StudentPerformancePredictionUsingMachineLearning

SimranKapure,VarshaRaje,DaminiRajput,YashodipKamble

InformationTechnologyDepartment,PDEA'sCollegeofEngineering,Manjari,SavitribaiPhulePuneUniversity,Pune-411028

Abstract: *In the era of data-driven decision-making, educational institutions leverage technology to predict student performance effectively. This paper presents a comprehensive study on existing literature in student performance analysis and proposesadetaileddesignforanautomatedsystemusingDjango, Pandas, and Machine Learning. Student academic performance predictionisacrucialtaskintheeducationsector,enablingearly identification of studentswho mayrequireadditional support. This study leverages machine learning techniques to analyze various factorsaffectingstudentperformance,suchasacademicrecords, attendance, behavioural traits, and socioeconomic status. The systememploystheSupportVectorMachine(SVM)algorithmfor classification, predicting students' performance levels as High, Medium, or Low.*

Keywords: **Student Performance, Machine Learning, CSV Processing, personalized learning , SVM**

1. INTRODUCTION

Studentperformancepredictionplaysacrucialrolein educationalinstitutionstomonitoracademicprogress and provide necessary interventions. Traditional manual analysis is time-consuming and prone to errors.Withadvancementsindataanalytics,machine learningtechniquescanbeemployedtoautomatethis process. This paper presents a literature review on student performance prediction methodologies and details the proposed system's architecture, which integrates Django for web-based implementation and machine learning for predictive insights. The system will feature distinct logins for teachers and students, where teachers can upload student performance data and recommend study materials, while students can access personalized insights.

2. LITERATUREREVIEW

We studied 10 different research papers, which we have mentioned in the reference section. From which weunderstandthatnumerousstudieshaveexplored student performance prediction and data-driven education analytics:

Educational Data Mining (EDM) techniques such as Decision Trees, Support Vector Machines (SVM), and Neural Networks have been widely applied for student outcome prediction.

ResearchhasdemonstratedthatSVMmodelsoffer high accuracy in classifying students based on performance indicators.

Prior studies emphasize the importance of academic scores but often fail to consider engagement and behavioural parameters, which are critical in student success.

Most existing models lack real-time CSV processing capabilities for dynamic updates, limiting their practical implementation in academic institutions.

Few systems incorporate personalized learning strategies, whereas this project introduces a teacher-driven study material recommendation mechanism based on individual student performance.

Studieshavehighlightedtheeffectivenessofrole-based educational platforms, supporting the need for teacher and student logins for efficient monitoring and guidance.

3. PROPOSEDSYSTERMAND DETAILED DESIGN

SystemOverview:

The proposed system consists of three major components:

User Authentication and Role-Based Access:
Separate login systems for teachers and students. Studentscancreateprofileswithpersonaland academicdetails.Teacherscanaccessstudentdata, upload CSV files, and provide personalized study material recommendations.

DataCollectionandPreprocessing:
Students provide academic details during profile creation. Teachers upload CSV files containing student performance data.The system processes data using Pandas, handling missing values and normalizing scores for consistency.

Predictive Analytics and Recommendation System:
The system uses an SVM (Support Vector Machine) model for student performance prediction.
Teachers can review predictions and assign personalized study materials to students who need assistance.

SystemArchitecture:

Thearchitectureconsists of:
Frontend:HTML,CSS,JavaScript,Bootstrap(for user interaction)
Backend:Django(handlingrequests,processingdata, storing results)
Database:SQLite(forpersistentdatastorage)
MachineLearningModel:Implementedusing Scikit-learn with SVM for classification.

WorkflowDiagram :

StudentRegistrationandProfileCreation
Explain what details students need to enter (e.g., name, roll number, course, previous grades).
Mention if any validation checks are applied (e.g., ensuringcorrect format foremailor numeric values).
Clarify how student data is stored securely in the database.

TeacherLoginandDataUpload
Describe how teachers authenticate (e.g., username-password authentication).
ExplaintheCSVformatrequirements(columns needed, data structure).
Discusshowincorrectorincompletedataishandled.

DataPreprocessingandCleansing
Detail how missing values are managed (e.g., mean imputation, removing empty records).
Explainnormalizationtechniquesusedtostandardize student scores.
Mentionifoutliersaredetectedandremoved.

PredictionModelExecution
ExplainhowtheSVMmodelistrained(featuresused, label categories).
Discuss the accuracy of the model and potential improvements. Clarify how real-time predictions are generated when new data is uploaded.

Personalized Study Material Recommendation
Explain how recommendations are generated based on predicted student categories.
Describe whether teachers manually upload study materials or if the system suggests them automatically.

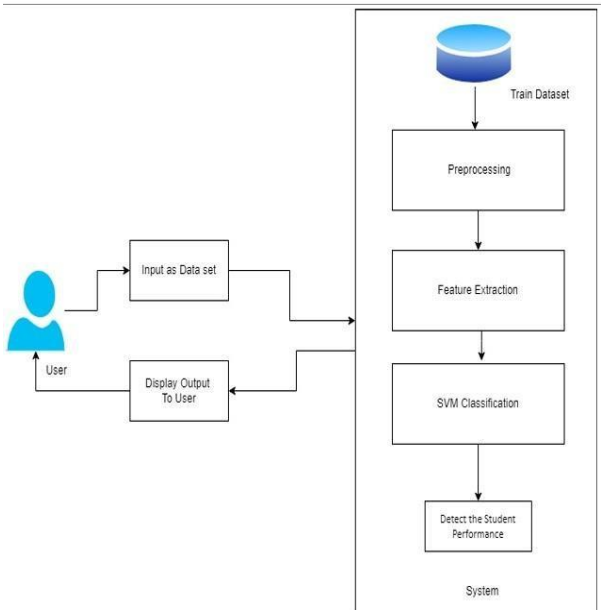

Figure1.SystemArchitecture

4. CONCLUSION

This paper presents a literature survey on student performancepredictionanddetailsthedesignofan automated system for predictive analytics. The systemfeaturesrole-basedaccess,CSV-baseddata processing, an SVM predictive model, and personalizedstudyrecommendations.Futurework will focus on implementing the methodologies, training machine learning models, and evaluating the system's effectiveness through real-world testing.

5. REFERENCES

1.SafaaAlhusban,MohammedShatnawi,Muneer BaniYasin,IsmailHmeidi."Measuringand Enhancing the Performance of Undergraduate Student Using Machine Learning Tools" .2020

11th International Conference on Information and Communication Systems (ICICS)

2.HinaGull1,MadeehaSaqib2,SardarZafarIqbal3, Saqib Saeed4, P.O. Box No. 1982 : "Improving LearningExperienceofStudentsbyEarlyPrediction of Student Performance using Machine Learning"2020IEEEInternationalConferenceforInnovationin Technology (INOCON)Bengaluru, India. Nov 6-8, 2020

3.MarianBucos,BogdanDrăgulescu."Studentcluster analysis based on Moodle data and academic performance indicators".2020 IEEE

4. Fidelia Orji, Julita Vassileva." Using Machine Learning to Explore the Relation Between Student Engagement and Student Performance." 2020 24th International Conference Information Visualisation.

5.Manjari Chitti1, Padmini Chitti 2, Manoj Jayabalan3."Need for Interpretable Student Performance Prediction."2020 IEEE 13th InternationalConferenceon DevelopmentsineSystem Engineering.

6.Swati Verma, Rakesh Kumar Yadav : "Effect of Different Attributes on the Academic Performance of Engineering Students " 2020 IEEE International Conference on Advent Trends in Multidisciplinary Research and Innovation (ICATMRI)

7. SaharVoghoei1,NavidHashemiTonekaboni2 , Delaram Yazdansepas3,Hamid R. Arabnia4 : " University Online Courses: Correlation between Students' ParticipationRateandAcademicPerformance"2019 International Conference on Computational Science and Computational Intelligence (CSCI)

8. Latifaestrelita Indi PramestiAji,Andi Sunyoto."An Implementation of C4.5 Classification Algorithm to AnalyzeStudent's Performance."20203rd International Conference on Information and Communication Technology.

9. John A. Olorunmaiye ,Olalekan J. Ogunniyi, Taiwo Yahaya, Joshua O. Olaoye , Ademola A. Ajayi-Banji : " Modes of Entry as Predictors of AcademicPerformanceofEngineeringStudentsin a Nigerian University" 978-1-7281-9756-2/20/$31.00 ©2020 IEEE

10.FideliaOrji,JulitaVassileva:"UsingMachine LearningtoExploretheRelation BetweenStudent EngagementandStudentPerformance"202024th InternationalConferencInformationVisualisation (IV)