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Predicting Stress and Mental Health Conditions Using Machine Learning

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I. INTRODUCTION

Mental health is very important in today's world because many people are struggling with mental health issues. Factors like sleep patterns, work hours, social interactions plays a big role in mental well-being. In modern life, stress, anxiety, and depression have become common due to a busy lifestyle. Many people suffer from stress because of poor sleep, long working hours, and difficulty in focusing on tasks, lack of physical activity, frequent irritation, and sudden mood changes.

These factors not only affect mental health but also impact physical health and daily life. When stress level increases, people may feel tired all the time, lose interest in their work, and find it hard to enjoy life. Long term stress can even lead to serious health problems like heart disease, high blood pressure, and weak immune system.

By understanding these factors, we can find ways to check a person's stress level. If stress is too high, we can take steps to reduce it such as improving sleep, managing work hours, exercising, and spending time with family and friends. If stress level are normal, we should maintain a healthy routine to keep mental health in balance.

MACHINE LEARNING IN STRESS PREDICTION

Machine learning plays an important role in stress prediction. It uses advanced algorithms to analyse a large amount of data and detect stress patters in individuals. By processing information from sleep patterns, work hours, and social interactions, machine learning models can identify and categorize stress level into different groups such as high stress, moderate stress, and low stress.

These are various machine learning techniques used in stress prediction. One of the main approaches is supervised learning, where the model is trained using labels. These techniques make stress prediction more accurate and efficient. Another approach is unsupervised learning, which helps in discovering hidden stress patterns without predefined labels.

Nowadays, artificial intelligence and machine learning are becoming popular in healthcare. By using these technologies, healthcare professionals can collect patient data, analyse stress level and provide personalized care based on individual needs. This helps in early stress detection and improves mental health management.

LOGISTIC REGRESSION

Logistic Regression is widely used to predict stress level. It works by analysing various factors such as sleep patterns, work hours, and social interactions. Based on this analysis, the algorithm classifies individuals into different stress categories such as high stress, moderate stress, low stress, depending on their total score.

One of the main advantages of logistic regression is that it is easy to implement, simple to interpret, and highly efficient for training models. This makes it popular choice for stress prediction, as it can quickly process data and provide accurate results.

It is particularly useful for stress prediction because it can quickly process large datasets and provide accurate classifications. Additionally, logistic regression works well with both binary classification (stress vs no stress) and multi-class classification (low, moderate, high stress), making it a flexible and effective tool for mental health research. Due to its efficiency and accuracy, logistic regression is widely used in healthcare and psychology to monitor stress levels and develop effective intervention strategies

MACHINE LEARNING STEPS:

To build an efficient machine learning model for stress prediction, the following key steps are involved:

1. DATA COLLECTION: The dataset includes responses to questions related to sleep hours, work hours, focus difficulty, physical activity, social interactions, irritability, and sudden mood changes. These factors

help to assess the mental stress level of individuals. The data was collected through surveys where participants selected predefined response options for each questions, ensuring consistency and easy to analyse.

2. DATA PRE-PROCESSING: The collected data is converted into numerical scores and total score is computed to determine the stress level categories (low, moderate, high). The dataset has no missing values or inconsistencies since responses were collected using predefined options. Normalization was not required as categorical responses were used directly in the model.

3. MODEL TRAINING: The pre-processed data is used to train a Logistic Regression model, where the total score is considered as the target attribute. The model classifies individuals into different stress levels (low, moderate, high) based on their responses. The training process involves mapping input features to the corresponding stress level to recognize patterns in the data effectively.

4. MODEL EVALUATION: The performance of trained model was evaluated using accuracy, which measures how the model classifies individuals into the correct stress levels. The accuracy was calculated using the formula:

Accuracy= Number of correct predictions/ Total number of predictions)*100

HOW TO ANALYZE

Logistic Regression is a statistical method used for classification problems, and it is useful for predicting stress levels. It works by adding the scores for each option chosen by the user. The total score is then used to classify individuals into different stress categories. This algorithm is particularly effective in handling categorical data and provides clear insights into how different stress levels are predicted.

Table 1.1: Example of Scoring System for Stress Prediction

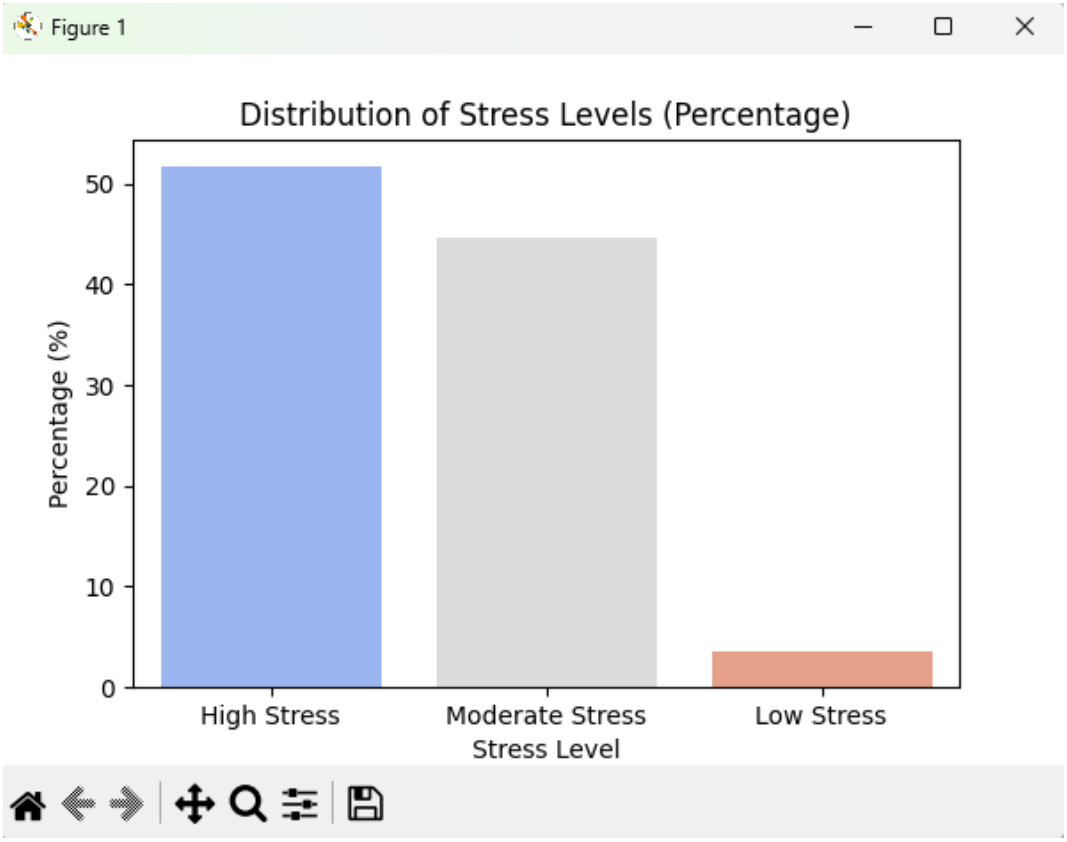
QUESTION	OPTIONS	ASSIGNED SCORE
Sleep Hours	<4hrs, 4-6hrs, 6-8hrs, >8hrs	5,3,1,0
Wake-up Refreshment	No, Sometimes, Yes	5,3,0
Work/Study Stress	Always, Sometimes, Never	5,3,0
Focus Difficulty	Very Difficult, Sometimes Difficult, Not Difficult	5,3,0
Physical Activity	Never, Once a week, Daily	5,3,0
Social Interaction	Yes, No	5,0
Irritation Without Reason	Always, Sometimes, Never	5,3,0
Mood Changes	Frequently, Sometimes, Rarely/Never	5,3,0

To analyse stress levels, the dataset was processed by calculating total scores based on each user's responses. Each options was assigned with a predefined score, and the total score determined the stress category of the individual (low, moderate, or high). The Logistic Regression model was then applied to classify individuals into these categories. The model's prediction were compared with the actual stress levels derived from the total scores to calculate accuracy.

Table 1.2: Predicted Stress Levels vs Actual Stress Levels

S.NO	TOTAL SCORE	ACTUAL STRESS LEVEL	PREDICTED STRESS LEVEL
1	5	Low Stress	Low Stress
2	25	High Stress	High Stress
3	15	Moderate Stress	Moderate Stress
4	2	Low Stress	Low Stress
5	11	Moderate Stress	Moderate Stress

OUTPUT



The bar graph titled "Distribution of Stress Levels (percentage)" illustrates the percentage of individuals experiencing different levels of stress. The X-axis represents three categories of stress levels: High Stress, Moderate Stress, and Low Stress, while Y-axis indicates the percentage of individuals in each category. From the graph, it is clearly shown that High Stress has the highest percentage. Moderate Stress indicates that a considerable number of people also experience moderate level of stress, but at a manageable level. Low Stress has the smallest percentage, showing that only a few individuals experience minimal stress. This data suggest that stress is one of the common issue, with most of the individuals falling into the high or moderate stress categories. This highlights the need for effective stress management strategies to improve overall well-being and reduce the impact of stress on daily life.

ACCURACY

The accuracy is a good metric for balanced classification tasks. The accuracy of this model is **94.4%**, which indicates that the model is correctly predicted the outcome.

The formula used to calculate accuracy is:

Accuracy= Number of correct predictions/ Total number of predictions)*100

II. CONCLUSION

The study on Stress and Mental Health Prediction highlights the significance of identifying stress levels using machine learning techniques. By analysing key factors such as sleep patterns, work hours, focus difficulty, physical activity, and mood changes, the model successfully classifies individuals into different stress categories: low, moderate, and high stress.

The Logistic Regression model used in stress prediction demonstrates its reliability and efficiency, providing an accuracy of 94.4%, which indicates a reliable classification of stress levels. The use of a structured dataset and predefined scoring system enables better assessment and early identification of stress-related issues.

The results from this study emphasize the growing importance of mental health awareness and the need for proactive stress management strategies. Overall, this research contributes to the field of mental health monitoring by demonstrating how machine learning can be used to categorize stress levels and support mental well-being strategies.