

Student Stress Level Prediction through Academic and Lifestyle data using ML

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Abstract - Student stress is a growing issue in educational institutions due to academic pressure, lifestyle imbalance, and increased digital engagement. Traditional methods of stress assessment rely on manual surveys and counseling, which are time-consuming and subjective. This project presents a machine learning-based Student Stress Level Prediction System that analyzes academic, personal, and lifestyle factors to classify students into Low, Moderate, or High stress levels. Multiple machine learning algorithms are evaluated, and the best-performing model is used for prediction. The system is implemented using Python and integrated with a Streamlit web application to provide real-time and user-friendly stress prediction.

Key Words: Stress detection, Machine learning, Random Forest Classifier, Decision Tree Classifier, Logistic Regression, KNN, SVM.

1. INTRODUCTION

The problem of student stress has become more prominent in recent years. This is largely due to the increased academic expectations placed on students, changing social habits, and increasing use of technology. Academic work load, lack of sleep and social media use, along with limited time to relax can significantly impact how students are feeling and performing academically. Current methods used to identify stressed students (such as surveys and counseling) are often slow and difficult to administer across a large number of students. New machine learning technologies allow for the use of academic and lifestyle data to create a more efficient way of identifying the stress levels of students. This study develops a Machine Learning-based Student Stress Prediction System that uses machine learning algorithms including Random Forest, Decision Tree, Logistic Regression, Support Vector Machine (SVM), K-Nearest Neighbors (KNN) to classify students into low, medium and high stress categories. The system is developed using Python and the Streamlit platform, with an intuitive user interface where users can enter student demographics to produce an accurate prediction of student stress level. The system will enable early identification of students in distress so that institutions can provide their students with timely assistance, thereby improving student mental health and academic success. Student stress is becoming an increasingly common concern in today's schools and colleges. The reason is primarily due to academic stress and to stress caused by living conditions (lifestyle). When a student experiences elevated amounts of stress for prolonged periods of time, their mental well-being and ability to perform academically can be adversely affected. Traditional approaches for detecting student stress (e.g., student surveys/counseling) require a substantial amount of time and are not scalable.

However, machine learning techniques make it possible to use student data to predict levels of student stress much more quickly. Additionally, using predictive systems to identify students who may be stressed allows academic institutions to provide their students with earlier support than they would otherwise be able to do. Ultimately, this can lead to improved well-being for those students[1]. Enrique Macías-Arias and his group of researchers have shown that due to academic pressure and lifestyle choices, student stress is increasingly being perceived as a problem in the education systems. As a result of all these different forms of stress, students are negatively affected in their mental health and academic performance as well. By applying machine learning techniques to both academic performance and behavioral data from students, researchers have been able to utilize predictive analytics to make accurate predictions about student stress. Institutions will be able to use predictive models to identify students with high levels of stress before they realize that they are stressed and provide them with adequate support in a timely manner[2]. According to Shahid Shabeer Malik and Aneeqe Khan, due to academic demands, social pressure, and lifestyle choices, student stress has been recognized in higher education as a serious consequence of this phenomenon. High levels of stress negatively affect students' mental health and academic performance, as well as their overall quality of life. Traditional methods of assessing stress, such as counselling and surveys, can be time-consuming and lack scalability; therefore, machine learning provides an adequate mechanism for evaluating student-related data and recognising the patterns of stress. Institutions can use predictive models to identify students at risk of

stress and offer timely assistance to enhance students' mental health and well-being[3]. Anuradha Parasar & her team, The increasing pressure placed on students from academic, societal and health-related issues, has made student stress a significant issue for current educational settings. It has become apparent that high levels of stress have had a negative impact on students' mental health; learning skills; and their academic performance. Many traditional means of assessing stress have been done through manual effort and time-consuming processes that have resulted in delayed or missed opportunities for early detection. Machine learning offers a more efficient means of analyzing a variety of academic, psychological and behavioral data to predict stress levels for students. By using these predictive models, schools may be in a position to identify at-risk students early on and implement effective early intervention strategies to enhance student well-being[4].

2. OBJECTIVE

- Assessing student stressors including schoolwork completion pressure, how many hours of studying they get, amount of sleep, and amount of time spent on social media.
- Creating a machine learning model that will estimate student stress levels using both academics and lifestyle variables.
- Categorizing students into 3 categories of stress - low, moderate, high.
- Testing several types of machine learning models (e.g., Random Forest, Decision Tree, Logistic Regression, SVM, KNN) to identify the one with the best overall predictive performance.
- Developing an easy-to-use web-based application using Streamlit for students to will indicate their current level of stress.
- Providing students and colleges with a means to recognize stressors before they become severe and allow for intervening with preventive measures.
- Utilizing data to provide students with insight that will improve their wellness and their academic success.

2. LITERATURE SURVEY

[1]L. Rahunathan, A. Suhana Nafais (2023). Machine Learning Model for Student Stress Level Prediction. Causes of Current Research on Machine Learning Setting For Predicting Student Stress Levels have been primarily Around Student Factors of Academic, Behavioral, Social and Lifestyle (ie sleep, academic performance, social support). The most common Algorithms used for classifying Student Stressed Levels are Logistic Regression, Decision Tree, Random Forest, Support Vector Machine and K-Nearest Neighbors. Conducted out of many characteristics such as quality of sleep, academic performance, available social supports, and history underlying student's MHA, these Unique Characteristics will also assist in Identifying Patterns Associated with Student Stress. The Findings of the research support the use of Machine Learning for Efficiently supporting identifying students with high stress levels thereby facilitating colleges with the ability to proactively provide Early interventions to assist with Student Mental Health. [2]The paper "Stress Detection Among Higher Education Students: A Comprehensive Systematic Review of Machine Learning Approaches," written by Enrique Macías, Jorge Parraga-Alava, and David Zambrano, gives a thorough examination of various machine learning algorithms used to determine the level of stress in university students. The algorithms being evaluated in this paper include Logistic Regression, Support Vector Machine (SVM), Decision Tree, Random Forest, and K-Nearest Neighbors as means of predicting stress in students. The study demonstrates that machine learning models rely on three core types of data (academic, behavioral, and psychological) to reveal patterns of stress in university students. The authors stress that there are several elements that improve the accuracy of machine learning models when predicting student stress including data preprocessing, feature selection, and model evaluation. In particular, they found that Random Forest and other ensemble models produce more accurate results than other types of traditional classifiers. Overall, the conclusion of the study is that machine learning can effectively assist in the identification of stress in university students and give educational institutions the ability to provide timely interventions. [3]Shahid Shabeer Malik, Aneeq Khan, Anxiety, Depression, and Stress Prediction Using Machine Learning Algorithms in College Students is a study that will utilize a machine learning approach to identify mental health problems in college students. The focus of this research will be on how to predict anxiety and depression as well as the levels of stress experienced by college students using a variety of supervised learning algorithms, along with the factors that have influenced the prediction of mental health issues such as school-related stressors, lifestyle habits, etc. In order to determine the best machine learning model for predicting mental health problems among college students, many different machine learning models will be used, and the results of each of the models will be compared to determine which machine learning model(s) provides the most accurate predictions about mental health problems in college students. The findings of this research demonstrate that various machine learning techniques have the ability to successfully identify college students who may have risk of stress and/or mental health issues associated with their college experience.

The authors of the study also provide evidence that early identification of mental health issues for college students is important for enhancing students' overall well-being and academic performance. [4]Anuradha Parasar, Sujatha N, Sweta Priya, Pramod S, Sasi Kumar A, Kogila Palanimuthu have studied how machine learning can help assess the stress levels of students due to social media addiction using their social media use and behaviour patterns. They have looked at various factors like academic pressure, lifestyle choices and social media addiction to come up with indicators for stress. They will analyse this collected data using machine learning algorithms to develop different levels of stress across the students sampled. The findings of the research indicate that using machine learning algorithms, it is possible to detect student stress levels and monitor mental health issues before reaching crisis point. The proposed model will enable various educational institutions to identify students at risk and provide them with timely support. [5]Researchers from the fields of science and computer sciences at higher education institutions were responsible for conducting research that resulted in developing a predictive model. The predictive model uses a machine learning algorithm that has been developed to predict how and when students will be under stress based on a set of defined characteristics of students that indicate the level of stress (e.g., study habits, sleep level and social interaction). Students will be placed in either the "not stressed" or "stressed" category based on their response to stress levels, thus establishing an overall picture of student stress. Researchers attempted to test multiple types of algorithms through a comparative analysis to discover the best performing machine learning algorithm that provided the best results in predicting students' levels of stress. In conclusion, the results of this study demonstrate that there are strong correlations between student stress levels and identified student characteristics.

Therefore, early prediction of students likely to be under stress can be beneficial in some way to be able to provide assistance with their stress, thus improving their learning outcomes. [6]This study by Muskan Gupta, Ena Jain, Shreya Vashisth, & Aanchal Bisht explores the ability to predict the stress level of school kids in India using various types of model-based data. Data related to students' emotions and academia was collected from a sample of school children, including levelling criteria (workload), lifestyle, and psychological criteria. The researchers tested models to determine the ability to classify stress and measure the accuracy of each method. It was found that by utilising machine learning coupled with other methods of evaluating the stress level of students, problems that may occur to them due to mental health problems can be detected at a much earlier phase than would typically be observed. [7]Dr. Vishnukumar A, Kavitha A, Akshaya G, studying stress levels and predicting care by evaluating academic and behavioral data for students living in dorms have factored in items such as the students' academic load, their lifestyle, and their psychological indicators (e.g., anxiety, depression) to assess stress levels of students over time. Machine learning algorithms of varying types were used to classify students' stress levels, evaluate the prediction quality of the algorithms, and develop systems to identify students that exhibit high levels of stress. The findings of this study provide insight into the ability of machine learning models to identify students experiencing elevated stress levels, and that early prediction systems based upon these models will allow schools, colleges and universities to proactively monitor the mental well-being of students exhibiting high levels of stress and provide appropriate interventions promptly. [8]The research study called "Stress and Anxiety Level Prediction in Students Using Psychological Metrics and Machine Learning Techniques" included Hafiz Arslan Ramzan, Muhammad Arslan Ul Haq, Maria Sehar, Minahil Rauf, Muhammad Adnan, and Sadia Ramzan. The focuses of the research were psychological, physiological, academic, and social variables and how to measure and evaluate them. The researchers conducted a study on stress and anxiety levels with a sample of students using a dataset to identify factors contributing to stress levels.

Researcher employed machine learning/classification modeling analysis (Random Forest and correlation analysis) of the dataset to predict the degree of influence by each of the research variables (sleep quality, self-esteem, and academic pressure) on stress levels. The findings of the research indicate that the three principal factors listed above have the strongest influence on stress levels in the student population. Additionally, the findings support the proposition that machine learning techniques are an effective tool for analyzing patterns of student stress and for providing evidence for early identification and intervention to enhance the overall well-being and academic performance of students.

3. METHODOLOGY

In this research project, a machine learning approach been developed to determine how much stress the students have. The collection of questionnaire data (PSS and DASS-21) for the analysis, preprocessing of data items, selection of relevant features, and determination of student's stress levels using classification methods such as the K-Nearest Neighbors and Naïve Bayes were used for the creation of this method[1]. The data set was examined through a systematic review method and all the available machine-learning methods for predicting stress levels were examined. Several algorithms were included in the research, including: Support Vector Machines, Random Forest, Logistic Regression, Decision Tree and KNN were evaluated using existing data from the research[2]. The methodology in this research was to use surveys to collect data from students and then to apply different supervised machine-learning algorithms to determine mental illness (anxiety and

depression). After data preprocessing, data analysis and classification models were then used to determine student stress levels[3]. In this research, an analysis of the link between social media and student anxiety was performed using a machine-learning framework. The process consisted of data collection from social media habits, preprocessing the data, extracting features, and applying classification techniques to create models that predict the level of anxiousness students experienced[4]. To achieve that, the predictive modeling techniques of K-nearest neighbors (KNN) were applied, to find students in one of three levels of anxiousness: low, medium, or high, as predicted by another set of data collected from surveys asking questions about anxiousness[5]. In the study, data mining and machine learning techniques were applied to predict academic and/or behavioral factors of student anxiousness. From the data that were collected, algorithms such as support vector machine (SVM), random forest, naïve bayes, and linear regression were used to predict and classify the anxiousness of students[6]. The methodology of data collection for each student was used, then data were processed and examined to find appropriate data features, and by using several classification analyses, such as decision trees, random forest, logistic regression, and SVM, predictive models were created to report on the anxiousness of students[7]. In this research project, we set out to find the main factors of stress by using machine learning to analyze various features. The approach we used to complete this task was to analyze a data set by using correlation analysis and then analyze it again to determine which of the features were the most predictive of stress among students using Random Forest feature importance analysis [8].

4. EXISTING SYSTEM

In another study, Rahunathan et al. used a machine learning model to classify students' stress levels based on responses to the Perceived Stress Scale and DASS-21 questionnaires. Algorithms, such as Naïve Bayes and K-Nearest Neighbors (KNN), were applied to classify students into distinct categories of stress relative to the use of these two surveys. The authors concluded that machine learning methods can be used to classify student stress levels and potentially allow for early intervention in mental health issues [1]. The existing system classifies students' stress levels by using machine learning predictive modeling methods, including SVM, Random Forest, Decision Tree, Logistic Regression, and KNN. The combination of prediction algorithms applied to survey and questionnaire responses about each student's academic, psychological, and behavioral factors allows predictions of student stress, and therefore provides a mechanism to identify high-risk students and allow for appropriate early intervention. The limitation to the existing system is it relies primarily on limited survey-based data sets, which have the potential to limit accurate predictions and scalability of the system [2]. Another research study examined the ability of machine learning to predict anxiety, depression and stress in college students. Data for the study was collected using surveys and then classifiers were applied to classify students into categories representing those with mental health issues versus those without, showing that using data-driven methodologies can help with identifying and detecting mental health issues earlier[3]. Through the use of machine learning techniques, the researchers evaluated levels of stress in students by identifying key stress-inducing attributes using datasets from students. The research findings utilized methods such as correlation analysis and using Random Forest model for feature importance to find the psychological, physiological, academic, and social factors that contribute most to students' stress level, with findings indicating that sleep quality, anxiety, and self-esteem have a significant effect on students' levels of stress and their academic performance. The framework developed will assist institutions in identifying the most significant contributor(s) of student stress as well as assist in developing effective targeted interventions to improve the overall health of students[8]. Using machine learning techniques applied to survey-based data including academic and psychological factors, they predict the amount of stress each student experiences. They accomplish this by having students respond to a questionnaire that describes what has caused them stress. The responses to the questionnaire are used as input into a K-Nearest Neighbor classification model to determine whether the student has high levels of stress, or no stress at all, and provide recommendations for how to decrease their levels of stress. This study indicates that using machine learning can accurately identify patterns of student stress and help institutions to better support students with mental health issues[5]. Using machine learning algorithms implemented on data sets of students containing academic and behavioral information, student stress levels are predicted. The collected data is pre-processed for use in training classification models such as Support Vector Machine (SVM), Random Forest, Naïve Bayes and Linear Regression which will classify stress levels of students based on the same categorical variables ranging from exam pressure, use of the internet, and the amount of academic pressure experienced by students. This shows how well machine learning techniques such as these can effectively classify students into their level of stress and assist in early recognition of potential need for support[6]. Through the use of machine learning methods, a system currently exists which is capable of measuring and analysing the levels of stress experienced by students as a consequence of being addicted to social media. The data collected for this study consists of information regarding students' use of social media, along with their behavioural patterns and psychological aspects, in order to create an accurate and reliable set of machine learning models which can give an indication of an individual's level of stress by analysing patterns found within their dataset that reflect how excessive use of social media

creates stress in students. This shows that the use of machine learning is an effective means by which to detect patterns of stress and can therefore provide educational institutions with the ability to monitor their students' psychological state[4]. The study set out to develop a means of detecting the presence of mental stress in college students by means of applying machine learning algorithms to a set of behavioural and psychological data collected from students. The classifiers used in this study included: Decision Tree, Random Forest, Support Vector Machines (SVM), and Logistic Regression, to examine the data collected to develop and identify factors contributing to levels of stress in students and to subsequently classify students according to their level of stress. Based on the results produced from this analysis, there exists a clear indication that machine learning classifiers can be effectively used to provide early detection of mental stress and provide a means through which institutions can better aid student's psychological well-being in a student academic setting[7].



Fig. 1 System Architecture

5. PROPOSED SYSTEM

The objective of the system is to build an intelligent model for predicting student stress using machine learning based on both academic and lifestyle data. Data will include input parameters: study hours, amount of sleep, amount of academic workload, amount of social media usage, amount of physical activity and any other habits that influence student's stress. The first step in the overall system will be to perform a pre-processing phase on the original data set to remove missing data, remove noise, and convert all categorical variables into a numerical format through an appropriate encoding method. After pre-processing, exploratory analysis will be done to determine how each attribute relates to stress level. There will be a number of machine learning algorithms applied to the final data set to train the prediction model including Logistic

Regression, Decision Tree, Random Forest, Support Vector Machine (SVM) and K-Nearest Neighbours (K-NN). The data is split into train and test sets in order to evaluate each algorithm’s performance. To measure the performance of each model there are several metrics that need to be used, which include: accuracy, precision, recall, and F1-score, to identify the best-performing model. The model selected for the prediction when running the algorithms was the model with the highest prediction accuracy. The final model is trained and is being deployed through a user-friendly interface using Streamlit, allowing the user to enter their academic/lifestyle information to receive a stress level prediction in real-time. Once implemented in the classroom, this proposed system would allow students to early identify their stress level and to provide institutions and educators with insight to assist students making proactive decisions toward improving their mental health and academic success.

Table. 1 Accuracy of all the models

Models used	Accuracy
Random Forest Classifier	93.28%
Decision Tree Classifier	78.41%
SVM	65.70%
KNN	62.58%
Logistic Regression	51.53%

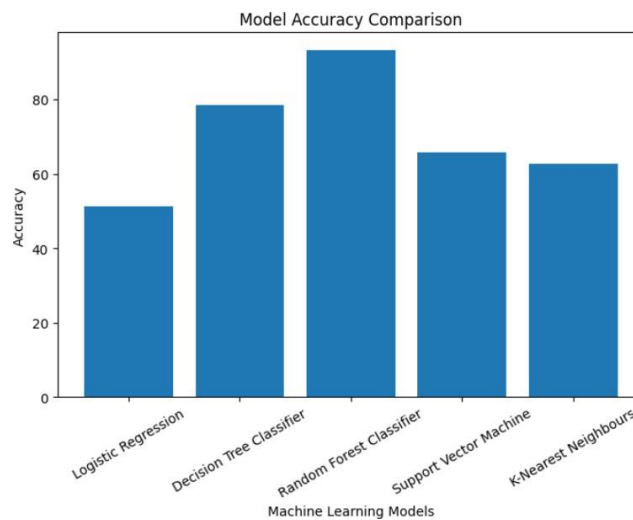


Fig. 2 Accuracy of Random Forest with other Algorithms

6. FUTURE SCOPE

Using larger amounts of information in future developments of the enhanced system will allow for better prediction accuracy and have the enhanced system connected or integrated with internet or mobile applications to allow real-time predictive capabilities. Real-time monitoring of student stress levels could be carried out through the use of one or more applications providing additional reliable data as a result of including alternative data sources. Other alternative data sources such as exercise habits, overall mental health and emotional indicators will produce a more comprehensive assessment of the student and will enable departments to provide individualized recommendations for maintaining a healthy academic lifestyle.

7. CONCLUSION

This project aims to predict student stress levels using various machine learning methods and models based on factors linked to the student's academics and how they live. For instance, amount of time studying, sleeping patterns, how much academic pressure they face, and how frequently they use social media are all included as input into the various machine learning algorithms used for analysis of the dataset and classification of the students into appropriate

stress categories (low, medium, and high) based on the prediction provided by each algorithm tested (ex: random forest was found to be most accurate and reliable). The data generated from this application of machine learning showed that patterns associated with student stress can be identified accurately using machine learning techniques. The information produced by this system will allow education institutions as well as students to identify stress early, and take proactive steps toward improving academic performance and overall well-being of their students.

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