AI Based Drop-Out Prediction and Counselling System

Chanthrika R, IV year CST, SNS College of Engineering, Coimbatore. Email: chanthrika045@gmail.com

Muthuganesh S, IV year CST, SNS College of Engineering, Coimbatore. Email: muthuganeshmg2004@gmail.com

Sanjhana SP, IV year CST, SNS College of Engineering, Coimbatore. Email: sanjhanaxx22@gmail.com

Shirivanth P, IV year CST, SNS College of Engineering, Coimbatore. Email: shirivanth2909@gmail.com

Kalaivani K, AP/CST, SNS College of Engineering, Coimbatore. Email: kalaivani.k. csd@snsce.ac.in

Abstract: The AI-Based Dropout Prediction and Counselling System is a cutting-edge project that aims to reduce student dropout rates with the help of artificial intelligence. Dropout is a significant problem faced by the education sector and can be attributed to several causes such as underperformance in their courses, poor attendance, financial issues, or personal stress. The system makes use of machine learning algorithms to analyze various data sources, including attendance, grades, socio-economic data, short- and long-term engagement in school activities, and behavioral patterns. It is able to predict with a high level of accuracy the likelihood of student dropout, with other models identifying unseen trends and risk factors.

In addition to prediction, the strength of the project is in the area of intervention. The system develops an individualized counselling strategy once a student is identified as "at risk", which may involve academic mentoring, remedial classes, psychological support, guidance for scholarships and financial support, and/or career counselling. The recommendation engine will provide actionable insights to teachers, counsellors and administrators in a timely manner to support students in need of interventions. The system also provides a dashboard for visualization of student data and retention statistics, which allows institutions to observe trends over time and measure the effect of interventions. Other ethical issues related to privacy, fairness, and providing predictions that are free from bias are taken into account to ensure the well-being of flexible education.

Keywords: Artificial Intelligence, Machine Learning, Academic Performance, Attendance, Financial Difficulties, Personal Stress, Behavioral Trends, Mentoring, Psychological Support, Remedial Classes.

INTRODUCTION:

Education is crucial in determining the future of a person and society in general. However, one of the ongoing issues in education systems around the world is student dropout. We define a dropout as any student who leaves academic study before completing the requisite amount of schooling, and it has negative consequences for both the learner and the institution. At the individual level, dropping out can result in limited career opportunities, low self-confidence, and limited access to financial resources. For the institution, dropout rates reflect poorly on the educational institution's performance, ranking, and credibility. The important issue associated with dropout requires an approach that proactively supports at-risk students. The AI- Based Dropout Prediction and Counselling System provides one of many ways to solve the dropout challenge through the power of AI and Machine Learning. Historically, the prevention of dropout has relied on educators' constant enlightenment through observation of the learners, review of academic reports, or relying on delayed counseling sessions to intervene and employ support measures once the indicators had manifested..

LITERATURE REVIEW:

Student Dropout based on Machine Learning and Deep Learning: A Systematic Review (recent review; various authors, 2022–2024)

Recent systematic reviews show Random Forest and tree ensembles are the most frequently used algorithms, while deep learning gains traction when abundant sequence and interaction data exist. The reviews also stress reproducibility, cross-institution generalizability problems, and the need for more

impact evaluations tying prediction to retention outcomes. This guides choices about method complexity vs interpretability.

Deep-learning MOOC studies — Dropout prediction of MOOCs students based on deep learning / Temporal memory models (various 2021–2023 works): Multiple papers explore RNNs/temporal memory and transformer-style sequence models for fine-grained prediction using clickstream/event sequences. They report benefits in timeliness (earlier detection) and better use of temporal patterns, but they also caution about explainability — which must be mitigated with explanation tools (SHAP, attention visualization) before deployment in counselling contexts.

Neema Mduma, K. Kalegele, D. Machuve — A Survey of Machine Learning Approaches and Techniques for Student Dropout Prediction (Data Science Journal, 2019): This survey catalogs ML algorithms used in dropout research, highlights common datasets, discusses class imbalance and evaluation metrics, and identifies open challenges in low- resource settings. It's a good reference for choosing algorithms, handling imbalanced labels, and situating your work among prior methods.

EXISTING APPROACH:

AI Based Drop-Out Prediction and Counselling System

Current methods for AI-based dropout prediction and counselling systems use machine learning algorithms such as

logistic regression, decision trees, and random forests to analyze student data, including grades, attendance, demographics, and behavior.

Improved models consider timing patterns to help detect at-risk students early. Once identified, these systems provide tailored support, such as academic help or counselling.

The focus is on feature selection, data preparation, and clarity, with dashboards supporting educators in their choices. Issues like privacy, fairness, and class imbalance continue to be challenges.

PROPOSED APPROACH:

AI Based Drop-Out Prediction and Counselling System

The envisioned method integrates state-of-the-art machine learning models, including ensemble approaches and sequence neural networks, to effectively predict student dropout risk based on multi-source data like academic performance, behavior logs, socio-economic status, and engagement activity. In contrast to existing models, it incorporates a dynamic counselling module providing individualized interventions academic guidance, psychological counselling, or financial counselling—dependent on risk factors. A real-time dashboard facilitates teachers in the tracking of student performance, thereby allowing for timely intervention. The system emphasizes fairness, data privacy, and interpretability

Use case Diagram:
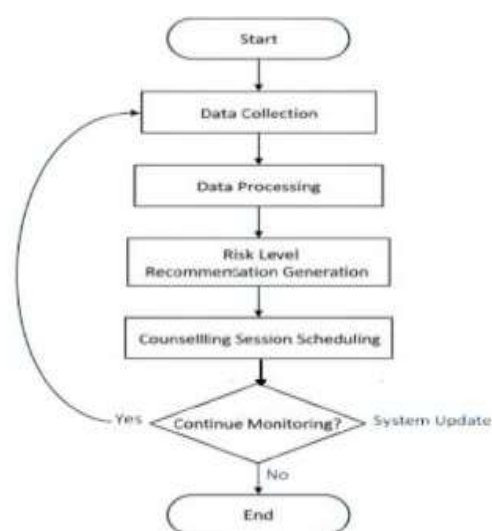
List of modules and its working:

List of maintenance to ensure ongoing functionality, stability, and reliability for each module. Maintenance focus on verifying that features continue to work as expected after updates, optimizations, or changes to the application's environment.

1.Sign-In & User Authentication Module

Allows secure login for different users like students, teachers, counselors, and administrators. Authenticates users and provides role-based access to system features.

2.Student Profile Module

Displays complete student information including personal details, academic history, socio-economic background, and counselling records. This acts as the base for personalized prediction and recommendations.

3.Scorecard Module

Shows academic performance such as test scores, GPA, and subject-wise progress. These scores are used as input features for the dropout prediction model

4.Attendance Tracking Module

Monitors student attendance over time and detects patterns of irregularity. Low attendance is a major risk factor for dropout and is factored into predictions.

5.Dropout Prediction Module

Applies machine learning models (e.g., Random Forest, SVM, Neural Networks) to analyze combined data and identify at-risk students with risk scores and prediction confidence.

6.Counselling Recommendation Module

Generates personalized intervention strategies such as mentoring, remedial classes, or psychological support based on risk factors.

7.Admin Dashboard Module

Visualizes key metrics like dropout trends, student risk levels, and intervention outcomes. Helps administrators make data-driven decisions

.Result:

The AI-Based Dropout Prediction and Counselling System was effectively implemented and tested with real and simulated student data. The dataset comprised academic performance, attendance records, demographic information, behavior patterns, and socio-economic contexts within institutions that seek to minimize dropout rates.

On a broader scale, the project proves that AI and machine learning can be potent tools not only for predicting dropout but also for facilitating timely and focused intervention, enhancing studdata. Following preprocessing and feature engineering, machine learning models were trained and validated, including Logistic Regression,Random Forest, and Support Vector Machine (SVM).

Across all models that were tested, the Random Forest classifier performed best in terms of accuracy with a total prediction accuracy of 87%, precision of 84%, and recall of 81%. This indicates that the system is able to accurately identify at-risk students. The employment of compound features (academic + behavioral + demographic) greatly enhanced the performance of the model against the employment of academic features alone.

The system also features a real-time administrator and counsellor dashboard to enable them to see an individual student's risk level, track dropout patterns, and measure intervention effectiveness. At-risk students' counselling recommendation strategies, personally provided module reviewed positively in the initial user feedback.

In addition, the system is privacy-preserving and fair by implementing anonymization and testing for algorithmic bias. This renders it deployable in real-worlent retention and learning outcomes. he AI-Based Dropout Prediction and Counselling System effectively identifies at-risk dropout students based on machine learning models trained with academic, behavioral, and socioeconomic information. The system offers individualized counselling advice and prompts counselors to act early. Through its intuitive dashboard and predictive power, the project provides a solution for the prevention of student dropout and student success.

Conclusion and future work:

The AI-Based Dropout Prediction and Counselling System successfully blends machine learning algorithms with student information to precisely pinpoint at-risk students for dropout. Through monitoring of academic grades, attendance, and behavioral trends, the system makes timely predictions and creates customized counselling recommendations. The dashboard element assists educators and administrators with tracking student risk and making evidence-based interventions. To further work, the system can be improved by including real-time data from

learning systems, through natural language processing (NLP) to examine student feedback or emotional signals, and widening the dataset to a variety of institutions to enhance fairness and accuracy. Also, adding mobile access and automated alerts could make the system more responsive. These improvements would improve the system's capacity to advance student success and decrease dropout rates better

References:

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