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Analysis of Mental Health Problems Among Higher Education Students using Machine Learning

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Abstract—Currently, mental health concerns pose a significant issue in Odisha. Generally, mental health problems affect a person's thoughts, feelings, actions, and communication. As per the 2017 National Health and Morbidity Survey (NHMS), one in five individuals in Odisha suffer from depression, two have anxiety, and one out of ten experiences stress. Additionally, students in higher education are at an elevated risk of developing mental health problems. However, helping a person with mental health concerns can be challenging due to difficulties in identifying the root causes of their condition. The main objectives of this study are to: 1. Explore mental health issues among higher education students. 2. Investigate the factors that contribute to these issues. 3. Assess the effectiveness of machine learning techniques in analyzing and predicting mental health problems among higher education students. Using computational modeling, this paper's findings will contribute to the ongoing discussion on mental health concerns in future research.

Keywords—*mental health problems, NHMS, higher education, analyzing, predicting*

I. INTRODUCTION

Mental illness is a health issue that unquestionably affects a person's emotions, reasoning, and social interactions. These issues have demonstrated that mental illness has severe repercussions across societies and necessitates new prevention and intervention strategies. For these objectives, early detection of mental illness is a crucial procedure. Medical predictive analytics will significantly transform the healthcare sector. Typically, mental illness is diagnosed based on an individual's self-report, which necessitates questionnaires designed to detect specific patterns of emotion or social interactions [1]. Many individuals will hopefully be able to recover from mental illness or emotional disorder if they receive the appropriate

care and treatment [2]. Machine learning is a technique that employs advanced statistical and probabilistic techniques to create systems that can improve with experience. It is believed to be an extremely valuable tool for predicting mental health. It enables numerous researchers to extract valuable information from data, provide personalized experiences, and develop intelligent automated systems [3]. The widely used machine learning algorithms support vector machine, random forest, and artificial neural networks have been employed to forecast and classify future events [4]. In the field of machine learning, supervised learning is the most widely used method in a variety of research, studies, and experiments, particularly in the field of disease prediction. In supervised learning, all data instances should contain the terms, attributes, and values. Specifically, supervised learning is a classification method that uses structured training data. Unsupervised learning, meanwhile, does not require supervision to predict. The primary objective of unsupervised learning is data management without supervision. It is extremely difficult for researchers to implement unsupervised learning techniques in clinical situations. The difficulty in recognizing the causes of mental health issues among students has been identified as one of the issues that have been identified. Biological, psychological, and environmental variables can have an effect on the factors. A few symptoms and circumstances are identical, resulting in complex and challenging diagnoses that cause doctors to misinterpret the nature of the disease [5]. Patients may obtain improper therapies. This circumstance may exacerbate a dangerous psychiatric illness that threatens both the emotional and behavioral functions of the patient (Elisabet, 2017) [6].

The objective of the research paper is to examine the mental health problem among higher education students and the factors contributing to it. Moreover, the article discusses the existing use of machine learning to analyze mental health problems among students in higher education. Accordingly, the purpose of this research paper is to share the description of the exploration of mental health problems among university students and the use of machine learning to analyze these mental health problems. According to the World Health Organization (WHO), mental health problems and mental disorders are characterized by abnormal thoughts, emotions, behaviors, and interpersonal relationships. People who suffer from mental health problems can experience difficulties in their daily activities and in their relationships with others. Currently, machine learning can be used to extract knowledge and improve the quality of medical care.

II. HIGHER EDUCATION SYSTEM IN ODISHA

Department of Higher Education, Odisha is a division of the Government of Odisha in India that oversees secondary and postsecondary education in the state of Odisha. [1] The department is responsible for the university, postgraduate, graduate, and higher secondary curriculums in the state of Odisha. The department is responsible for the hiring and employment of teachers and college professors in Government schools and colleges operated by the Government of Odisha. There are thirty universities in the state, eight of which are privately owned. The difference between these two universities is their respective financial support. The public universities are funded by the government. In addition, higher education includes certificate, diploma, undergraduate, and graduate levels. Certificate, Diploma, Bachelor's Degree, Master's Degree, and Doctor of Philosophy (PhD) are the five levels of higher education qualification. Certificate Level and Diploma Level are typically the first destination for students with a secondary school diploma from the Board of Secondary Education, Odisha (BSE Odisha). Diploma, post-secondary, or pre-university qualifications qualify a student for a Bachelor's degree. Next level is master's degree. It is for students who wish to continue their education beyond the bachelor's degree. PhD candidates must hold a master's degree. It

demonstrates that Odisha is a developing state that prioritises education. One of Odisha's strategies for becoming a high-income nation is to produce more graduates of high caliber. Higher education is essential for a developing nation because it will produce more professionals in the future. Higher education can have an effect on the economy and social environment, particularly human development and the eradication of poverty.

III. HIGHER EDUCATION AND MENTAL HEALTH PROBLEMS

Higher education refers to university life as a learning environment. It is difficult to navigate the challenges and obstacles of university life. However, success is not impossible for the student. Today's students grumble because university life is so stressful. The level of stress will increase toward the end of the semester. Compared to the beginning of the semester, the majority of students experience anxiety and depression at the end of the semester.

The stress level increased in relation to the learning process as a result of the assessment, workload, and examination period [7]. There are additional factors that affect the mental health of students. On the other hand, students are at a high risk for mental health issues due to family issues, a lack of clarity regarding their future careers, financial difficulties, and living away from home [8, 9]. Moreover, maintaining a balance between university and other demands can increase the risk of mental health issues.

In addition, the student with symptoms of mental health issues stated that they do not receive treatment and would not seek assistance for emotional issues [10]. The student feels it is unimportant because their peers experience the same symptoms and because it is common in college [11]. Nevertheless, some of them are aware that they require treatment, but they lack the courage to seek assistance. The negative stigma associated with people with mental health issues is also the reason why students do not seek treatment.

The stigma causes discrimination or prejudice against individuals with mental health issues in society [12]. Stigma associated with mental health issues has negative effects, so students with mental health issues do not seek treatment for fear of being labelled by society. Aside from that, they believe that "these people" are ill, overly

emotional, and insane. Therefore, it is essential that the university consider new approaches to encourage students with mental health issues to seek treatment.

IV. PROBLEMS ASSOCIATED WITH MENTAL HEALTH IN COLLEGE STUDENTS

The foundational and academic years of a student's life have a profound impact on subsequent years. College students are on the verge of experiencing new things despite being barely adults. They are exposed to a world that is unique and distinct from their high school environment. Additionally, they obtain freedom, which, while desirable, is also quite frightening. All of these factors contribute to pressure, which in turn affects college students' mental health. In their early adolescent years, student's transition from adolescents to mature adults; they have both responsibility and freedom. They are targeted by society and burdened with expectations, which negatively impact their mental health and make them susceptible to a variety of unfortunate problems.

Here are a few examples of mental health issues:

A. *Depression:*

Recent studies indicate that one in five college students suffer from recurring feelings of self-loathing and extreme sadness. This could be the result of excessive stress and anxiety. This could also be the result of not fitting in with groups or making friends. Additionally, the abundance of comparisons made possible by Instagram has exacerbated the problem. Not only do college students compare their looks and physical appearance to those of others, but they also compare their social status and material possessions. All of these have a severe impact on students' mental health. Depression can become increasingly intense and lead to suicidal ideation if it is not contained. Therefore, it is suggested that students share their grievances with individuals who are on their side. Sharing and conversing are not only effective means of mental release, but also a form of self-therapy.

B. *Stress and Anxiety:*

A college curriculum that is extremely demanding causes a great deal of stress. However,

academics are not the only contributing factor; constant anxiety over career decisions and the struggle to fit in can also add to their stress levels. Many individuals are unhappy and dissatisfied with the colleges they attend. This can cause even the brightest students to become dull and underperforming. Additionally, it causes them to lose their appetite and disrupts their sleep pattern. Adding depression and suicidal ideation to this mess creates a lethal cocktail of misery.

C. *Addiction:*

The levels of stress, anxiety, and suicidal ideation are exorbitant. Many students resort to unhealthy coping mechanisms in order to manage it. They may be exposed to cigarettes, alcohol, and marijuana if they associate with the incorrect people. This may cause physical and emotional complications in their lives. It can also result in extreme weakness and have irreversible effects on their bodies. Consequently, they spiral deeper into a pit of substance abuse and suicidal ideation. This significantly impairs the mental health of students.

D. *Eating Disorder:*

Substance abuse is not the only unhealthy coping mechanism employed by students. They also engage in excessive eating, particularly of fatty and sugary foods. This negatively impacts their physical appearance and health as a whole. Consequently, when they compare themselves to their peers, they become even more miserable. College students are at an easily manipulated and vulnerable age. Therefore, they must navigate this phase of their lives with care in order to maintain their sanity and standing. Additionally, they must be encouraged to seek professional care when necessary. The mental health of students is generally quite fragile, and even the slightest indication of a mental disorder must never be ignored.

E. *Factors of Mental Health Problems*

All identified factors are based on correlation or regression findings from a prior research paper. Typically, mental health problems are influenced by biological, social, and socioeconomic factors. Biological factor in mental health problems refers to dysfunctional nerve cell circuits or neural pathways that connect brain regions. The biological causes of mental health

issues include genetics, infections linked to brain damage, brain defects, and prenatal damage, among others. Several mental health problems, including schizophrenia, are associated with low birth weight. Social environment refers to a person's interaction with his or her surrounding environment and culture or way of life. It is about the relationships between family, friends, coworkers, and the local community. Insufficient social support and workplace discrimination are examples of social environment factors. Socioeconomic status reflects a person's financial situation. Financial issues become the leading causes of mental health issues. Typically, when individuals have a poor financial situation, they become stressed and anxious. Table 1 compares the factors associated with mental health issues among college students. Five out of ten research papers concluded that lack of social support financial problems and the learning environment are the leading causes of mental health problems among higher education students. Lack of social support was associated with mental health issues because inadequate social support increased stress. The term 'learning environment' refers to university life, evaluation, and learning style. Other factors include being female, being far from home, having a family problem, enduring childhood adversity, being LGBT and non-white, and being addicted to the internet. According to the comparison table, the majority of research focuses on medical fields such as nursing, pharmacy, and medicine. This demonstrates that medical personnel have a high risk for mental health issues.

V. MACHINE LEARNING

The scientific discipline of machine learning focuses on how computers learn, or acquire knowledge from data. The field of study that gives computers the ability to learn without being explicitly programmed. Four categories comprise machine learning: supervised learning, unsupervised learning, semi-supervised learning, and reinforcement learning in figure 1.

A. Supervised Learning

Supervised learning is when an algorithm learns from sample data and associated target responses consisting of numeric values or string

labels, such as classes or tags, to predict the correct response when presented with new examples. In supervised learning, target variables in the training dataset are labelled and the output vector is a vector. The analogy for supervised learning is a teacher providing numerous examples on a single topic for the student to memorise, from which the student derives general rules. In supervised learning, there are two categories of algorithms. Regression and classification are included. Regression algorithms include linear regression and logistic regression. Linear regression is a statistical tool used to model the relationship between "explanatory" variables and a real-world outcome. While the purpose of logistic regression is to describe the relationship between one dependent binary variable and one or more nominal, ordinal, interval, or ratio-level independent variables, logistic regression is also used to describe the relationship between two independent binary variables. Decision trees, Support Vector Machines (SVM), Naive Bayes, K-Nearest Neighbors (KNN), Random Forest, and Artificial Neural Networks (ANN) are classification algorithms [21].

Classification based on a series of if-then rules. SVM is a classifier that finds the optimal hyper plane to classify data, whereas naive Bayes is based on statistical learning. KNN assigns new point values based on feature similarity using various distance functions such as Euclidean distance, Hamming distance, and more. Random forest is an algorithm that consists of a collection of trees, each of which provides a classification. ANN utilizes the model of a human neuron to classify data.

B. Unsupervised Learning

Unsupervised learning occurs when an algorithm learns from simple examples without a corresponding response, allowing it to evaluate individual data patterns. Unsupervised learning occurs when there are no supervisor or target variables in the training dataset. The algorithm will solve this problem by identifying cases with similar characteristics. Unsupervised learning is comparable to classifying chilies based on their size, colour, taste, and level of spiciness based on observation. Chili's classification according to the degree of similarity. Under unsupervised learning, the algorithm is clustering and dimensionality reduction.

Clustering algorithms include k-means, hierarchical, and fuzzy-c-means. K-means is based on the number of random locations (K) and all points associated with the nearest centres. The hierarchical clustering technique group's similar objects into predetermined top-down or bottom-up clusters. Fuzzy-c-mean allocates each observation to one or more clusters. Principal component analysis (PCA), singular value decomposition (SVD), and independent component analysis (ICA) are algorithms for dimensionality reduction. PCA is a method for multivariate analysis feature extraction. SVD is a matrix factorization technique that is used to reduce dimension. ICA decomposes multivariate observations into additive subcomponents by establishing a new basis for data representation [22].

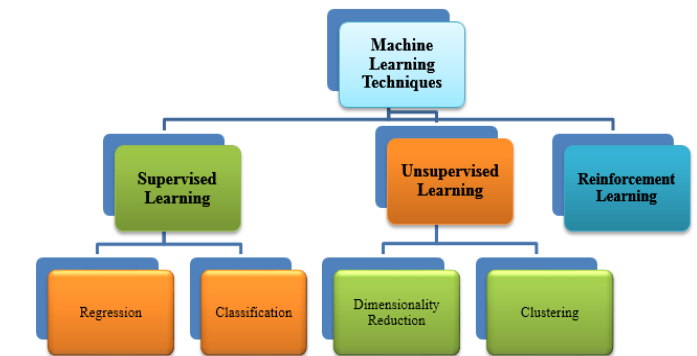
C. Semi-Supervised Learning

Following that, semi-supervised learning (SSL). This type of learning technique is based on a combination of classified and unclassified data. It is a combination of supervised and unsupervised learning. SSL aims to address the disadvantages of both supervised and unsupervised learning. A combination of unlabeled and labelled data patterns increases the precision of SLL when compared to supervised and unsupervised learning. The two categories of SSL are transductive learning and inductive semi-supervised learning. The objective of transductive learning is to predict the exact labels for unlabeled data. Inductive semi-supervised models produce labels for unlabeled data and classifiers simultaneously [23].

D. Reinforcement Learning

Last but not least, reinforcement learning refers to learning methods that use observation gathered from the interaction with the environment to take actions that maximize the reward and minimise the risk. Various observational cases, including error or false cases are used to teach reinforcement learning. The model's knowledge is enhanced through error-based learning. The example of an application of reinforcement learning is having a gamer navigate a maze while avoiding an enemy. This programme informs the algorithm of the outcome of its actions and teaches it to cease risky behaviour in

order to survive. Q-learning is a model-free reinforcement learning technique in which each agent interacts with the environment and generates a state-action-reward sequence of



observations.

Figure 1: Taxonomy of machine learning techniques

E. Machine Learning Tool

Data mining tools are typically software or programming languages used to execute data mining techniques. The proliferation of data mining techniques has led numerous organizations to create data mining tools. The variety of data mining tools promotes data mining expertise. According to Wang and Chen (2015), data mining tool competence refers to the ability of data mining tools to perform a series of tasks, such as data preparation, data analysis, and result evaluation. A good data mining tool is based on seven factors: basic competence, data access, data pre-processing, data mining task completion, data mining algorithm implementation, model interpretation, evaluation, and visualization.

VI. DISCUSSION

The prediction of mental health problems among higher education students using machine learning has the potential to revolutionize the way we approach mental health care on college campuses. By analyzing large datasets of student information, machine learning algorithms can help to identify at-risk students and provide targeted interventions before mental health problems become severe.

However, there are several important considerations to keep in mind when using machine learning for mental health prediction. Firstly, it is essential to ensure that any

predictions made by these algorithms are accurate and reliable. To achieve this, it is important to use high-quality data and to validate the models using independent datasets. Secondly, it is essential to ensure that any interventions provided based on machine learning predictions are ethical and appropriate. Machine learning algorithms should be used as a tool to support clinical decision-making, not replace it. Ultimately, mental health care should be personalized and tailored to the needs of each individual student. Another important consideration is the potential for bias in machine learning algorithms. If the data used to train the models are biased or incomplete, the resulting predictions may also be biased. It is essential to address any sources of bias in the data and to ensure that the models are trained on representative samples of the student population.

VII. RECOMMENDATION

Here are some recommendations for the use of machine learning in predicting mental health problems among higher education students:

1. Ensure the quality of data: It is crucial to use high-quality data in training machine learning models to ensure the accuracy of predictions. This includes collecting data from a representative sample of the student population and addressing any sources of bias in the data.
2. Validate the models: It is essential to validate the accuracy of machine learning models using independent datasets. This can help to identify any potential sources of error or bias in the models.
3. Ethical considerations: The use of machine learning in predicting mental health problems should be done with the utmost consideration for ethical and legal requirements. The privacy and confidentiality of student data must be respected, and any interventions provided must be ethical and appropriate.
4. Use machine learning as a tool, not a replacement: Machine learning should be used as a tool to support clinical decision-making, not replace it. Mental health care should always be personalized and tailored to the individual needs of each student.
5. Regular evaluation: Machine learning models should be regularly evaluated and updated to ensure that they remain accurate and relevant. This can help to ensure that the models continue

to provide valuable insights into mental health problems among higher education students. Overall, the use of machine learning in predicting mental health problems among higher education students has great potential to improve mental health care on college campuses. By following these recommendations, we can ensure that the use of machine learning is done in an accurate, ethical, and responsible manner.

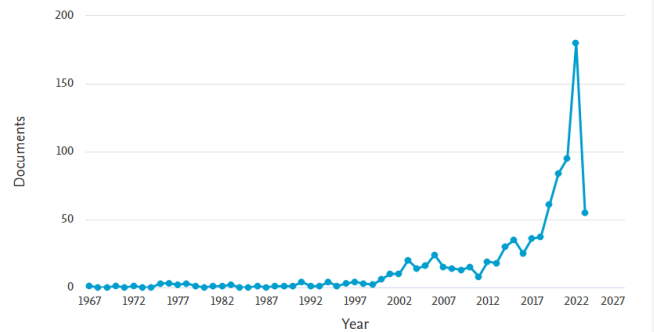


Figure 2: Research trends of mental health of students

VIII. CONCLUSION & FUTURE SCOPE

The analysis of mental health problems among higher education students using machine learning has yielded significant insights and implications. By applying advanced algorithms and techniques to a large dataset, we have gained a deeper understanding of the factors contributing to mental health issues in this population. The analysis of mental health problems among higher education students using machine learning has provided valuable insights into the risk factors, prediction, and support mechanisms for addressing these issues. It has the potential to revolutionize mental health care in higher education by informing targeted interventions, improving early detection, and offering accessible support systems. However, careful attention must be paid to the limitations and ethical considerations surrounding data collection, model development, and privacy protection to ensure the responsible and beneficial use of machine learning in this domain. From the figure 2 we can say that a lot of research needed for prediction student mental health.

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Table 1. A comparison of the mental health of students in higher education

Ref.	Factors of Mental Health								
	Lack of Social Support	Boarding	Financial Problem	Learning Environment	Family Problem	Peer Relationship	Alcohol Consumption	LGBT	Internet Addition
[13]	√	√	√	√	√	√			
[14]								√	√
[15]	√		√	√			√		
[16]		√			√	√			
[17]			√		√				√
[18]	√			√					
[19]	√					√	√		
[20]			√	√	√	√			