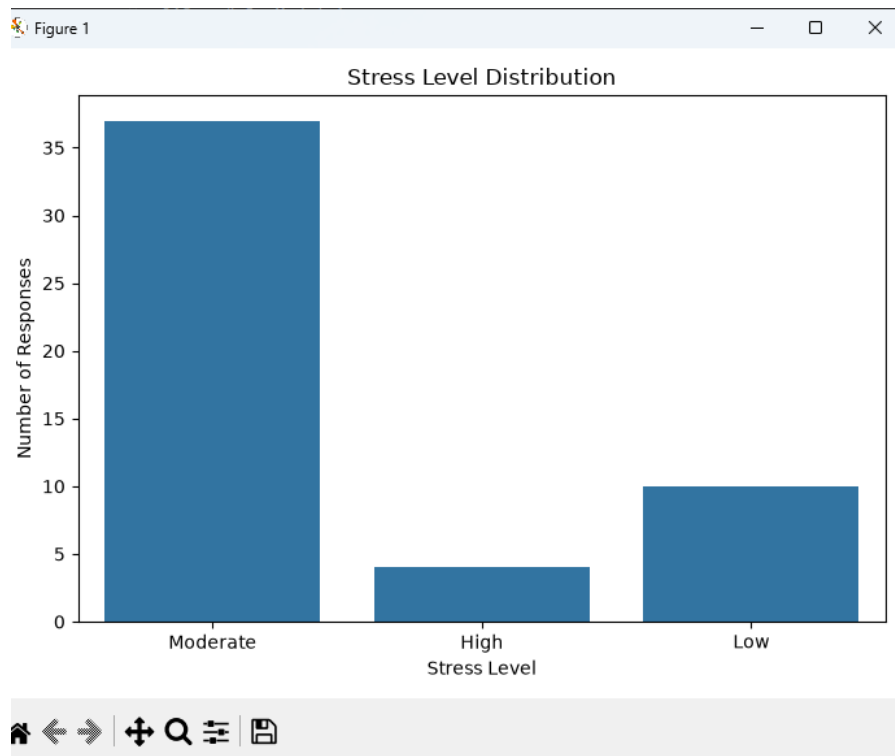
The model was used to analyze the collected data and classify the stress level based on different factors such as sleep, screen time, workload, physical activity, social interaction, and personal responsibilities.

The input factors were used to calculate the stress score and classify respondents into three categories: Low, Moderate, and High stress levels.

The model was evaluated using accuracy and classification report to check its performance. The model achieved an accuracy of approximately 81.82%.



9. RESULT AND DISCUSSION



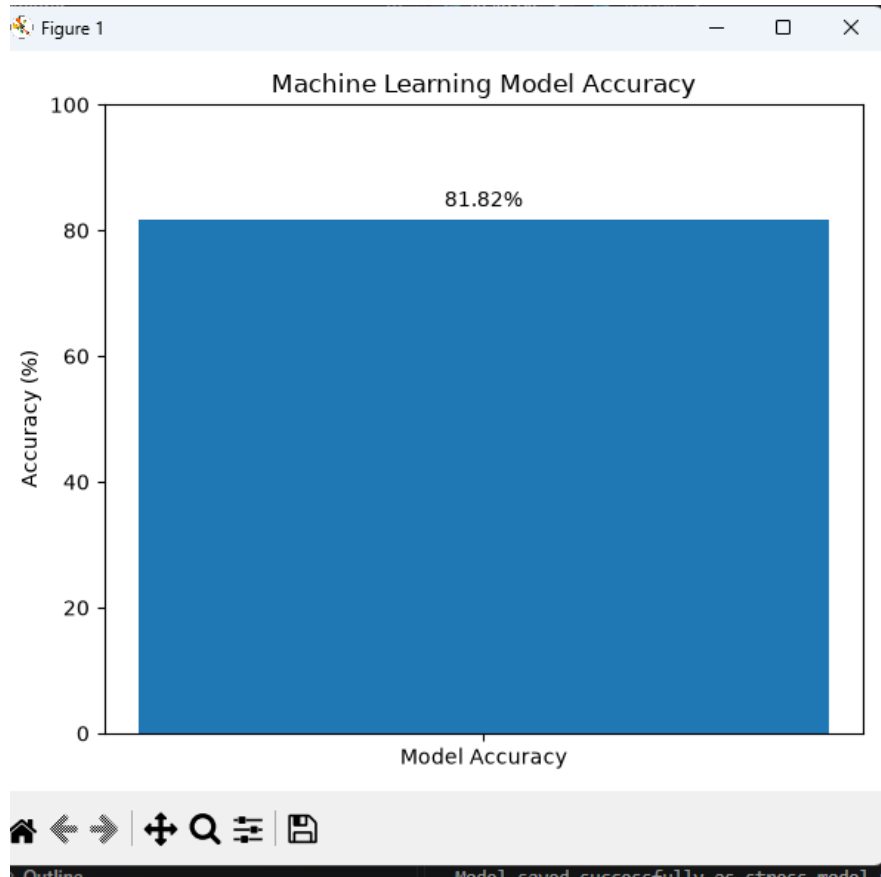
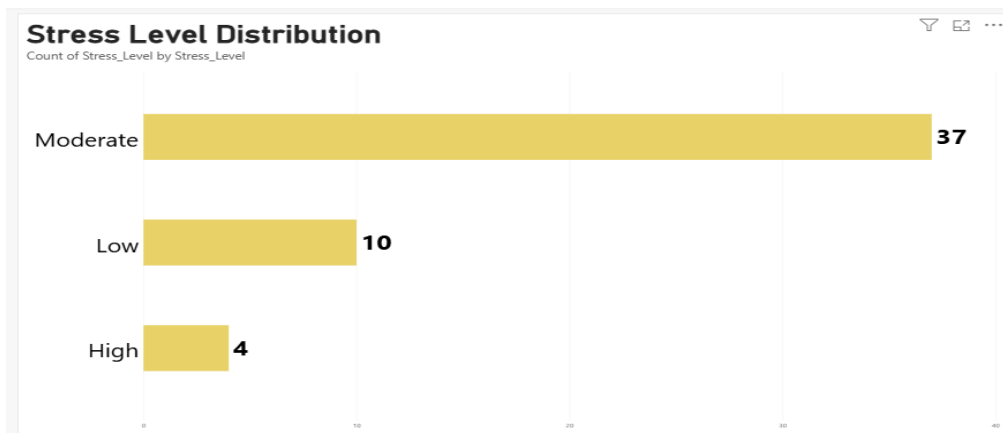
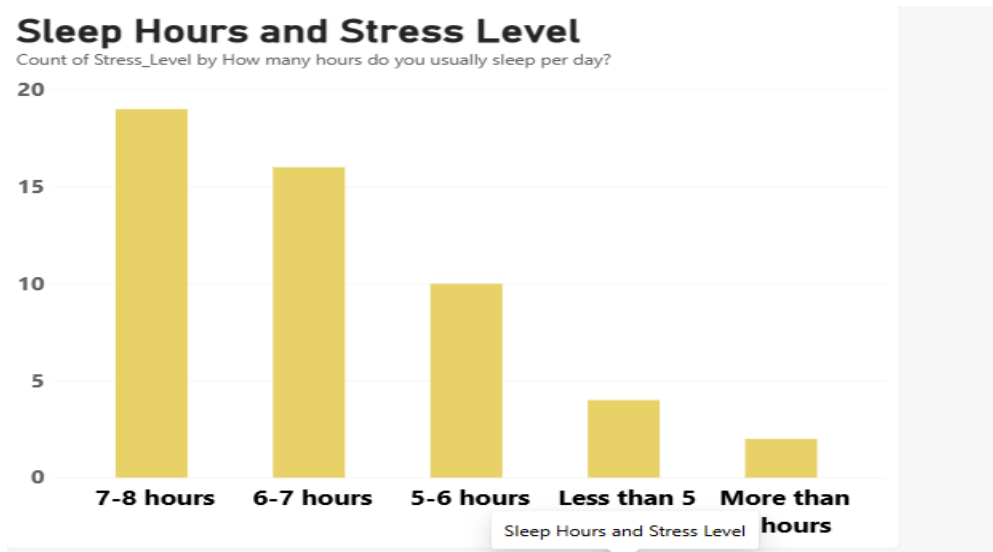
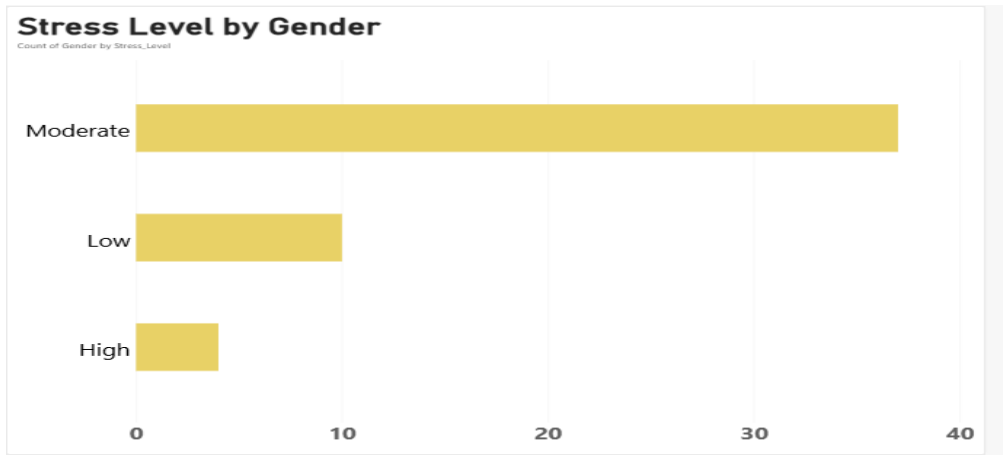


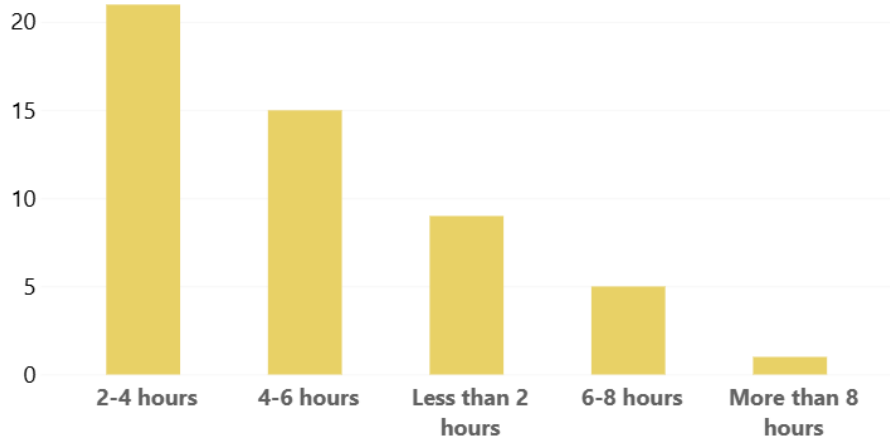
Figure 2: Power BI Analysis



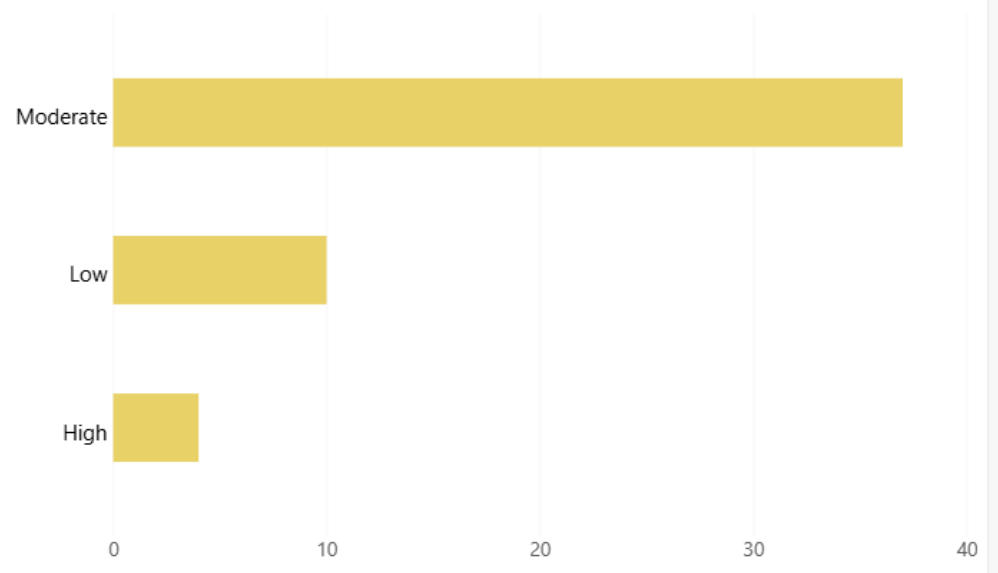


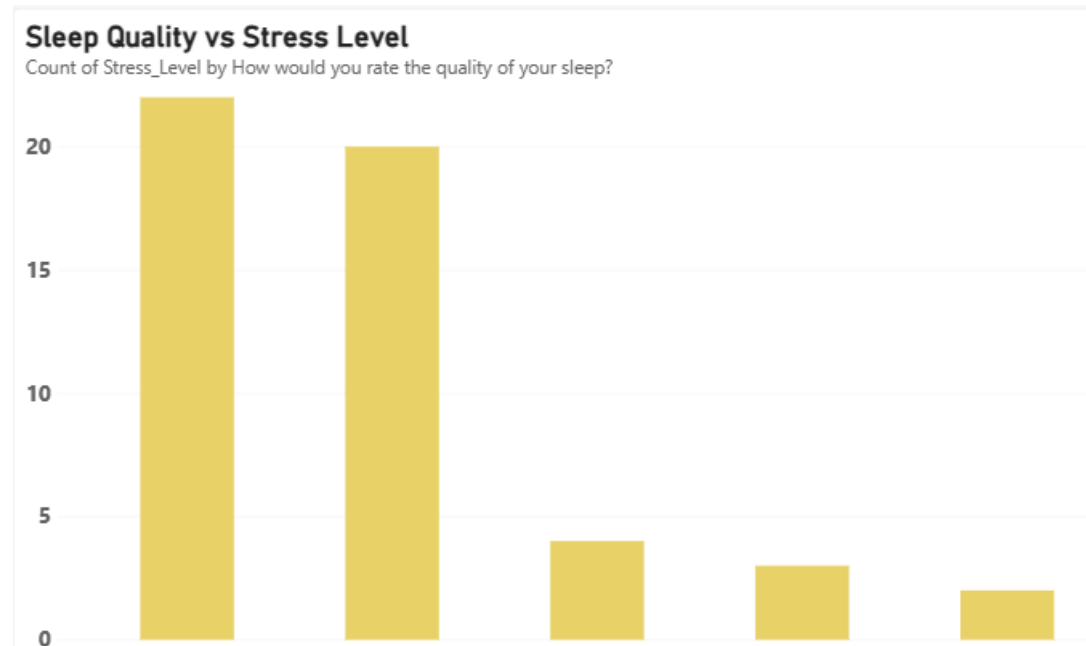
**Work/Study Hours and Stress**

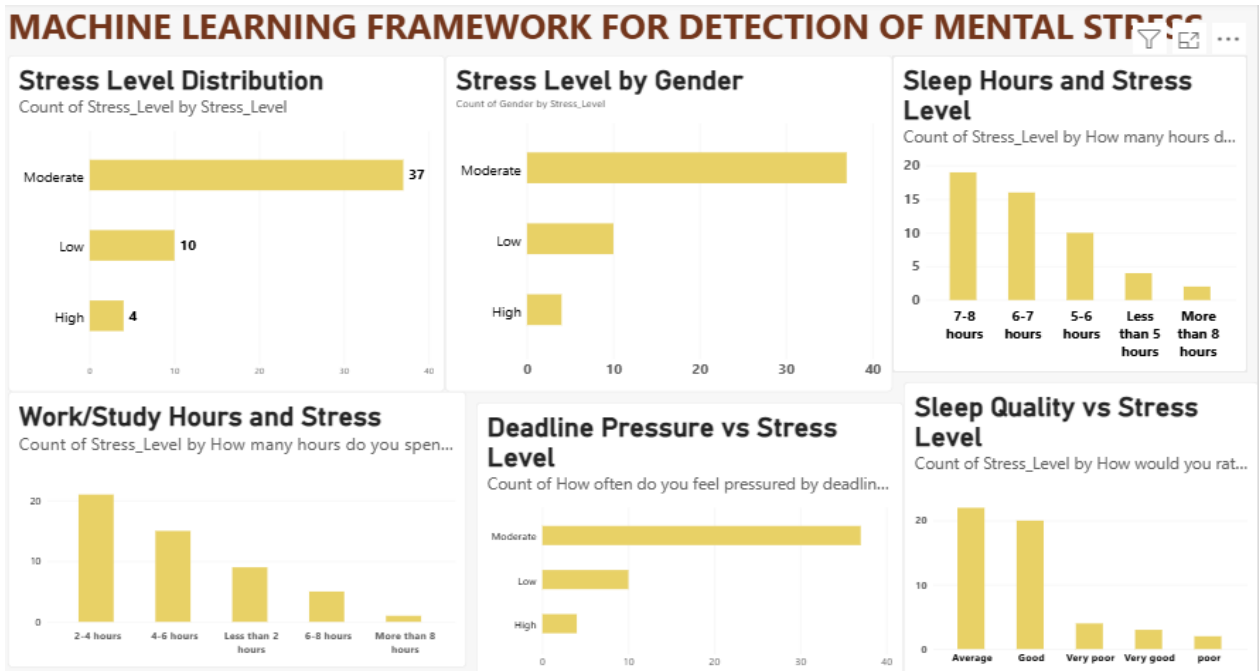
Count of Stress_Level by How many hours do you spend on screens per day outside essential work/study?

**Deadline Pressure vs Stress Level**

Count of How often do you feel pressured by deadlines, examinations, work targets, or other responsibilities? by Stress_Level







10. CONCLUSION

This research focused on developing a Machine Learning Framework for the Detection of Mental Stress. Data was collected through a structured Google Form containing questions related to factors such as sleep, daily activities, study/work patterns, lifestyle, and other factors associated with mental stress.

The collected data was preprocessed and prepared for machine learning. Different classification algorithms were applied to identify patterns related to mental stress. The performance of the models was evaluated using accuracy and other classification measures.

Among the models considered, the Decision Tree Classification Model achieved an accuracy of 81% in the results being reported for this project. This shows that machine learning can be useful for identifying patterns associated with mental stress from questionnaire-based data.

Overall, the study demonstrates the potential of machine learning as a supportive tool for mental-stress detection. However, the model should not be considered a medical diagnosis. In future work, a larger and more diverse dataset can be used to improve the reliability and performance of the framework.

LIMITATIONS AND FUTURE SCOPE

Limitations

The main limitation of this study is the relatively limited size of the dataset, which may affect the generalization of the machine learning model to a larger population. Since the data was collected through a questionnaire, the results depend on the accuracy and honesty of participants' self-reported responses. The framework also uses a limited number of features related to mental stress and may not consider all psychological, social, environmental, and lifestyle factors that can influence stress levels. Additionally, the model's performance may vary when tested on a different or larger dataset. The proposed system is designed as a supportive research and screening tool and should not be considered a substitute for professional medical or psychological diagnosis.

Future Scope

In the future, the proposed framework can be improved by collecting a larger and more diverse dataset from participants belonging to different age groups, backgrounds, and occupations. Additional relevant lifestyle, behavioral,



academic, and work-related features can be included to improve the model. Different machine learning and advanced ensemble algorithms can also be explored, along with feature selection and hyperparameter tuning, to improve prediction performance. The framework can further be developed into a user-friendly web or mobile application that allows users to enter their information and obtain a predicted stress category. Future research could also explore integrating wearable-device data such as sleep and activity patterns for more comprehensive stress monitoring.

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