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.

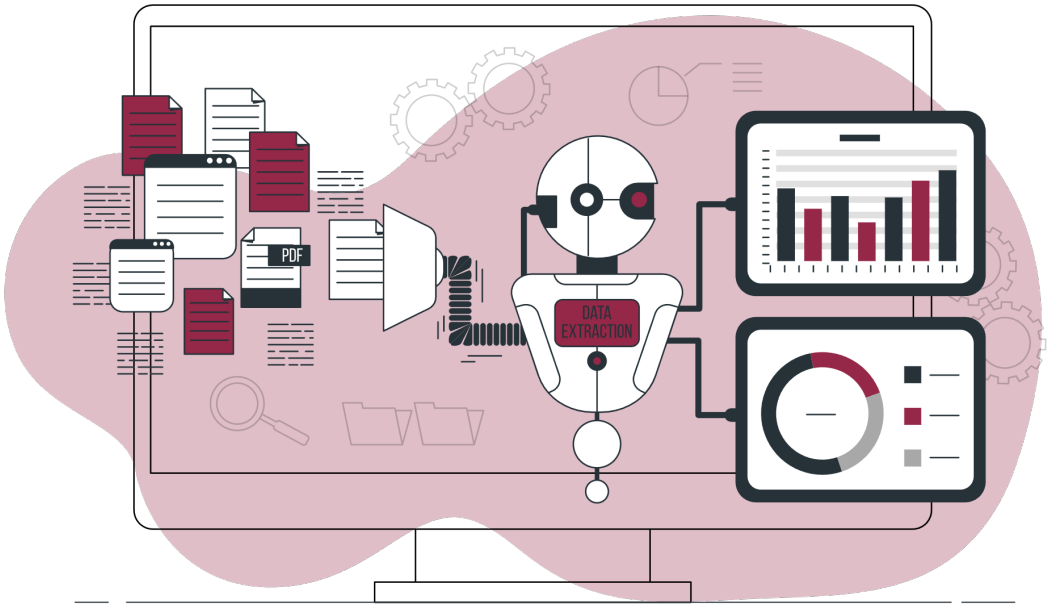
Over 350 million individuals worldwide suffer from mental disorders [1].

Why Accurate Diagnosis Matters for Students?

- Mental health disorders can significantly impact students' academic and social lives [2].
- 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 [3].
- There is a lack of effective tools to identify at-risk students before issues escalate [2].

Data-Driven Models

As the ability to collect and process data has advanced, leveraging evidence to identify patterns is now essential for supporting accurate diagnoses and planning effective therapies.



A question arises: Why shouldn't schools use data-driven methods to identify mentally ill students? [1]

Machine Learning Models

While machine learning models, as a subset of data-driven models, are designed to adapt to complex phenomena without explicit programming.

Machine learning models continuously learn and refine their predictions as more data becomes available.

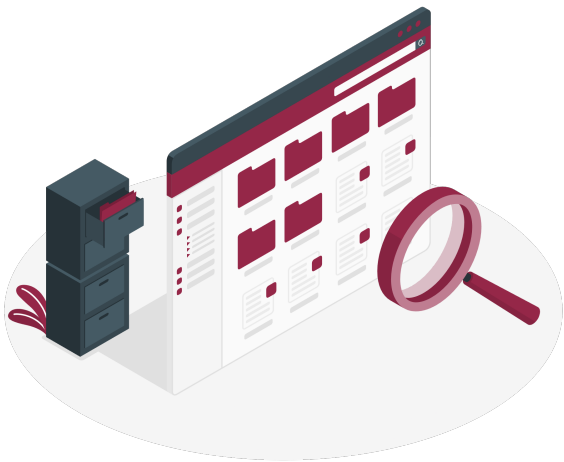
The Role of Machine Learning in Mental Health Counseling

Machine learning models are not a replacement for professional counselors but a tool to enhance their work. These models:

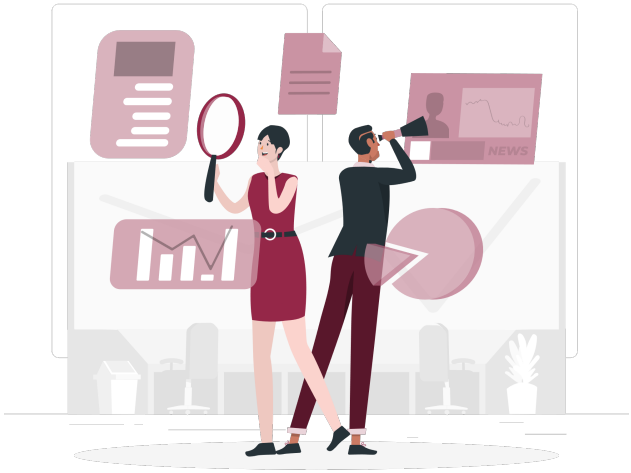
- Provide a data-informed foundation for developing prevention and intervention strategies.
- Identify students at heightened risk of mental health disorders such as anxiety and depression.
- Reduce demands on time, manpower, and resources while maintaining effectiveness.
- Highlight features that contribute to mental health predictions.

Three-Step Module-Based Methodology

Mental Disorder Identification



Student Prioritization



Therapy scheduling

Data Collection and Labeling

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.

Input Space: $\mathcal{X}$ (data features)
Output Space: $\mathcal{Y} = \{(l, s)\}$

- l: Multi-label classification for different mental disorders.
- s: Severity level of the disorder, ranging from 0 (none) to 1 (severe).

Mental Disorder Classification

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.

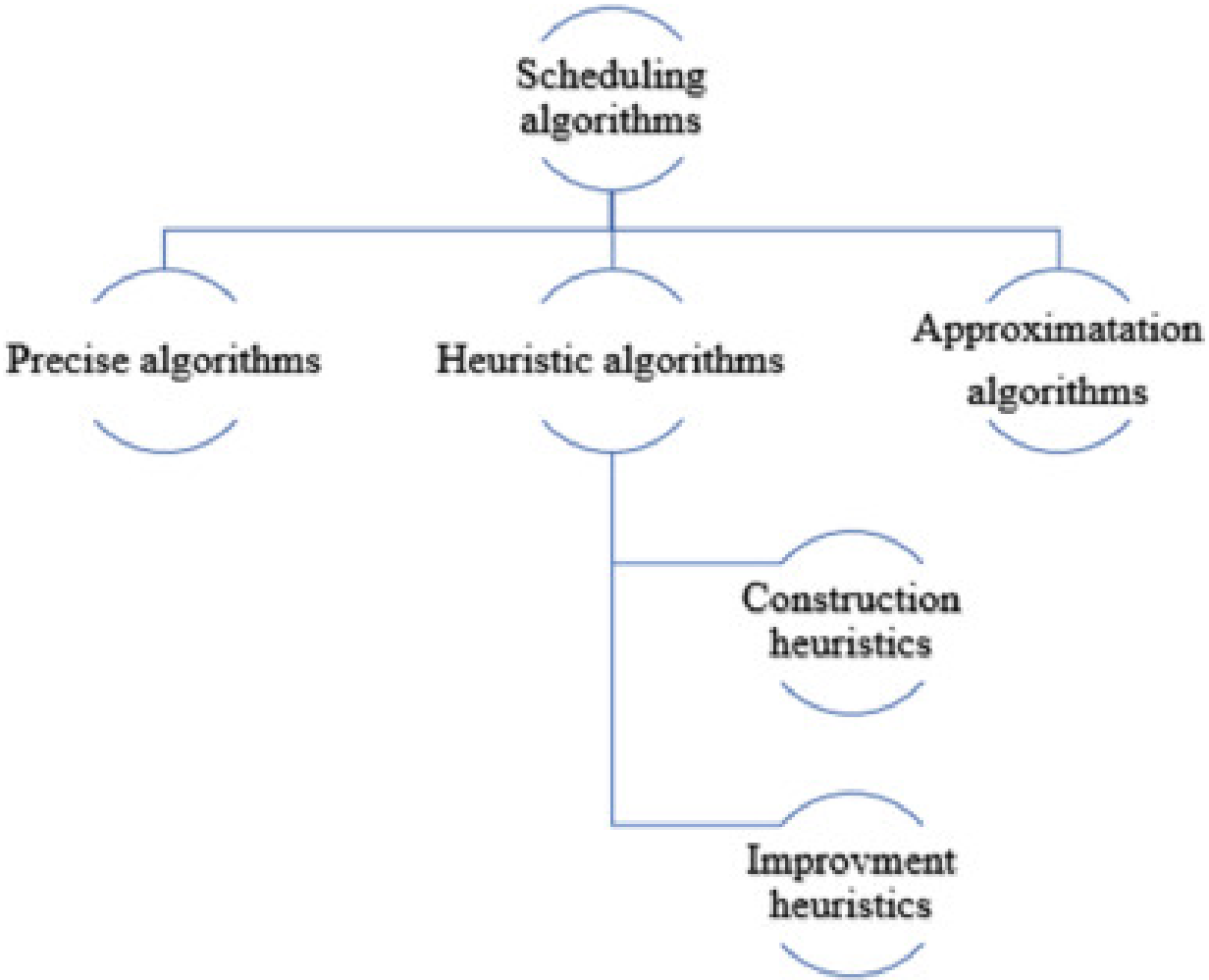
Prioritization of Students for Treatment

Using the same input space $\mathcal{X}$, a model trained on severity levels $s \in [0, 1]$ 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.

Scheduling Algorithms for Therapy Appointments



Case of Study: A diagnostic analytics model for managing post-disaster symptoms of depression and anxiety among students using a novel data-driven optimization approach

This study aims to implement and scrutinize a data-driven optimization method for identifying and providing therapy to students with symptoms of depression and anxiety.

Findings:

- Conventional methods detected only 7 to 15% of cases.
- The proposed strategy improved detection rates to 44%.
- Enhanced ability to identify and prioritize students for interventions.

Case of Study: Machine learning predictive models to guide prevention and intervention allocation for anxiety and depressive disorders among college students

Machine learning models were used to identify US college students at heightened risk of diagnosable anxiety and depressive disorders.

Findings:

- Provides a proactive tool for counselors to identify at-risk students before conditions escalate.
- Offers data-driven insights to enhance understanding of mental health determinants.
- Guides prevention and intervention strategies to support diverse student populations.
- Promotes well-being through informed and targeted counseling approaches.

Conclusions

- Increased 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.

Future Directions

- Expand the methodology to include other mental health conditions.
- Explore integration with external mental health centers for advanced therapy options.
- Incorporate real-time monitoring systems to adapt models dynamically.

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