



International Journal of Journalism and Mass Communication (IJJMC)

Received: 30/08/2025; Accepted: 11/09/2025;

Published: 11/09/2025

DOI: <https://doi.org/10.5281/zenodo.17101645>

Using machine learning to comprehend the mental health of students

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Abstract

The way in which mental health affects university students has become an increasing concern, thus dictating the need for new strategies dealing with early identification and preventive methods. This research aims at evaluating the machine learning algorithms for predicting future mental well-being based on academic records and social media usage of students. A comprehensive dataset was examined using different techniques like Support Vector Machines (SVM), k-Nearest Neighbors (kNN), AdaBoost, Neural Networks, and Random Forest employing several algorithms. The outcomes indicated that most machine learning models were accurate with 96.7% accuracy noted across them all. Therefore, this demonstrates that machine learning methods effectively identify latent patterns and predict individuals' personal mental changes among learners. These insights can be used to design appropriate interventions focusing on enhancing individual student's psychological health within schools of higher education.

Keywords: - *Machine learning, Predictive modeling, Deep Learning, Preprocessing*



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Introduction

The issues of college include things like school stress, problems with friends, and a change in lifestyle that may affect their mental health. Researching teachers have found out that those setting rules are starting to see more of these cases nowadays and concluded that we urgently take measures put up mechanisms to control the situation when it is had (Williams & Martin 2). Nevertheless, students have a hard time asking for help because the society expects them to be self-reliant or else they are weak if they visit psychologists or counsellors at school for instance. This lack of openness leads to minimal conversation among individuals who interact with peers hence many psychological issues remain unresolved.

Researchers have begun employing a sort of self-learning technology to facilitate the monitoring and management of mental health among students. It is quite difficult to notice such patterns as excellent results, being a student's friendliness with mates, as well as behavior without understanding accurately person's mental state when dealing directly with large data sets such as grades, relations in class or student behavior itself. As a result, it has made it easy for individual student beneficiaries to be recipients of personalized assistance geared towards reducing academic stress levels.

This research brings new knowledge to the ever-growing body of research in this area, including the promotion of artificial intelligence in mental health studies, through rigorous experiments. This investigation can support individual-based interventions and support systems that can improve overall life satisfaction and academic achievements for students. The article also provides an overview of some of the challenges and dilemmas that come with the deployment of machine learning models into the privacy-sensitive areas, such as mental health care, and speaks to responsible application of technologies to protect students' rights to privacy and self-governance.

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Literature Review/ Existing Studies

In Malaysia, there is a great concern about mental health problem in day-to-day life. The statistics gathered by the National Health and Morbidity Survey (NHMS) 2017 indicate that every one out of five Malaysians suffer from depression, two out of five have anxiety and one out of ten go through stress. These problems are common among university students. This problem is getting



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worse because the size of data increases without proper management or analysis which leads to lack of counselors.

Because of this paper addresses factors contributing to mental health issues in some first-year college students. In particular, this research seeks to use machine learning algorithms to categorize students into various categories according to on their mental health status namely; stress, depression and anxiety. The Data was gathered from students at a higher education institution situated in Kuala Terengganu.

Some of the techniques used are logistic regression, decision trees, neural networks, support vector machines and naïve bayes. Decision tree algorithm serves as the most accurate model for stress while support vector machine is highly recommended for treating depression and anxiety cases according to our findings from the research we did with college students in Kuala Terengganu.

International students usually undergo stresses that are not the same as those experienced by higher education students; thus, People frequently believe that these students are more likely to experience psychological issues. But every study to date has demonstrated that foreign students do not suffer from anxiety and depression more frequently than their native peers but rather the opposite is true. Hence this study seeks to find out why such unexpected findings could have been recorded by examining the resilience levels among international students in comparison with domestic ones. This is done through evaluating self-compassion as an emotion regulation strategy known for its ability to mitigate adverse consequences of stresses on mental health. Although favorable psychological results have been linked with SC within university settings, prior studies did not distinguish between global and local cohorts. Thus, the purpose of this current investigation involves comparing mean levels as well estimating effect sizes for self compassion between international and domestic students. Our analysis revealed that on average worldwide scholars had significantly greater amounts of SC than their nationals counterparts . In case these higher degrees were not there to shield against distress then it was expected that foreign learners would indicate more intense emotional suffering while indicating less mental soundness compared to home based peers.

Objective: Because of COVID-19, higher education changed as institutions went remote and students' mental health was challenged. Rural universities were disproportionately affected because of limited Internet access. The goal of this research was to investigate the psychological need satisfaction/frustration and mental health among rural college students during this pandemic.

Participants: Six hundred ninety-eight students ($M_{age} = 22.15 \pm 2.55$) at a rural South-eastern university were recruited.

Methods: Participants completed a survey examining stress, anxiety, need satisfaction/frustration, and previous experience with online courses.



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Results: Anxiety, autonomy, and competence frustration were discovered to be 60% variance predictors of stress. Another regression analysis found stress, autonomy, competence, and relatedness frustration to predict 70% of the anxiety variance.

Conclusions: Students are frustrated because to the absence of control and restrictions affecting their social interaction. Understanding the connection between need satisfaction/frustration and mental health can aid university administration in developing interventions that address rural students' needs.

The fear of contracting coronavirus and the measures put in place to curb the spread of the virus had a significant impact on peoples' lives. University students were the most impacted who had to adapt to new routines that forced them into unfamiliar territories. However, a few students did not report any sign of mental health issues, which suggests that inner strengths could have served as protective factors against distress. The purpose of this study was therefore to determine if resilience served as a mediator between emotion regulation and stress, anxiety, depression and post-traumatic stress disorder (PTSD) symptoms among college students using cross-sectional design. According to findings, mental well-being increased with higher employment of emotional management techniques while perception-of-self mediated all links with other dimensions showing specific associations depending on context specificity; future planned mediated relationship between depressive symptoms and regulation strategy use whereas family cohesion played this role for perceived stress levels; cognitive reappraisal used social resources through direct positive relationship suppression in relation with anxious feelings or PTSD awareness cognition about such an event occurring again. Such outcomes underscore the importance of being resilient during uncertain times like these.

The research attempts to investigate the scientific management of guidance and counseling to enhance students' mental health. Qualitative research, particularly employing a case study design, was chosen to delve deeply into the context, processes, and nuances of the phenomenon under investigation. According to the study's conclusions, advice and counseling teachers in state high schools in West Kalimantan, Indonesia, not just in response but also proactively safeguard students' mental health. They utilize a scientific approach involving observation and interviewing to comprehend students' holistic needs and challenges. Furthermore, they employ various counseling techniques, including individual counseling, group counseling, cognitive-behavioral approaches, as well as art and play therapy, to offer personalized support tailored to individual student needs.

The design of systems that use machine learning (ML) will have a significant mediating effect on the impact of ML on mental health. For this reason, we should look at contemporary HCI and computing research that addresses this issue. This paper presents a systematic review of the ACM Guide to Computing Literature to gain a deeper understanding of the current state of ML



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applications for mental health from an HCI and computing science perspective, complementing research perspectives from medical science and clinical psychology. Our work expands upon a recent review by Sanches et al. in this area.

The aim of this research is to investigate the effects of the lockdown imposed due to the devastating novel coronavirus (SARS-CoV-2) on the daily routines, activities, learning preferences, and mental well-being of young Indian students enrolled in undergraduate and graduate programmes at colleges and universities, as well as those attending classes IX to XII.

Numerous documented occurrences, such as mass shootings, have involved suspects with poor mental health. Early identification and awareness can aid in the person's recovery and return to a normal life by extending the necessary emotional support and care from friends and family as well as by supplying any necessary medical or professional assistance.

In these real-world applications, contemporary face expression detection system approaches are crucial. Usually, these methods consist of several elements, such as facial feature extraction, facial feature categorization, and facial localization and alignment.

The field is already paying enough attention to the main causes of mental health issues among college students, as seen by the collective focus on data that create aspects linked to sleep, activity, and social interactions.

Methodology

This part gives a full summary of the machine learning techniques used in this article to solve the problem of movie classification. A distinct algorithm for supervised machine learning were concentrated on by the researcher in this study including Random Forest, AdaBoost, Support Vector Machines, and K nearest neighbour. With a metropolis within 20 miles, universities are situated in suburban and rural (college town) environments. Because of this, these four datasets are distinct and suitable for used as benchmarks for different machine learning models. The steps involved in the methodology followed are feature extraction, pre-processing and evaluation of different matrices for each model used in this research as demonstrated by figure no. 1

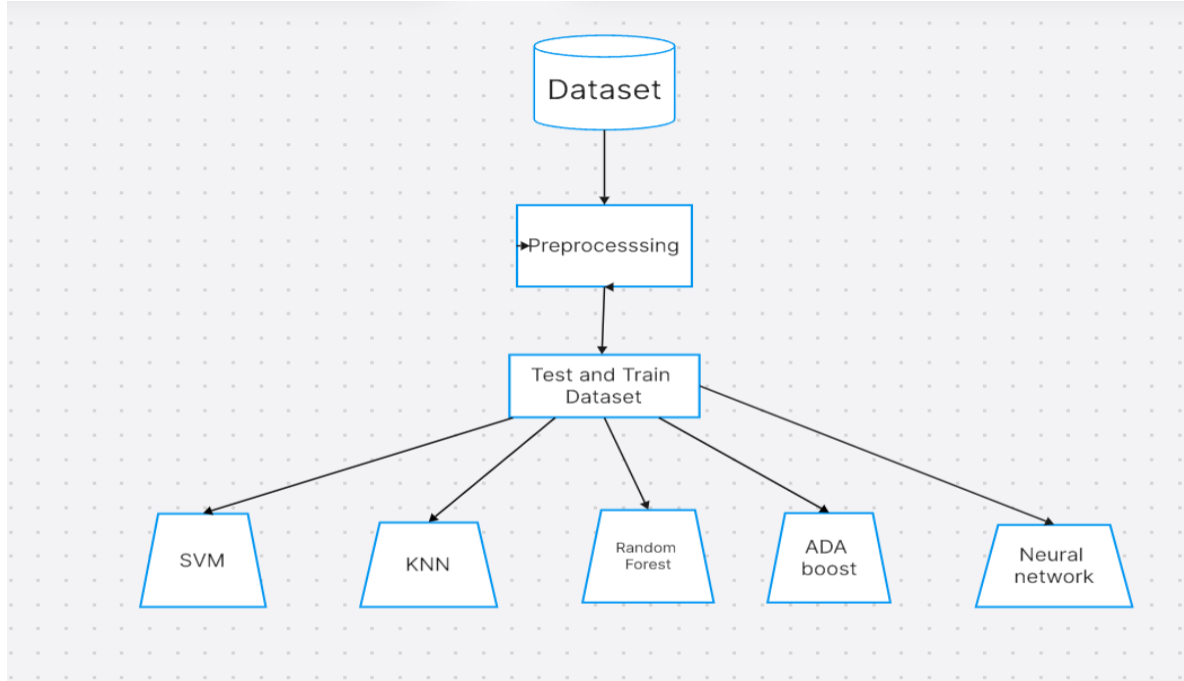


Fig. 1. Using of Different widget to test and train dataset

Dataset collection

At this stage, data was visually represented and patterns were discovered. This study employed the dataset from the Kaggle repository called "student stress factor." A full description of the characteristics is located in the table below that goes with it.

Preprocessing

There are 1100 rows and 21 columns in the original dataset. The table below represents various features in the dataset (Table 1). All the data is used to assess the effectiveness of many supervised machine learning models. The dataset is pre-processed and split into two files, which are tested and trained with a ratio of 90:10

Attribute	Type of attribute	Description of attribute
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Anxiety level	Float in range 0 to 21	It represents the anxiety level
Self-esteem	Float in range 0 to 30	It represents how we value and perceive ourselves
Mental Health History	Float in range 0 to 1	It represents the history of mental
Depression	Float in range 0 to 27	It represents the level of depression
Headache	Float in range 0 to 5	It represents the headache level
Blood pressure	Float in range 1 to 3	It represents the Blood pressure level
Sleep quality	Float in range 0 to 5	It represents the sleep quality level

SVM: One of the leading options for Supervised Learning tasks includes the Support Vector Machine, commonly known as the SVM, which works for both grouping things into categories and prediction of values. But mainly, the SVM is used for sorting things into categories in Machine Learning. SVM will attempt to draw the very best dividing line or border that separates the space



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in multiple dimensions into groups. Later on, this will assist us in assigning the new point to the appropriate group. We term such a hyperplane as the best border.

Knn : A guided machine learning technique called K-nearest neighbours (KNN) selects a location's group based on how close it is to other spots. It's a top pick and easy-to-use way to sort and guess in machine learning now. Lots of machine learning tools use KNN, such as: Suggesting systems, Idea finding, Filling in lost data, Spotting patterns, and Finance work.

AdaBoost : AdaBoost, which is short for Adaptive Boosting, is a mathematical model for sorting that was developed by Yoav Freund and Robert Schapire in 1995. They were awarded the 2003 Gödel Prize for this. It can be mixed with lots of other ways of learning to get better at its job. What the other ways to learn give out ('weak learners'), comes together in a mix that has certain weights. This mix tells you what the stronger sorter decides. Often, AdaBoost is used for two-group sorting, but you can make it fit for many groups or fixed ranges on the number line.

Neural Network: A brain-like system for tech, a neural network is a machine smartness training process which is used by making a pattern like that of the brain. This particular type of learning, deep learning, build in the sequential manner similar to the cells in brain. This way of machine learning is changing the existing system as machines get better by cleaning up their own mistakes. Thus, these computers are trained to handle challenging tasks like startups or picture finding with relevant hits.

Random Forest: Machine learning which is a combination of computer science and statistics is emerging as a superstar. One of the most popular technique is Random Forest. Random Forest refers to a series of tree-like models that work together to give one final output. In 2001 random forest was created by Leo Breiman and is now among the most significant approaches for machine learning assistants. In this paper, we will touch on the basic concepts of Random Forests and how to use them.

ROC: A ROC curve is a graphical representation concerning how strong the model that classifies different objects may be at all threshold levels that it can attain. This curve plots two things: the positive rate of good yeses and the bad yeses as well. The curve maps the good yes rates against the bad yes rates at various separation levels. In case you were to set the level lower, more stuff would get a yes, which means more good yeses but also more bad yeses.

Confusion matrix: This is an N-by-N grid. This grid attests to how well a naming scheme works. N is for the number of group names that you would like to give. This grid cross-references actual group names to the one the computer guesses. The mixed-up chart is used to check the sorting system to see how good it is. This tutorial explains the significance of the mix-up chart in machine learning.



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Test and score: A test result indicates the degree of fit of a certain test set. Train, validation, and test partitions are made of data. Scores for every part are checked. A good model may be indicated by the variation in test and training scores¹.

SVM

Predicted Value				
Actual		0	1	Σ
	0	410	148	558
	1	52	490	542
	Σ	462	638	1100

KNN

Predicted Value				
Actual		0	1	Σ
	0	557	1	558
	1	2	540	542
	Σ	559	541	1100

ADA Boost

Predicted Value				
Actual		0	1	Σ
	0	558	0	558
	1	3	539	542



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	Σ	561	539	1100
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Neural Network

Predicted Value				
Actual		0	1	Σ
	0	473	85	558
	1	69	473	542
	Σ	542	558	1100

Random Forest

Predicted Value				
Actual		0	1	Σ
	0	531	27	558
	1	16	526	542
	Σ	547	553	1100

Performance and Evaluation Matrices

Model	AUC	CA	F1	Prec	Recall	MCC
SVM	0.893	0.818	0.817	0.829	0.818	0.647
kNN	0.997	0.997	0.997	0.997	0.997	0.995
AdaBoost	1.000	0.997	0.997	0.997	0.997	0.995



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Neural Network	0.951	0.860	0.860	0.860	0.860	0.720
Random Forest	0.994	0.961	0.961	0.961	0.961	0.922

ROC :-

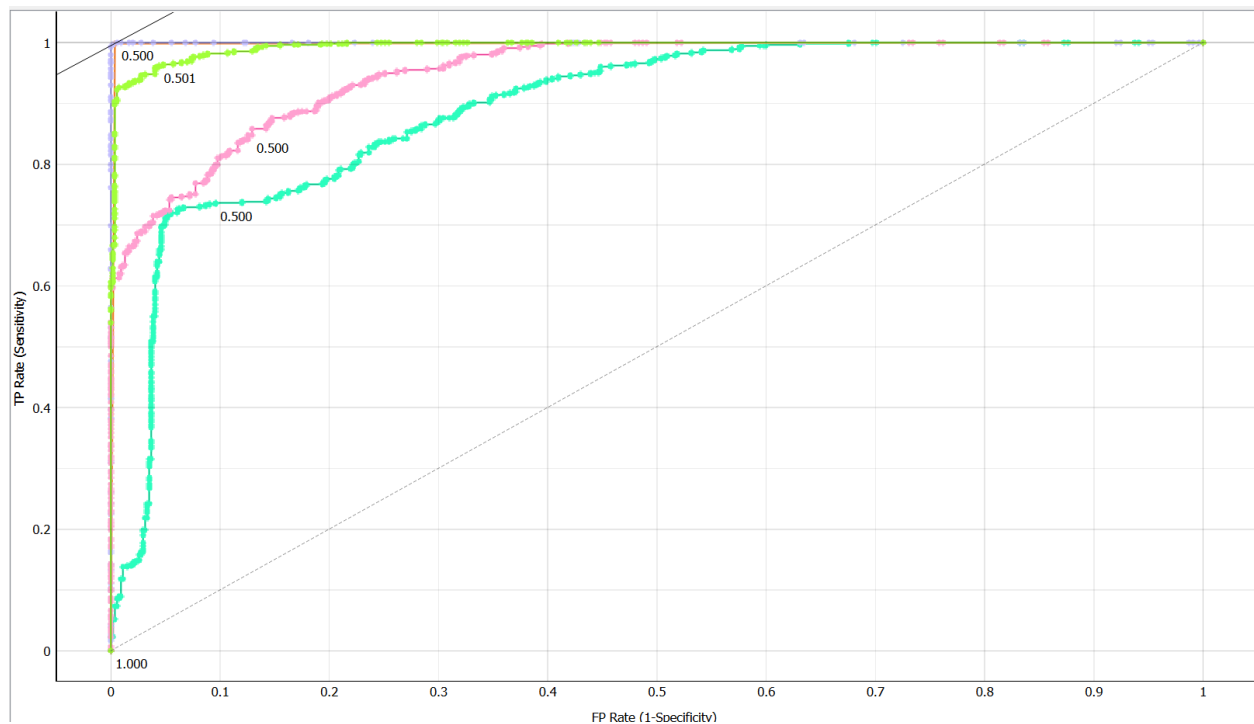


Fig.2 . ROC Analysis Graph

Result

The analysis of data revealed positive results, as the average accuracy was at 96.7% for all classification models. Different algorithms were used to assess each model's performance, such as Support Vector Machines (SVM), Random Forest, Ada Boost, k-Nearest Neighbors (kNN), Neural Networks and Naïve Bayes.

Support Vector Machines showed strong performance with 89.3% accuracy. The accuracy of Random Forest was also found to be close to that with a percentage of around 99.4%. On its side, Ada Boost achieved an accurate prediction with no mistake since it scored 100%. This displays the effectiveness of k-Nearest Neighbors in classifying the dataset since they had an accuracy value of 99.7%.



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The Neural Network algorithm finally reached a milestone by achieving an accuracy of 95.1%.

From these results, the dataset was suitable for classification task while using different algorithms which gave a good idea about what underlies this dataset. High accuracies from various models indicate that the dataset was robust while classifying using various techniques were effective.

Conclusion

According to our research, machine learning is crucial for university students' mental health. Different algorithms such as SVM, KNN, AdaBoost, Neural Network, and Random Forest have been applied to predict future outcomes linked to mental wellbeing based on school performance records on social networks. we found out promising results in our study, which achieved high accuracy in different performance measures. These results show machines efficiency in showing secret patterns as well as predicting personal mental health changes among students that help design individualized remedies.

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