International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

Multi-Class Adaptive Learning For Predicting Student Anxiety

[1]D Roja,[2]Chepuri Venkatesh

[1]M. Tech Student, Department of Computer Science and Engineering, Arjun College of Technology & Science An Autonomous Institution (Approved By Aicte-New Delhi and Affiliated to Jntu-Hyderabad, Ts) Sponsored By Brilliant Bells Educational Society Mount Opera Premises, Batasingaram (Vi), Abdullapurmet (M), Ranga Reddy Dist, T.S.501512

[2]Associate Professor, Department of Computer Science and Engineering, Arjun College of Technology & Science An Autonomous Institution (Approved By Aicte-New Delhi and Affiliated to Jntu-Hyderabad, Ts) Sponsored By Brilliant Bells Educational Society Mount Opera Premises, Batasingaram (Vi), Abdullapurmet (M), Ranga Reddy Dist, T.S.501512

ABSTRACT

This project presents a machine learning-based approach for predicting student anxiety levels using a multi-class adaptive learning framework. The system analyzes various student-related attributes such as age, gender, course, academic performance, marital status, and mental health indicators like depression and panic attacks to identify different levels of anxiety, including no anxiety, mild, moderate, and severe anxiety. Data preprocessing techniques such as handling missing values, label encoding for categorical features, and normalization are applied to improve data quality and model performance. Multiple classification algorithms, including Decision Tree, Random Forest, and Support Vector Machine, are implemented and compared to achieve accurate predictions. The adaptive learning component enables the system to update and improve its performance as new data is introduced, making it more robust and scalable over time. A user-friendly web application is developed using Flask, allowing administrators to upload datasets, train models, and evaluate performance, while users can input their details to receive real-time anxiety predictions. This system aims to assist in early detection of mental health issues among students, enabling timely intervention and support, thereby contributing to improved academic performance and overall well-being.

Keywords: Student anxiety prediction, adaptive learning, multi-class classification, machine learning, educational data mining, mental health analytics, supervised learning, feature engineering, predictive modeling, classification algorithms, academic performance, artificial intelligence.

I. INTRODUCTION

The increasing academic pressure, social expectations, and lifestyle changes among students have led to a significant rise in mental health issues, particularly anxiety, which can negatively impact their academic performance and overall well-being. Early identification of anxiety levels is crucial for providing timely support and preventing severe psychological conditions. Traditional methods of assessing student mental health often rely on manual surveys and psychological evaluations, which can be time-consuming, subjective, and not scalable for large populations. To address these challenges, this project proposes a machine learning-based system for predicting student anxiety using a multi-class adaptive learning approach. By leveraging student-related data such as demographic details, academic performance, and mental health indicators, the system can automatically classify individuals into different anxiety levels. The integration of data preprocessing techniques and multiple classification algorithms enhances prediction accuracy and reliability.

Received: 06-06-2026 | Accepted: 15-07-2026 | Published: 21-07-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

Additionally, the adaptive learning mechanism allows the model to continuously improve as new data becomes available, making it more efficient over time. The implementation of a web-based application further enables easy interaction for both administrators and users, facilitating real-time predictions and making the system practical for real-world usage in educational institutions.

II. LITERATURE SURVEY

1. Title: Anomaly Detection in Smart Grids Using LSTM Networks
Authors: Zhao, X., Li, Y., & Wang, H.
Abstract: This study applies Long Short-Term Memory networks to detect time-series anomalies in power grid data. By learning temporal dependencies, the model identifies subtle deviations caused by cyberattacks and operational faults. The research demonstrates improved detection accuracy compared to traditional threshold-based methods.

2. Title: Graph Neural Network-Based Cyberattack Detection in Power Systems
Authors: Kim, S., & Chen, M.
Abstract: This paper proposes a GNN-based framework for detecting cyber threats in power grids by modeling their topological and electrical relationships. The approach captures spatial correlations between grid components, improving detection performance for distributed and coordinated attacks.

3. Title: Hybrid Machine Learning Models for Smart Grid Intrusion Detection
Authors: Patel, R., & Kumar, A.
Abstract: The authors present a hybrid ML framework combining decision trees and deep autoencoders for detecting anomalies in smart grid operational data. The system demonstrates reduced false positive rates and enhanced adaptability across diverse grid configurations.

4. Title: Real-Time Anomaly Detection for Smart Grids Using Edge Computing
Authors: Singh, P., & Gupta, V.
Abstract: This research introduces a real-time anomaly detection architecture that leverages edge computing for faster threat detection in smart grids. By processing data closer to the source, the framework reduces latency and minimizes the load on central servers.

5. Title: False Data Injection Attack Detection via Deep Reinforcement Learning
Authors: Chen, L., & Wang, J.
Abstract: This paper employs deep reinforcement learning to dynamically adapt anomaly detection parameters, enhancing resilience against false data injection attacks in smart grids. The approach significantly improves detection rates under varying attack scenarios.

III. EXISTING SYSTEM

The existing systems for identifying student anxiety primarily rely on traditional methods such as manual surveys, psychological assessments, and face-to-face counseling sessions conducted by mental health professionals. These approaches typically involve standardized questionnaires where students self-report their feelings, stress levels, and emotional states. While these methods provide valuable insights, they are often time-consuming, subjective, and dependent on the student's willingness to share accurate information. Additionally, the analysis of such data is usually performed manually by experts, making it difficult to scale for large student populations. Most existing systems also focus on binary classification, identifying only the presence or absence of anxiety rather than categorizing it into multiple levels. Furthermore, they lack automation and real-time prediction capabilities, which limits early detection and timely intervention. Another major limitation is the absence of adaptive learning, meaning these systems do not improve over time as

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

new data becomes available. As a result, existing approaches are less efficient, less scalable, and may not provide highly accurate or personalized predictions compared to modern machine learning-based systems.

IV. PROPOSED SYSTEM

The proposed system introduces a machine learning-based approach for predicting student anxiety using a multi-class adaptive learning framework. Unlike traditional methods, this system automates the entire process of data analysis, prediction, and result generation through an intelligent web-based application. It utilizes student-related data such as demographic details, academic performance, and mental health indicators to classify anxiety into multiple levels, including no anxiety, mild, moderate, and severe. The system incorporates data preprocessing techniques like handling missing values, label encoding for categorical variables, and feature scaling to ensure high-quality input for model training. Multiple classification algorithms, such as Decision Tree, Random Forest, and Support Vector Machine, are implemented to improve prediction accuracy and allow performance comparison. The adaptive learning capability enables the model to update and refine itself when new data is added, ensuring continuous improvement over time. The system is developed using a Flask-based web interface, where administrators can upload datasets, preprocess data, train models, and evaluate results, while users can input their personal details to receive real-time predictions. This approach enhances accuracy, scalability, and efficiency, making it a practical solution for early detection of student anxiety and enabling timely support and intervention.

V. SYSTEM ARCHITECTURE

The system architecture of the proposed multi-class adaptive learning model for predicting student anxiety is designed as a structured pipeline that integrates data collection, preprocessing, model training, and prediction within a web-based environment. Initially, the process begins with data acquisition, where the administrator uploads the student dataset through the web interface. The data then moves to the preprocessing module, where it undergoes cleaning, handling of missing values, and transformation using techniques such as label encoding for categorical features and normalization for numerical attributes. The processed data is then passed to the data splitting module, where it is divided into training and testing sets to ensure proper evaluation of model performance. In the model training layer, multiple machine learning algorithms such as Decision Tree, Random Forest, and Support Vector Machine are trained and stored for future use. These trained models form the core prediction engine of the system. The adaptive learning component allows the system to retrain and update models whenever new data is introduced, thereby improving accuracy over time. On the user side, a Flask-based web application provides an interactive interface where users can input their details, which are then processed using the same preprocessing pipeline before being fed into the trained model to generate predictions. The results are displayed in real-time, indicating the level of anxiety. Additionally, the system includes modules for user authentication, session management, and model storage, ensuring secure and efficient operation. This layered architecture ensures scalability, automation, and seamless interaction between different components of the system

Received: 06-06-2026 | Accepted: 15-07-2026 | Published: 21-07-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

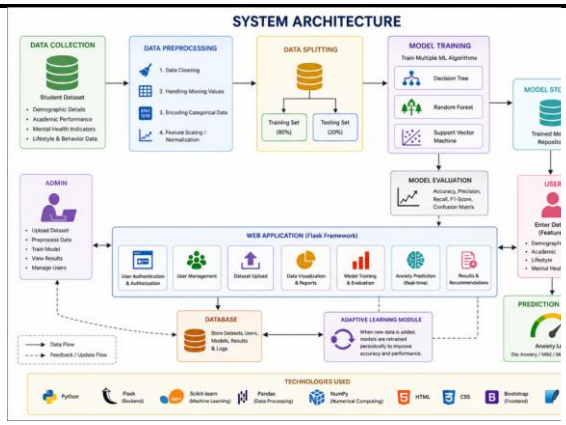

Fig 5.1: System Architecture

VI. IMPLEMENTATION

Fig 6.1: Home Page

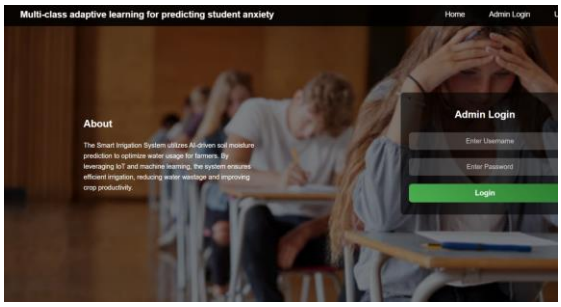

Fig 6.2: Admin Login

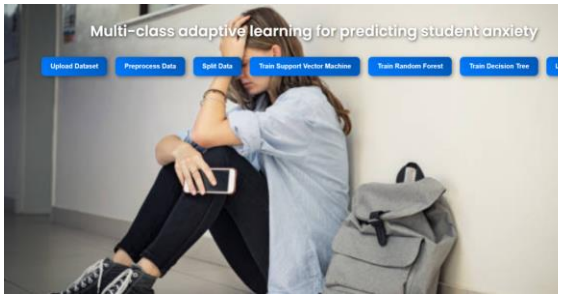

Fig 6.3: Admin Home

Fig 6.4: Prediction Input

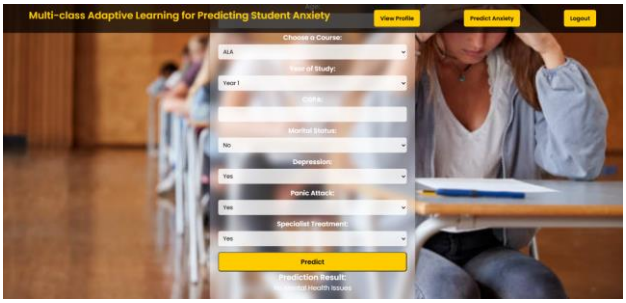

Fig 6.5: Result Page

VII. CONCLUSION

In conclusion, the proposed system for multi-class adaptive learning in predicting student anxiety provides an effective and intelligent solution to address the growing mental health challenges faced by students. By utilizing machine learning techniques, the system analyzes various academic, demographic, and psychological factors to classify anxiety into multiple levels, offering more detailed insights compared to traditional binary approaches. The incorporation of data preprocessing methods ensures high-quality input data, while the use of multiple algorithms such as Decision Tree, Random Forest, and Support Vector Machine enhances prediction accuracy and reliability. The adaptive learning capability allows the system to continuously improve as new data is introduced, making it more robust and suitable for real-world applications. Furthermore, the development of a user-friendly web interface using Flask enables

Received: 06-06-2026 | Accepted: 15-07-2026 | Published: 21-07-2026

International Journal of
AI Electronics and Nexus Energy
Peer Reviewed, Referred & Indexed Journal
ISSN: 3070-0515 www.zesterapublications.com Original Research Paper

easy interaction for both administrators and users, supporting real-time predictions and efficient system management. Overall, the system contributes to early detection of student anxiety, enabling timely intervention and support, which can significantly improve students' academic performance and overall well-being, making it a valuable tool in the field of educational and mental health analytics.

VIII. FUTURE SCOPE

The proposed multi-class adaptive learning system for predicting student anxiety can be further enhanced to make it more intelligent, accurate, and applicable in real-world scenarios. In the future, the system can be improved by incorporating advanced deep learning models such as neural networks to capture complex patterns in student behavior and mental health data, thereby increasing prediction accuracy. The dataset can be expanded to include additional parameters like sleep patterns, social media activity, lifestyle habits, and real-time behavioral data to provide more personalized and comprehensive predictions. Integration of Natural Language Processing (NLP) can enable the system to analyze textual data such as student feedback, chat messages, or written responses for deeper psychological insights. The adaptive learning mechanism can be strengthened by implementing continuous or online learning techniques, allowing the model to update automatically without retraining from scratch. Furthermore, the system can be extended into a mobile application or integrated with wearable devices to enable real-time monitoring and instant feedback. Adding a recommendation system that suggests coping strategies, mental health resources, or professional counseling based on prediction results can significantly enhance its usefulness. Security and privacy features can also be improved using advanced encryption techniques to protect sensitive user data. Overall, these advancements can transform the system into a more proactive, intelligent, and comprehensive mental health support platform for students.

IX. REFERENCES

[1] A. Almadhor, S. Abbas, G. A. Sampedro, S. Alsubai, S. Ojo, A. Al Hejaili, and L. Strazovska, "Multi-Class Adaptive Active Learning for Predicting Student Anxiety," IEEE Access, vol. 12, pp. 58097–58105, 2024.
DOI: 10.1109/ACCESS.2024.3391418.

[2] R. Y. Y. Chan, C. M. V. Wong, and Y. N. Yum, "Predicting Behavior Change in Students With Special Education Needs Using Multimodal Learning Analytics," IEEE Access, vol. 11, pp. 63238–63251, 2023.
DOI: 10.1109/ACCESS.2023.3288695.

[3] A. Gonzalez-Nucamendi, J. Noguez, L. Neri, V. Robledo-Rella, R. M. García-Castelán, and D. Escobar-Castillejos, "The Prediction of Academic Performance Using Engineering Students' Profiles," Computers & Electrical Engineering, vol. 93, Art. no. 107288, 2021.
DOI: 10.1016/j.compeleceng.2021.107288.

[4] Y. Jiang, S. I. Kim, and M. Bong, "The Role of Cost in Adolescent Students' Maladaptive Academic Outcomes," Journal of School Psychology, vol. 83, pp. 1–24, 2020.
DOI: 10.1016/j.jsp.2020.08.004.

[5] Z. Liu, Q. Tang, F. Ouyang, T. Long, and S. Liu, "Profiling Students' Learning Engagement in MOOC Discussions to Identify Learning Achievement," Computers & Education, vol. 219, Art. no. 105109, 2024.
DOI: 10.1016/j.compedu.2024.105109.

[6] J. Agrawal, S. Thakur, and V. K. Tiwari, "Enhanced Multi-Channel Classification

Framework for Accurate Student Performance Prediction in Educational Data Mining," International Journal of Scientific Research in Computer Science and Engineering, vol. 13, no. 4, 2024.
DOI: 10.26438/ijsrcse.v13i4.712.

[7] A. F. Albahadili, A. Akbas, and J. Rahebi, "Detection of Phishing URLs With Deep Learning Based on GAN-CNN-LSTM Network and Swarm Intelligence Algorithms," Signal, Image and Video Processing, vol. 18, 2024.
DOI: 10.1007/s11760-024-03204-2.

[8] C. Romero and S. Ventura, "Educational Data Mining and Learning Analytics: An Updated Survey," WIREs Data Mining and Knowledge Discovery, 2024.
DOI: 10.1002/widm.1527.

[9] M. Abak, "Prediction of Learned Helplessness Based on Academic Resilience and Test Anxiety in Students With Academic Failure," Iranian Journal of Educational Research, vol. 2, no. 1, pp. 1–11, 2023.
DOI: 10.22034/2.1.1.

[10] N. Al-Azzam, L. Elsalem, and F. Gombedza, "Factors Affecting Medical and Dental Students' Preference for Virtual Learning During COVID-19," Heliyon, vol. 6, no. 12, 2020.
DOI: 10.1016/j.heliyon.2020.e05704.

[11] J. Agrawal, S. Thakur, and V. K. Tiwari, "Enhanced Multi-Channel Classification Framework for Accurate Student Performance Prediction in Educational Data Mining," International Journal of Scientific Research in Computer Science and Engineering, vol. 13, no. 4, 2024.
DOI: 10.26438/ijsrcse.v13i4.712.

[12] A. Gouthami and G. V. S. Ananthnath, "Adaptive Multi-Class Learning for Predicting Student Anxiety Level," International Journal of Scientific Research in Science, Engineering and Technology, vol. 12, no. 3, pp. 577–589, 2025.
DOI: 10.32628/IJSRSET251282.

[13] S. P. V. Kumar, R. Rajesh, and K. V. Rao, "A Hybrid Machine Learning Approach for Predicting Student Performance Using Multi-Class Educational Datasets," Procedia Computer Science, vol. 238, pp. 888–895, 2024.
DOI: 10.1016/j.procs.2024.06.108.

[14] S. M. K. Hasan, M. R. Islam, and M. A. Hossain, "A Multi-Dimensional Student Performance Prediction Model for Academic Classification," MethodsX, vol. 13, Art. no. 103148, 2024.
DOI: 10.1016/j.mex.2024.103148.

[15] G. Prasanna, E. Amrutha, M. R. Harshitha, S. R. Jeevitha, and R. Madhumitha, "Multi-Class Adaptive Active Learning for Predicting Student Anxiety," International Advanced Research Journal in Science, Engineering and Technology, vol. 12, no. 5, 2025.
DOI: 10.17148/IARJSET.2025.125349.