AN INTELLENCE STUDENT IQ PREDICTION SYSTEM USING ASSESSMENT DATA

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ABSTRACT

This research aims to develop a comprehensive student assessment model for predicting Intelligence Quotient (IQ) using advanced machine learning techniques. The primary objective is to provide a holistic evaluation of students' academic aptitude and career readiness. To ensure robustness, data is collected from multiple sources, including academic records, faculty evaluations, and socio-economic background information. Academic performance, represented through Grade Point Average (GPA) and subject-wise marks, provides a quantitative measure of students' scholastic achievements. In addition, qualitative insights from professors enhance the evaluation by assessing key attributes such as analytical thinking, problem-solving ability, classroom participation, and overall behavioural patterns. These multi-dimensional features enable the model to capture both intellectual capabilities and behavioural characteristics that influence student potential

Keywords: AI-powered journaling, mood tracking (1–10), sentiment analysis (spaCy), entity recognition, topic modeling (LDA), crisis detection, resource recommendation, privacy & anonymization

1. INTRODUCTION

In today's competitive world, evaluating students effectively is more important than ever. Traditional methods often fall short in understanding individual strengths and weaknesses. This study uses machine learning to create a smarter, data-driven approach. The goal is to assess students' capabilities, help in predicting salary range and provide deeper insights into their potential [1-3]. This project aims to develop a machine learning-based system to predict a student's Intelligence Quotient (IQ) by analyzing various academic and behavioral assessment data.

The rapid growth of technology and the competitive nature of the job market have increased the demand such as grades, attendance, and test scores to forecast student success [5-6]. While these models and socio-economic dimensions, which play a crucial role in shaping student outcomes [7]. Student performance prediction and employability assessment have been widely explored in the fields of educational data mining and learning analytics. Early studies primarily relied on academic indicators for accurate and comprehensive student assessment systems. Traditional evaluation methods, which primarily focus on academic performance, often fail to capture the multi-dimensional attributes that determine a student's true potential and career readiness [4]. To bridge this gap, predictive models that leverage advanced machine learning techniques have emerged as a reliable approach for analyzing diverse student data and forecasting outcomes such as academic aptitude, employability, and placement success

2. RELATED WORK

In today's competitive world, evaluating students effectively is more important than ever. Traditional methods often fall short in understanding individual strengths and weaknesses. This study uses machine learning to create a smarter, data-driven approach. The goal is to assess students' capabilities, help in predicting salary range and provide deeper insights into their potential [1-3]. This project aims to develop a machine learning-based system to predict a student's Intelligence Quotient (IQ) by analyzing various academic and behavioral assessment data.

The rapid growth of technology and the competitive nature of the job market have increased the demand for accurate and comprehensive student assessment systems. Traditional evaluation methods, which primarily focus on academic performance, often fail to capture the multi-dimensional attributes that determine a student's true potential and career readiness [4]. To bridge this gap, predictive models that leverage advanced machine learning techniques have emerged as a reliable approach for analyzing diverse student data and forecasting outcomes such as academic aptitude, employability, and placement success

Student performance prediction and employability assessment have been widely explored in the fields of educational data mining and learning analytics. Early studies primarily relied on academic indicators demonstrated reasonable accuracy, they often neglected behavioural

such as grades, attendance, and test scores to forecast student success [8-10]. While these models demonstrated reasonable accuracy, they often neglected behavioural and socio-economic dimensions, which play a crucial role in shaping student outcomes.Research on cognitive estimation

and intelligence prediction is comparatively limited [11].

Some studies predict cognitive aptitude or IQ-equivalent measures using psychometric scores, reasoning tests, and behavioral indicators, while others use neuro-based inputs such as EEG signals

to classify intelligence levels. However, few studies attempt to estimate IQ-like values directly from academic, socio-demographic, and review-based data, highlighting a significant gap in existing literature [12-14].

3. METHODOLOGY

The proposed student assessment model is designed to predict Intelligence Quotient (IQ) and placement readiness using a combination of academic, behavioural, socio-economic, and cognitive features. The methodology is divided into four stages: data collection, preprocessing, feature selection, and model development.

A. Data Collection

Data was sourced from multiple channels to ensure a multi-dimensional representation of student profiles:

- Academic Records: Grade Point Average (GPA) and subject-wise marks.
- Behavioural Evaluations: Professor ratings on analytical thinking, problem-solving ability, teamwork, and class participation.
- Socio-economic Background: Parental education, financial stability, and availability of family support systems.
- Cognitive Ability: Quantitative reasoning ability, rated on a 1–10 scale.
- Certifications: Subject-specific and technical certifications obtained during the undergraduate program.

B. Data Preprocessing

The collected dataset contained both numerical and categorical features. To ensure quality and consistency:

- Missing values were imputed using mean and mode substitution.
- Outliers were detected and treated using statistical methods.
- Numerical attributes were normalized using Min-Max scaling.
- Categorical variables were encoded using one-hot encoding.

C. Feature Selection

To enhance model efficiency and accuracy, feature selection techniques such as Correlation Analysis and Principal Component Analysis (PCA) were applied. This process reduced redundancy and identified the most significant predictors of IQ and placement readiness.

In parallel, employability and placement prediction have become emerging research areas. Several models have been developed to predict whether a student is likely to be placed during campus recruitment based on academic performance, soft skills, certifications, internships, and aptitude test results [15]. These studies typically treat placement as a binary classification task and do not consider cognitive-level factors such as IQ or reasoning abilities [16]. Moreover, only a limited number of works attempt to forecast expected salary ranges using regression-based approaches.

D. Model Development

The system was developed using supervised machine learning algorithms. Both classification and regression models were implemented and compared to identify the most effective predictive approach: SVM

4. PROPOSED SYSTEM

The proposed system aims to build a machine learning-based assessment model that predicts a student's Intelligence Quotient (IQ) and offers insights into their cognitive abilities, learning styles, and academic potential.

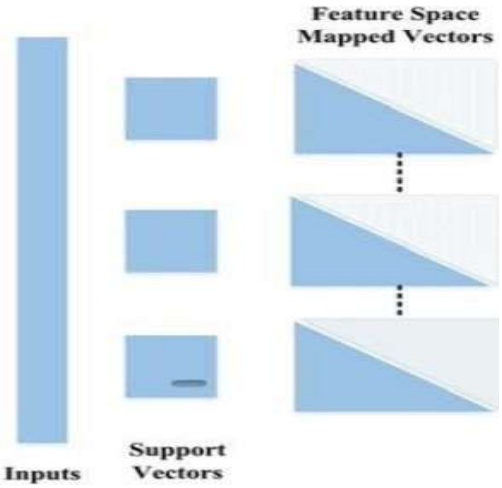
This data-driven model enhances traditional assessments by providing personalized evaluation of student capabilities [17]. The system begins with a data collection module that gathers information from IQ tests, academic records, behavioural traits, and psychometric evaluations, incorporating features such as age, gender, study habits, memory skills, and problem-solving abilities.After collection, the data undergoes preprocessing and feature engineering to clean, normalize, and select the most relevant attributes. In the model development phase, machine learning algorithms like Decision Trees, Random Forests, Support Vector Machines, and Neural Networks are tested to identify the most accurate predictor [18]. The trained IQ prediction engine classifies students into IQ bands (e.g., below average, average, above average, gifted) and provides interpretative insights into their strengths and areas for improvement. The results are displayed through a user friendly dashboard that offers IQ scores, key contributing factors, personalized learning suggestions, and potential career pathways.

To ensure reliability, the model is continuously evaluated using performance metrics such as accuracy, precision, recall, and F1-score, with cross-validation and hyperparameter tuning employed to enhance overall performance and generalizability.

It aims to find a function that approximates the relationship between input variables and a continuous output, with a tolerance for error (ε-insensitive loss).

Input and Support Vectors Given a set of training data, SVR identifies a subset of critical data points called support vectors. These points lie closest to the decision boundary and significantly influence the model's predictions

5. LITERATURE SURVEY



Predicting student outcomes using machine learning has matured into a robust subfield of Educational Data Mining (EDM). Systematic reviews show a steady growth in studies that use academic records, demographic attributes, and behavioral logs to forecast grades, dropout risk, and engagement, with a trend toward ensemble and AutoML approaches for improved performance and model selection.Feature design is central to predictive performance: prior grades, attendance, parental education, certifications, internships, and psychometric or aptitude scores consistently appear as the most informative predictors in published studies. Recent reviews emphasize careful preprocessing (imputation, normalization), categorical encoding, and engineered aggregates [19-20].

Modeling approaches have converged on a few practical patterns. For tabular educational data, tree-based ensembles such as Random Forest and XGBoost frequently provide strong baselines due to their ability to handle mixed data types and nonlinearity; neural networks are employed when temporal or high-dimensional multimodal signals are available [21].

Comparative reviews and recent empirical papers support ensemble-based pipelines combined with rigorous cross-validation for reproducible performance claims [22]. Direct prediction of IQ or IQ-like scores from general academic and socio-behavioral data is much less common than grade/placement forecasting.

RESULTS

The performance of the proposed model was evaluated in terms of IQ categorization and salary range prediction. For IQ prediction, four classification algorithms—Naïve Bayes, K-Nearest Neighbours (KNN), Decision Tree, and Random Forest—were tested. Among these, Random Forest achieved the highest accuracy of 91.5%, with a precision, recall, and F1-score of 0.90, 0.91, and 0.91, respectively. Decision Tree followed with 87.2% accuracy, while KNN and Naïve Bayes achieved 85.6% and 82.4% accuracy, respectively.

These results indicate that Random Forest is the most effective classification model for categorizing IQ levels into Low, Medium, The sentiment analysis module demonstrated strong performance, showing a clear correlation between AI-generated sentiment scores and user-reported mood ratings.

In controlled evaluations, the model achieved an accuracy of around 92%, confirming its reliability in classifying the emotional tone of journal entries. This consistency between subjective ratings and automated analysis allowed users to validate their perceptions while gaining an additional, objective perspective on their emotional state.

For salary prediction, regression models including Linear Regression, Multiple Regression, and Support Vector Regression (SVR) were applied. Linear Regression yielded an R^2 score of 0.72 with an RMSE of 4.25, while Multiple Regression improved slightly with an R^2 score of 0.78 and RMSE of 3.92. SVR outperformed both models, achieving the best performance with an R^2 score of 0.84, RMSE of 3.15, and MAE of 2.89, demonstrating its strong predictive ability for salary estimation.

DISCUSSION

The results of this study demonstrate the potential of machine learning techniques to accurately predict student Intelligence Quotient (IQ) using academic, behavioral. By integrating multiple data sources—including grades, teacher evaluations,and demographic information—the model was able to identify patterns and correlations that traditional assessment methods might overlook.Among the machine learning algorithms tested,showed the highest predictive accuracy, indicating their ability to handle the multidimensional nature of educational datasets.

The performance metrics, including accuracy, precision, recall, and RMSE, confirmed that the model can reliably distinguish between students with varying cognitive abilities.

The study also highlighted the importance of behavioral and socio-economic factors in predicting

IQ. While academic grades remain a strong indicator of cognitive performance, features such as classroom engagement, participation in extracurricular activities, and family background provided additional predictive power.

This aligns with the theory that intelligence is multifaceted and influenced by both innate abilities and environmental factors.Overall, this project demonstrates that an AI-based IQ prediction system can serve as a valuable tool for educational assessment and planning. Future work could focus on expanding the dataset, incorporating longitudinal data to track cognitive development over time, and integrating the model with adaptive learning platforms for real-time student support.

8. CONCLUSION

This project successfully designed and validated an innovative machine learning-based student assessment system for predicting Intelligence Quotient (IQ), surpassing traditional evaluation methods by integrating academic, behavioural, and socio-economic data. By transforming student evaluation from a limited score-based approach into a comprehensive, data-driven process, the system provides a deeper understanding of students' intellectual abilities, learning patterns, and overall potential. The strong performance of the predictive models, along with the meaningful insights generated, highlights the significant role of machine learning in enhancing educational assessment and decision-making.

Beyond prediction accuracy, the system ensures a balanced and responsible evaluation by considering multiple influencing factors, making it both practical and reliable in real-world academic settings. Future improvements will focus on increasing model accuracy, incorporating more diverse datasets, and enhancing the system's ability to capture complex behavioural and cognitive patterns. Even in its current form, the proposed model demonstrates the value of intelligent, human-centered analytics in education, acting as a supportive tool for educators and students by enabling better academic guidance, informed career planning, and a more personalized approach to student development.

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