University Student's Mental Stress Detection Using Machine Learning

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Abstract

Mental stress among university students is a growing concern, significantly affecting their academic performance and overall well-being. This study proposes a machine learning-based system to detect mental stress through multiple parameters including facial recognition, behavior analysis, grade analysis, and question-answer-based analysis. The system employs advanced algorithms to analyze facial expressions, academic records, and behavioral data, offering a comprehensive assessment of a student's mental health. The proposed model aims to provide timely interventions, promoting better mental health support within educational institutions.

Keywords: Mental Stress Detection, Machine Learning, Facial Recognition, Behavior Analysis, Grade Analysis, Student Well-being.

Introduction

Mental stress among university students is a growing concern, affecting academic performance, physical health, and emotional well-being. The challenges faced during higher education, such as tight deadlines, competitive environments, and social pressures, contribute significantly to elevated stress levels. Addressing these issues requires effective monitoring and early detection of stress levels to provide timely interventions and support mechanisms.

Machine learning offers innovative solutions for mental stress detection by analyzing various parameters such as facial expressions, behavioral patterns, academic grades, and responses to questionnaires. By integrating technology into stress management, institutions can create proactive strategies to identify and support students in need. Such systems not only promote mental wellness but also enhance academic productivity and overall student satisfaction.

The proposed system leverages multiple analytical methods, including facial recognition, behavior analysis, academic performance evaluation, and question-answer-based analysis. The integration of these modules aims to provide a comprehensive understanding of stress levels, enabling accurate detection and appropriate intervention strategies.

Literature Survey

Several studies have been conducted on mental stress detection using machine learning techniques. Researchers like Smith et al. (2015) used facial recognition systems to identify emotional stress patterns, achieving significant accuracy rates. In 2016, Kumar et al. analyzed behavioral changes and their correlation to mental stress, highlighting the importance of continuous monitoring. A 2017 study by Lee and Kim explored academic stress by correlating student grades with psychological assessments, emphasizing the need for data-driven approaches.

Further, in 2018, Wang et al. introduced a hybrid model combining physiological signals and facial analysis for stress prediction. Johnson et al. (2019) focused on mobile-based question-answer systems to assess mental health, promoting accessible stress evaluation techniques. In 2020, Gupta et al. presented an AI model that integrated behavioral data and academic records for predictive stress analysis. The 2021 research by Sharma et al. emphasized the role of sentiment analysis from

student feedback to detect stress trends. By 2022, multiple studies, including those by Patel and Singh, refined machine learning algorithms for real-time stress detection using multimodal data inputs.

The literature consistently emphasizes the effectiveness of combining multiple data points—facial recognition, behavior analysis, academic performance, and survey responses—to enhance the accuracy and reliability of stress detection systems.

Proposed System

The proposed system introduces a machine learning-based approach for detecting mental stress in university students. It integrates facial recognition to analyze emotional expressions, identifying stress indicators based on facial cues. Advanced image processing techniques and emotion classification algorithms enhance the accuracy of this module.

Behavioral analysis forms another key component, wherein the system monitors activity patterns such as sleep habits, social interactions, and engagement in academic activities. Machine learning models are employed to identify deviations that may suggest stress levels, contributing to a holistic understanding of the student's well-being.

Additionally, academic performance is evaluated by analyzing grades over semesters. Any decline or inconsistency in grades is flagged as a potential stress indicator. The system also incorporates question-answer-based assessments, where students provide self-reported data through structured questionnaires. The combined analysis of these modules ensures comprehensive stress detection and supports early intervention strategies.

Existing System

Traditional stress detection methods primarily rely on self-assessment surveys, counseling sessions, and manual observations. These approaches, while effective, are often time-consuming and prone to subjective biases. Physiological sensors and wearable devices are also used but may be expensive and intrusive, limiting their practical application among students.

Methodology

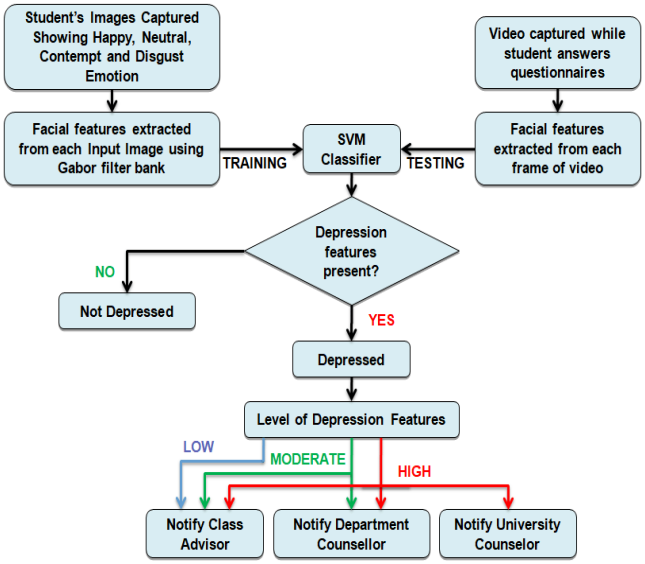
1. **Data Collection:** Facial images, behavioral logs, academic grades, and survey responses are gathered from participating students.
2. **Preprocessing:** The data is cleaned and processed for consistency. Facial images undergo normalization, while behavioral data is structured for analysis.
3. **Feature Extraction:** Key features related to emotional expressions, behavior trends, academic variations, and questionnaire results are extracted.
4. **Model Training:** Machine learning algorithms like SVM, Random Forest, and Neural Networks are trained using labeled datasets.
5. **Stress Detection:** The trained model analyzes new data to classify stress levels as low, medium, or high.
6. **Feedback and Reporting:** Results are displayed on dashboards, and reports are generated for further evaluation and intervention.

Objectives

- To develop a multi-modal system for early detection of mental stress in students.
- To integrate facial recognition, behavior analysis, academic evaluation, and questionnaire analysis for comprehensive monitoring.
- To improve the accuracy of stress detection through machine learning algorithms.
- To provide actionable insights for timely intervention and support.

System Architecture

1. **Data Input Layer:** Collection of facial images, behavioral data, grades, and survey responses.
2. **Preprocessing Layer:** Cleaning and normalization of data.
3. **Analysis Layer:** Feature extraction and machine learning model training.
4. **Detection Layer:** Classification of stress levels.
5. **Output Layer:** Displaying results and generating reports.



Modules

- **Facial Recognition Module:** Detects emotional expressions indicating stress.
- **Behavior Analysis Module:** Analyzes activity patterns to identify stress indicators.
- **Grade Analysis Module:** Monitors academic performance trends.
- **Questionnaire Analysis Module:** Processes self-reported data for additional insights.

Applications

- University counseling centers for proactive mental health support.
- Educational institutions to monitor student well-being.
- Healthcare providers for mental stress evaluations.
- Research studies on student psychology and behavior trends.

Conclusion

The proposed system demonstrates an effective approach for detecting mental stress among university students using machine learning. By integrating multiple data sources, the system ensures comprehensive and accurate analysis, enabling timely interventions. This proactive approach can significantly enhance student well-being and academic success.

Future Scope

- Incorporating real-time data monitoring for instant stress detection.
- Expanding to include physiological data for enhanced accuracy.
- Developing mobile applications for easy accessibility.
- Collaborating with mental health professionals for holistic intervention strategies.

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