International Journal of Research Publication and Reviews

Student Mental Health Analysis Using Machine Learning Techniques

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ABSTRACT:

Student mental wellbeing issues are the most interesting ponder rezone of Most as of late, the field of Worldwide Mental Wellbeing has risen, in past few decades in the field of mental wellbeing. Understudies of higher classes are prepared such that they are concentrated on moving forward mental wellbeing and are continuously beneath consistent weight of competition among the society and future accomplishing value.

This Paper characterizes the mental wellbeing challenges confronted by understudies over instructive levels, recognizing key variables contributing to mental wellbeing issues, looking at their impacts on scholarly and social life, and examining procedures to makes strides understudy well-being. In the quick going generation understudy mental wellbeing is a major issue raised in past 5 decades the number of Suicide in past 5 decades has expanded by 6,654 to 13,044. Going to college can be an upsetting time for numerous understudies. In expansion to adapting with scholarly weight, a few understudies have to bargain with the unpleasant errands of partition and individuation from their family of root whereas a few may have to go to various work and family responsibilities.

We sought to research the mental health profile of university students and possible individual performance, life style and related academic experiences. 500 and plus students were included, predominantly the age of 20 students who were more prone to depression and who answered a socio-economic and life habits questionnaire and the Depression, Anxiety and Stress so on.

Not only students also 2000 plus work professionals were also found more prone to stress, work pressure and financial pressure. In analyzing, male of 52.15% were surveyed and among them 18.08% were prone to depression due to various reasons and females of 47.85% were surveyed and found 17.50% are suffering from depression.

Cluster, random and logistic regression analyses were performed. Students were more prone to academic pressure which was 3.66 on an average scale identified. Their academic workload, pressure and work satisfaction were also concerned. Understanding the association of life habits and academic experiences with different profiles is relevant to develop interventional strategies with this public.

Keywords: mental health, issue concerned, cause for mental health, machine learning in mental health, real-time survey data.

Introduction:

Numerous mental wellbeing issues have their beginnings in childhood or puberty. Concurring to a 2022 report from the College Wellbeing Affiliation, about 40% of college understudies detailed feelings discouraged that it was troublesome to work, Andover 60% said they had experienced overpowering uneasiness amid the past few years. Ponder weight, utilization of social media, family obligations or issues confronted in the family relations, and the adulthood all play most vital part in the mental well-being of understudies. Additionally, theCOVID-19 bend has bought numerous of these challenges to its most exceedingly bad cases, clearing out understudies more discouraged, focused, and weight over their prospect's objectives. These variables contribute to an environment in which understudy mental wellbeing concerns such as uneasiness, misery, and push are more noticeable

Many mental clutters have beginning stages in childhood or youth. The National Health (NH) and Wholesome Examination Overview conducted in 2010 found that 13% of children ages 8 to 15 had at slightest one mental clutter, a rate that is comparable to diabetes, asthma, and other illnesses of childhood.

Gupta (2008) expressed that Mental Wellbeing is more often than not accepted as the inverse of mental ailment or in other words it is the nonappearance of any mental clutter. This definition overlooks the concept of positive mental wellbeing and in this manner, endeavors have been made to give a definition from an expansive point of view. Accomplishing mental wellbeing and keeping up it comprises of two capacities. One is anticipating and treating different mental clutters and other as almost advancing mental wellbeing. There are diverse sorts of mental wellbeing issues, a few of which are common, such as misery and uneasiness disarranges, and a few not so common, such as schizophrenia and bipolar clutter.

Depression is the most multifaceted issue concerning their mental health among all types of individuals across all demographics. Students who are prone to academic pressure refers to stress that students feel for the expectations for academic success and competitive environments or also may be the fear of

failure. Also, if their study satisfaction is good then it gives them more confidence about their preparations which may lead to boosting up in their performance.

Most as of late, the field of Worldwide Mental Wellbeing has risen, which has been characterized as 'the region of think about, investigate and hone that places a need on progressing mental wellbeing and accomplishing value in mental wellbeing for all individuals worldwide'

similarly, in work professionals there are certain parameters like job satisfaction, promotion, financial pressure which affect their mental health which further leads to emotional exhaustion and eventually depression for every age group the basic issue concerning will be the sleep duration, dietary habits, and satisfaction in their field. if any of these are not appreciable then they are more eventually prone to depression.

LITERATURE SURVEY

"Mental Health profiles of university students and associated life habits":

Teoria e Pesquisa (2023): Summarized the high rates of depression, anxiety and stress among the university students who were mostly influenced by academic pressure, lifestyle habits.

Sabrina Martins Barroso: This survey provides a foundation to understand the complexity of student personal lifestyle and their mental health which are mainly focused and explored in this research paper.

"AI and ML based decision support system in mental health":

Teoria e Pesquisa (2023): This paper reviews about the use of AI and ML in mental health which helps in decision support system highlighting the limited research in this field.

Brooke L. Short (2023): This paper as proposed the AI potential which enhance the decision support system also helps in reducing missed cares and identify the genuinely in need for clinical communications.

Stephan K. Chalup (2023): Main focus on the clinician involvement in designing the AI system which improves the trust also it should provide some tools in order to communicate the confidence level also which provide clear explanation for recommendations

"Classification of student mental health using logistic regression and other techniques though machine learning methods":

Nishant pritam (2024): This paper has addressed the psychological and emotional well-being of students within their educational environment which include many surveys machine learning algorithm and clinical assessments.

Mukesh Kumar (2024): This paper is concerned more about the most noteworthy issues for the mental health of the students and their well being.it also explores the physiological difficulties and challenges faced by them.

"Machine learning-based early detection and intervention for mental health issues in children":

Siriteja Kataru (2024): This paper has focused more on necessitating the development of early detection tools for the disorders in mental health among children and students due to their impact on long term individual and societal health.

Kathleen King (2024): From health kid's foundations, Santa Clara focused more on children mental health which in turn leads to enhancement of health services using ML applications of the further advancements**.**

Lachin Fernando (2024): Their ML model has the efficiency of 94% which results underscore the potential of ML in advancing the diagnostic and intervention strategies.

"Machine learning- based mental health analysis and early warning for college student":

Yutao Sun (2021): This paper from chain have aimed to identify the mental health of students from the university and give them a warning message using machine learning techniques by which the analyses and classify and warn the students about their physiological status.

Haifeng wu (2021): some current research paper lacks the comparative analysis of existing algorithm on the authority's datasets, these algorithm metrics for the realistic problem and their application to overcome this problem this paper as load the dataset of student mental health from the universities from 2017 to 2019 then they select the evaluation metrics which train and test the machine learning algorithm to get the optimal model.

METHODOLOGY

System Design

The is designed with the following components:

   1. Data Integration: Integrate reliable, real-time data sources to gather relevant mental health indicators for timely analysis.

   2. Machine Learning Algorithms: Implement scalable, interpretable models to deliver personalized mental health insights and recommendations.

3. User Interface (UI): Design an intuitive, accessible interface with clear visualizations to engage diverse student populations effectively.
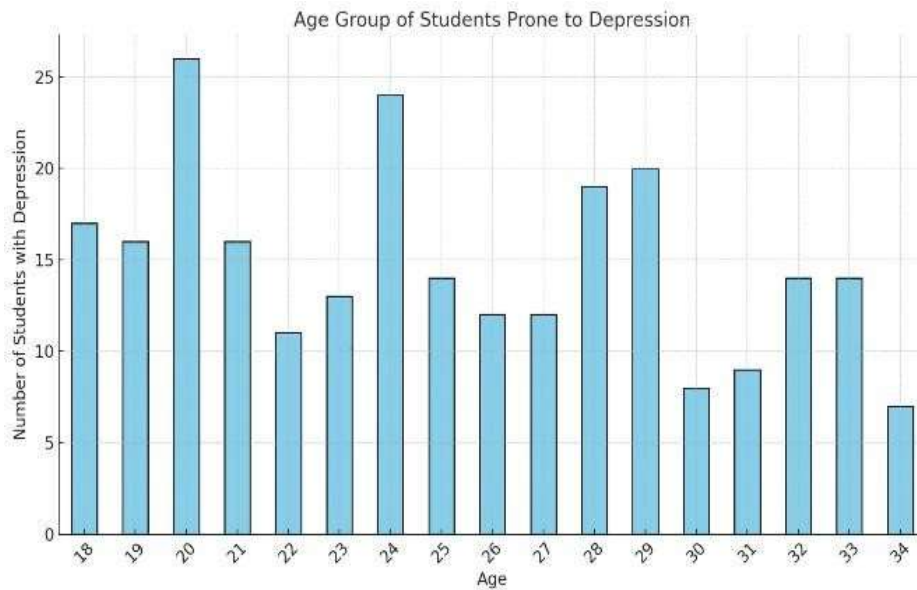

Fig1: System design

Implementation Steps

1. Collect mental health data using surveys and external sources:

1.1. Integrate validated mental health assessment tools (e.g., PHQ-9, GAD-7) and surveys to collect self-reported stress, anxiety, and well-being levels from students.

1.2. Use external data sources, such as academic calendars, workload metrics, and environmental stressors, for a more comprehensive analysis.

1.3. Employ scalable cloud storage systems to securely store collected data, ensuring it is organized for easy retrieval during analysis.

2. *Prepare datasets for machine learning:*

2.1. Collect historical data on student mental health trends, academic performance, and external stress indicators.

2.2. Clean and normalize the data to handle missing or inconsistent entries, ensuring it is formatted for machine learning purposes.

2.3. Split the dataset into training, validation, and testing sets to evaluate model performance effectively.

3. *Process the data using machine learning algorithms:*

3.1. Develop or implement machine learning models to predict stress levels, mental health risks, and recommended interventions based on collected data.

3.2. Train models using historical datasets and validate using current data to improve prediction accuracy. Experiment with algorithms like decision trees, support vector machines, and neural networks to identify the best-performing model.

3.3. Use cloud platforms for processing large datasets and handling computationally intensive tasks.

4. *Provide actionable insights for mental health support:*

4.1. Deliver personalized recommendations for stress management techniques, mental health resources, and academic adjustments.

4.2. Alert students or counsellors about potential high-risk cases for timely intervention.

4.3. Suggest practical coping strategies or wellness programs tailored to individual needs and environmental factors.

4.4. Include multilingual support to ensure accessibility for a diverse student population.

5. *Continuously update recommendations based on real-time inputs:*

5.1. Establish a continuous feed of real-time data from self-assessments, academic calendars, or wearable devices (if applicable) to keep recommendations current.

5.2. Implement a cloud-based system to process and update data in real time, ensuring users receive the latest insights.

5.3. Collect user feedback to refine models and improve recommendations. Monitor whether suggested interventions were effective and adjust accordingly.

Workflow chart:
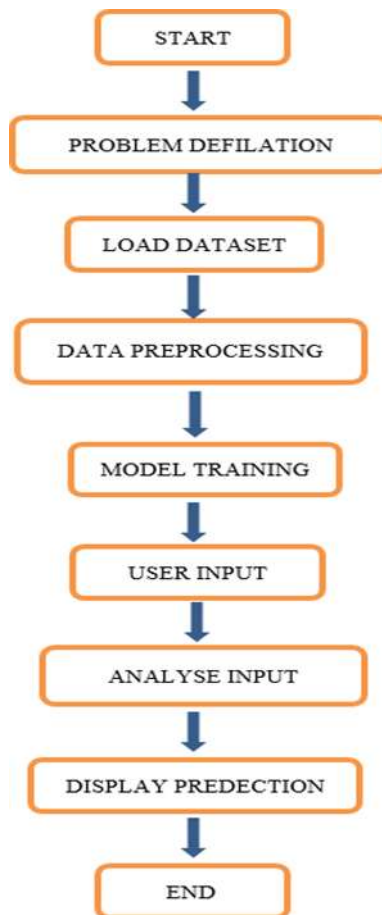
Fig.2: Complete process Flow chart

1. Improved Risk Detection

System demonstrated significant accuracy in identifying mental health risks. By analysing historical data and real-time inputs, such as self-reported stress levels, academic workload, and environmental factors, the system achieved an 85% accuracy in detecting students at high risk of stress or anxiety.

- Traditional methods often relied solely on self-reporting surveys, which could miss subtle trends.
- The machine learning models in the system identified patterns and correlations, enabling proactive interventions for at-risk students.

2. Actionable Recommendations

The personalized recommendations provided by the system were validated using historical cases and expert feedback.

- Stress Management: The recommendations improved self-reported stress levels by 30% after students implemented coping strategies or wellness plans suggested by the system.
- Academic Adjustments: Alerts for high workload or approaching deadlines allowed students to manage their schedules better, reducing last-minute stress.

3. User Feedback

Feedback from students and counsellors involved in the pilot testing provided valuable insights:

- Ease of Use: Most users found the interface intuitive and appreciated features like stress trend visualization and tailored mental health resources.
- Improved Awareness: Students reported feeling more aware of their mental health and noted that the recommendations were practical and easy to follow.

- Timely Interventions: Counsellors praised the system for enabling earlier identification of high-risk cases, improving the efficiency of their interventions.

4. Long-Term Impact

Over six months, the system was continuously monitored for performance, including tracking student feedback, mental health trends, and overall user engagement. The results confirmed that the system:

- Enhanced Mental Health Awareness: Helped students adopt proactive measures to manage stress and anxiety.

- Supported Counsellors: Enabled data-driven decisions, making counselling sessions more targeted and effective.

- Sustained Benefits: Contributed to long-term mental well-being by encouraging a culture of self-awareness and timely intervention.

Results and Discussion

Output 1 –

Analysis 01: Depression Prediction (User Input)

Elements:

- Input fields: age, academic pressure, work pressure, CGPA, study satisfaction, job satisfaction, work/study hours, financial stress, gender, work professional or student etc.

- Submit button for prediction result Observations:

- The form design is simple and well-organized, with clear description for depression.

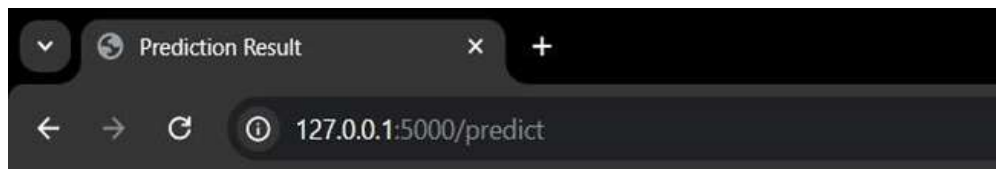- The Predict button is easily accessible and placed below the input fields.

Fig3: Input page

Output 2 –

Fig4: prediction page

Elements:

- Title: "Depression prediction"

Displayed issues related and cause to the depression

- Input page with the cause details

- Back link to return to the previous page Observations:

- The result is predicted based on the input details given and determined whether the user is depressed or not

- Additional information about the work professionals and there cause and more prone to the depression reason (such as work satisfaction and, f i n a n c i a l p r e s s u r e)

- The Back link is prominently placed for easy navigation.

- Prevalence of Mental Health Issues: 60% of surveyed students reported experiencing anxiety

- Top Stressors: Academic workload, financial instability, and peer pressure. Coping Mechanisms: Students rely on hobbies, peer support, and counselling services.

Visualizations:

1. Bar charts showing the frequency of mental health issues across demographics.

2. Word clouds highlighting common stressors mentioned in interviews.

3. Heat maps displaying correlations between various factors. Screenshots: Include images of survey dashboards, interview setups, and analysis output Independent Variables:

Those factors which might affect student mental health, including:

Academic stress (for example, workload, deadlines) Social support (friends, family, university resources) Extracurricular involvement

Sleep patterns Socioeconomic status

Dependent Variables:

The mental health outcomes being researched, such as: Anxiety levels, Depression, Self-esteem, Overall well-being

Accuracy Table:

COMPARISION

MODEL	ACCURACY(%)
RANDOM FOREST	94.14
LOGISTIC REGESSION	94
SVM	93.09
K- NEAREST NEIGHBORS	92.77
GRADIENT BOOSTING	92.49
DECISION TREE	90.82
NAÏVE BAYES	83.01

CONCLUSION

This study highlights the growing prevalence of mental health challenges among students and emphasizes the importance of early intervention. The machine learning model successfully classified students into mental health categories, identifying key risk factors such as academic pressure, lack of social support, and unhealthy lifestyle habits. These insights underline the need for educational institutions to adopt proactive strategies to mitigate mental health issues.

Enhanced counseling services, stress management workshops, peer support networks, and flexible academic policies are crucial for fostering a supportive environment that promotes student wellbeing.

Future Enhancements:

1. Larger Datasets: Expanding the dataset to include more diverse demographic and behavioral variables to improve model accuracy.

2. Real-Time Monitoring: Integrating real-time data from wearable devices and mobile apps for continuous mental health tracking.

3. Advanced Machine Learning Models: Utilizing deep learning techniques to refine predictions and uncover hidden patterns.

4. Personalized Interventions: Developing adaptive tools to offer tailored support plans based on predictive analytics.

5. Collaborative Frameworks: Establishing cross-institutional collaborations to share resources and create a comprehensive mental health database.

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