

# Data-Driven Models for Identifying Mental Disorders in Students and Enhancing Therapy Scheduling

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# Understanding Mental Disorders

A mental disorder refers to a significant disturbance in an individual's cognition, emotional regulation, or behavior.



- **Depression:** Persistent feelings of sadness and loss of interest.
- **Anxiety:** Excessive fear or worry, often irrational.
- **Impulsivity:** Acting without thought or consideration of consequences.
- **Hyperactivity:** Excessive movement, often interfering with daily activities.

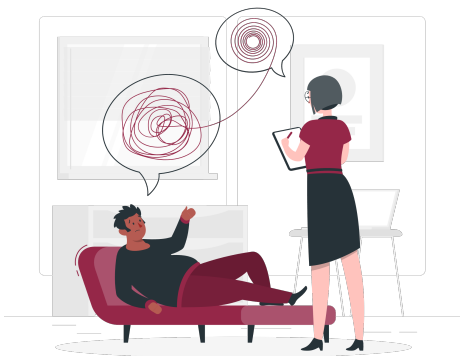
Over 350 million individuals worldwide suffer from mental disorders [1].

# Why Accurate Diagnosis Matters for Students?

- Mental health disorders can significantly impact students' academic and social lives [3].
- External factors, such as homesickness and family expectations, can intensify mental health issues [1].
- Anxiety and depression, the most common mental health concerns among U.S. college students, have been on the rise [7].



# Challenges

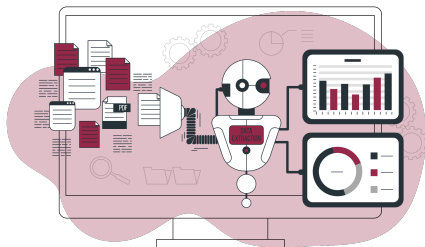


- A severe shortage of trained mental health professionals and infrastructure persists in many parts of the world, especially in developing countries [6].
- Accessible methods that can integrate seamlessly into patients' daily lives are urgently needed [5].
- Reducing the burden associated with mental disorders requires prioritizing early prevention before problems arise. [2].

# The Role of Data-Driven Tools in Mental Health Counseling

Data-Driven models are not a replacement for professional counselors but a tool to enhance their work. These models:

- Provide a data-informed foundation for developing prevention and intervention strategies.
- Reduce demands on time, manpower, and resources while maintaining effectiveness.
- Highlight features that contribute to mental health predictions.



How can data-driven models effectively identify mental disorders in students? [1]

# Machine Learning Models

Machine learning models adapt to complex problems without explicit programming. They improve continuously as more data becomes available, refining predictions and staying effective in dynamic environments.



# Three-Step Module-Based Methodology

The methodology has been divided into several steps to increase performance quality [1].

## Mental Disorder Identification



## Student Prioritization



## Therapy Scheduling



# Data Collection and Labeling

Labeled text data is used to train a machine learning model for mental disorder classification. The model classifies individuals as healthy or with mental disorders to aid diagnosis.

Input Space:  $\mathcal{X}$  (data features)

Output Space:  $\mathcal{Y} = \{(l, s)\}$

- $l$ : Labels
- $s$ : Severity level of the disorder.



## Data Collection

- Emails, forms, messages
- Course-related groups
- Student affairs office data
- Supervision by psychiatrists

## Data Labeling

Expert labeling ensures reliable data for analysis, addressing cases with indirect or hard-to-measure target variables.



## Case of Study: Mental Disorder Identification [4]

This single-centre, retrospective, naturalistic study, approved by the University of Alberta Research Board, included 955 participants; 18.7% subsequently diagnosed with Bipolar Disorder

Elastic net and leave-one-out cross-validation was used to make more confident predictions at an individual level.

Compared to the questionnaire scoring method, the machine learning model achieved a 6.9% improvement in accuracy.

# Prioritization of Students for Treatment

Using the same data, a model trained on severity levels is applied.

This model prioritizes students based on the severity of their mental disorders, allowing for:

- Identification of students needing urgent psychological support.
- Optimization of resources by efficiently allocating psychological professionals.
- Ensuring timely and focused interventions for those with the highest severity levels.



## Case of Study: Student Prioritization [7]

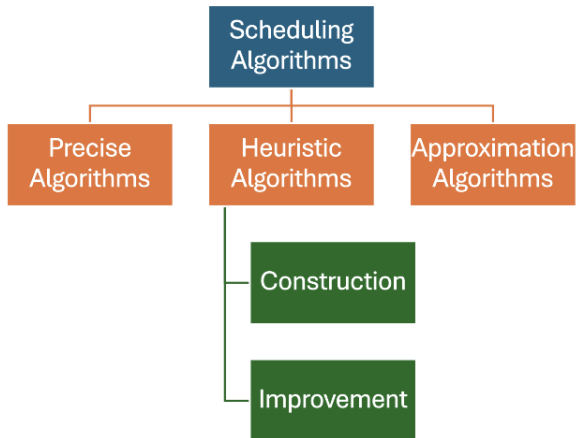
The dataset included 61,619 students from 133 US higher education institutions and was partitioned into a 90:10 ratio for training and testing the models.

They developed predictive models like, eXtreme Gradient Boosting, Random Forest, Decision Tree, and Logistic Regression to identify US college students at heightened risk of diagnosable anxiety and depressive disorders.

This study provides a practical tool for professional counselors to proactively identify students for anxiety and depressive disorders before these conditions escalate.

# Scheduling Algorithms for Therapy Appointments

The action of assigning resources to perform tasks.



# Case of Study: Therapy Scheduling [1]

The collected dataset used in this case study was sourced from the renowned school in Tehran, Iran.

After categorizing students and identifying high-risk groups in the current study, therapist appointments are scheduled using the Shortest Processing Time First method.

By incorporating a scheduling approach, this research aimed to optimize the allocation of therapy sessions, reduce waiting times, and improve the overall service quality for students with mental disorders.

# Conclusions

- Extend identification accuracy of mental disorders compared to conventional methods.
- Prioritizes high-risk students using severity classification, optimizing therapy scheduling.
- Reduces waiting times and enhances access to mental health services.
- Supports informed decision-making by mental health professionals.
- Facilitates early-stage interventions, minimizing escalation of disorders.

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