Examination of Artificial Intelligence Integration and Impact on Higher Education

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***Abstract*—This research investigates utilizing Machine Learning (ML) and Artificial Intelligence (AI) within academic settings. Drawing upon scholarly sources, we explore the strategic deployment of ML algorithms for tasks such as detecting AI-generated content, evaluating students' graduation potential, and enhancing personalized learning experiences. Our methodology encompasses several key stages: gathering and understanding ML, selecting appropriate models, collecting and prepossessing data, model training, evaluation, testing, and comparative analysis. Through rigorous evaluation using diverse datasets, we assess the performance of Decision Trees, Multinomial Naive Bayes, and Neural Network models in accurately classifying text samples. The findings from this study provide valuable insights into the efficacy of ML algorithms in academic contexts and offer practical implications for their implementation.**

***Keywords*—Privacy, Data Security, Cybersecurity, Machine Learning, Artificial Intelligence, Decision Trees, Multinomial Naive Bayes, Neural Network.**

I. Introduction

Unsurprisingly, integrated technology has become an integral part of the modern academic curricula. Advancements in data analysis have pushed forth new methods of personalized experiences. Schools host a wealth of student data, from financial situations to mental health and academic performance. Many provide educators with tools like learning analytics, scholarships, accommodations, or enrollment. However, having a collection of data is not without its merits. For instance, concerns about how it was collected and what the data will be used for beyond education, ethics, discrimination, or privacy can exist.

V. Scholes discusses ethical concerns with categorizing students using data analytics on risk [1]. Institutions devise the use of learning analytics to understand better students to help facilitate a better outcome for their education, predictive risk models can then assign a student of whether or not they face such risk in there academic success. The article continues with individuals of high risk that the institution has identified can now face different treatment from others to prevent that individual from becoming a "negative statistic". V. Scholes writes how students can experience an impact on their individuality and agency due to the learning analytics [1]. Moreover, for data use, Korir [2] writes about the concern that higher education students have over their data. The article continues by stating that when students were made aware of their school collecting data, they did not mind; however, they found an issue with the possibility of data being shared amongst third-party sources. The article's research shows that students seem to trust their school with data so long as there is transparency about its use and privacy. As an example from the article, they mention students being comfortable with data usage by their school for learning analytics. Still, they aren't as much for Amazon using their data [2].

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A. Implementation of AI in Education Using Collected Data

With the ever-evolving landscape of artificial intelligence, there is no doubt that it will eventually be implemented into a person's everyday life. This includes their work or academic environment. Research and experiments have been performed regarding the use of artificial intelligence in the educational system and how it could negatively or positively affect everyone involved in education.

One benefit of implementing artificial intelligence into the education system is the creation of cheating detection programs. Some programs have already been developed to detect possible plagiarism within a paper, and with machine learning models improving all the time, it becomes easier to detect. Another plus about these programs is their development in identifying any possible generation from artificial intelligence programs.

Another one would include predictive analytics. Akgun and Greenhow's 2021 article [3] reviews some ethical concerns of implementing artificial intelligence, and they review some

benefits as well. One of these is predictive analytics, which can be used to assess which students might need help. They can detect which students have a good possibility of failing or dropping a course, which allows the instructors to step in and provide the help they need [3].

Zawacki-Richter et al. 2019 article [4] reviews the application of artificial intelligence within the education system and how it would benefit it. They discuss a tool that would be worthwhile for students due to its potential to help them. This tool is the Intelligent Tutoring System (ITS). An ITS is a one-on-one tutor, but instead of being a teacher and student, it is an artificial intelligence model and student. Zawacki-Richter et al. They also studied different cases involving intelligent tutoring systems and discussed the various ways students can benefit from them. Many cases prove that intelligent tutoring systems benefit the students who take advantage of them. One of these is an experiment performed in Chinese middle schools by Zhen Xiu and Thai (2018) [5]. When the experiment concluded, they found that students who used an intelligent tutoring system performed better than students who had a teacher in a traditional classroom. Another experiment involving intelligent tutoring systems was performed by Kenneth Holstein and Vincent Aleven (2022) [6] that required some teachers to wear glasses with a built-in ITS, which displayed information about their students and compared them to teachers who did not. After the experiment concluded, similarly to the experiment in China, the teachers with glasses students performed better than the teachers without glasses students [6]. Overall, intelligent tutoring systems are very beneficial not only for students but also for instructors.

Moving on to the potential issues it can create is the amount of money spent. The requirements for artificial intelligence and machine learning models to function correctly and to perform effectively are very specific. Owoc et al. (2019) [7] review this issue in detail. They discuss the infrastructure needed to install all the essential system requirements, and since machine learning is constantly improving, the hardware and software need to be the best [7]. The best computer parts are costly, so if every school decided to implement artificial intelligence, the spending would be a massive issue within the country. Hypothetically, if schools decide to implement artificial intelligence, students may bring some other concerns to light.

Another challenge of schools using artificial intelligence would be the privacy concerns from the data collection performed by those programs. Maina Korir et al. (2023) [2] surveyed college students about data collection involving their school and third-party companies. In the survey results, most students answered that data collection happens at their school, but they do not like the idea of their school providing data to third parties [2].

One final example of artificial intelligence in the education system hindering students or instructors is some form of cheating. Before artificial intelligence was readily available to the general public, cheating, and plagiarism were issues. However, due to the surge in popularity of artificial intelligence, a new wave of concerns has risen. Research done by Abdelaal et al. (2019) [8] shows that a specific artificial intelligence program cheats the academic integrity of educational institutions, which is automatic article generators. Even though this particular aspect is not implemented into the educational system, it still creates problems because students can access these third-party programs whenever and wherever they want. However, artificial intelligence and machine learning programs have recently been developed to detect cheating.

B. Impact of Education with AI usage and ChatGPT

In contemplating the integration of AI into school curricula, numerous ethical, practical, and strategic considerations demand attention, echoing the insights provided in the resources cited. Ethically, the collection and potential sharing of student data by AI and machine learning models pose significant privacy concerns, as underscored in Lo [9] and David Baidoo-Anu [10]. School boards must conduct thorough assessments to weigh the benefits against the risks, ensuring compliance with privacy regulations and safeguarding students' sensitive information. Moreover, an exhaustive review of the advantages and drawbacks of AI implementation is imperative. While AI technologies offer personalized learning experiences, instantaneous feedback, and access to extensive educational resources, they also present challenges such as data privacy, information reliability, and algorithms' potential biases. Therefore, decision-makers must meticulously evaluate these factors to make informed choices regarding adopting AI programs within schools.

Efficient utilization of AI hinges upon carefully selecting appropriate machine learning models, educational programs, and tools that align with educational objectives and curriculum requirements. This necessitates comprehensive training for school administrators and educators to effectively leverage AI technologies in teaching practices. Moreover, integrating AI into the curriculum mandates thoughtful planning and alignment with educational goals. School boards must identify areas where AI can enhance learning experiences and support student achievement, collaborating with educators to develop relevant lesson plans, activities, and assessments that promote critical thinking, problem-solving, and digital literacy skills.

Furthermore, continuous evaluation and improvement are essential to successful AI implementation in schools. Establishing mechanisms for monitoring the effectiveness of AI programs, collecting feedback from students and teachers, and making necessary adjustments are crucial for optimizing learning outcomes. Additionally, staying abreast of advancements in AI technology and incorporating new developments into educational practices ensures that AI technologies effectively support academic goals and enhance student learning experiences. In essence, integrating AI into school curricula demands careful consideration of ethical, practical, and strategic factors to ensure its successful implementation and meaningful impact on education.

Overall, many considerations go into implementing AI in schools. First, there is the ethical side of things, where if AI

and machine learning models are added, then students' data will be collected and possibly shared with other parties. This will raise privacy concerns. School boards must review the different advantages and disadvantages and decide which will outweigh each other if they decide to implement AI programs in their schools. Finally, if everything follows through, they must also determine the most efficient way to use it. This includes the machine learning models, what programs to use, etc. All in all, there are a significant number of considerations when wanting to add AI to their curriculum.

II. Methodology

This section provides an in-depth exploration of Machine Learning and AI in academia. Our approach is rooted in academic research based on scholarly sources discussing Machine Learning and AI use for educational facilities and the strategic use of machine learning algorithms to determine accuracy in their effective detection of AI-generated content by Generative Pre-trained Transformer (GPT), determining students' graduation potential, etc. The overarching objective of this methodology is to understand machine learning and its applications for academic settings while evaluating the accuracy of our chosen models.

A. Gathering Information about Machine Learning

Before we performed any experiments involving the machine learning models, we needed to gather information about machine learning in general. This included studying papers listing different models, their performance, and which would yield more accurate results. After we gained some insight on how these models work, we looked at other papers that discuss how machine learning and artificial intelligence are implemented in academic settings and what kind of results they would provide us. These papers included possible benefits and/or dangers of implementing machine learning.

B. Model Selection

The pivotal decision in our methodology lies in carefully selecting machine learning models. We wanted to understand which kind of models can obtain the most accurate results based on the datasets. To determine that, we looked to online guides and sources to get a proper idea of how a model functions. For this experiment, we have chosen Decision Trees, Multinomial Naive Bayes, and Neural Networks as we believe they to be well suited for our datasets.

C. Data Collection and Preprocessing

We gathered multiple supervised datasets from different sources, including an IEEE paper and kaggle.com. Supervised datasets are predetermined datasets useful for determining a model's accuracy and predicting an outcome. We focused on finding datasets that involved plagiarism, graduation, and dropout rates based on specific situations and whether students need a study plan tailored to them. Also, during this stage, we cleaned up the text, removed the formatting, and converted some of the data into string integers to ensure we got reliable and consistent results.

D. Model Training

To have correctly functioning and trained models, we needed the software necessary to provide a training environment. After learning from various guides, we have chosen Anaconda as our platform. Anaconda provides all the essential tools for the experiment, such as Jupyter Notebook, an open-source web application popular amongst data scientists. This also gave us access to Scikit-learn and TensorFlow, which are machine-learning libraries. The coding was done within Jupyter Notebook on Python, a popular machine learning and data analysis choice. We then imported the libraries and called specific functions from the library for particular models. After this, we began to train our models with our formatted dataset. Each model was done in separate notebooks to avoid clashing issues.

E. Evaluation and Testing

For the rigorous assessment of our models, we introduce a separate testing dataset meticulously curated from reputable sources such as IEEE publications. This testing dataset comprises a diverse mix of text samples, encompassing both human-written and AI-generated content. The use of this dataset allows us to evaluate and measure the models' performance objectively. We employ a range of performance metrics to gauge the efficacy of our models. These metrics include accuracy, precision, recall, and the F1-score, comprehensively evaluating each model's capacity to classify text samples correctly.

To ensure rigorous evaluation of our models, we've established a separate testing dataset meticulously sourced from reputable outlets like IEEE publications and Kaggle.com. These datasets comprise a diverse range of text samples, including those written by humans. Utilizing these datasets enables us to evaluate and measure the performance of our models objectively. We employ various performance metrics, including accuracy, precision, and recall, to gauge the effectiveness of our models. These metrics provide a comprehensive evaluation of each model's capacity to classify text samples correctly.

F. Model Comparison

Upon completing the evaluation process, we conducted an in-depth comparative analysis of the multiple selected machine-learning models. This analysis is integral to our methodology as it elucidates which model exhibits superior proficiency in discerning between text and academic content. The results of this analysis guide us in determining the most effective approach to meet our research objectives.

G. Findings and Conclusion

The methodology's final stage entails interpreting the results derived from the model evaluations. By analyzing these findings, we derive well-founded conclusions regarding the models' performance and accuracy in achieving the results using each dataset.

H. Limitations and Future Work

We also conscientiously acknowledge the limitations inherent to our methodology, including potential biases in the dataset or the scope of model generalizability. This transparency in addressing limitations reinforces the integrity of our research.

III. The Different Algorithms and Datasets

There is a wide range of different machine learning algorithms, and we used five different algorithms. These algorithms were determined to be the best at catching generated papers and providing the most accurate outcome using our collected datasets: Decision Trees, Random Forests, Multinomial and Gaussian Naive Bayes, and Recurrent Neural Networks. Plenty of articles and journals provide extensive research on these algorithms. However, in a journal article in the *International Journal of Science and Research (ISJR)*, the author Mahesh (2019) [11] goes into some detail about Decision Trees, Naive Bayes, and Neural Networks, while providing the purpose and some pseudo code for each of them. Also, Gerard Biau and Erwan Scornet (2016) [12] discuss the Random Forests. Finally, Ilya Sutskever (2013) [13] did his PhD thesis all about the Recurrent Neural Network algorithm and goes into great detail about it and how he used it in his experiment.

A. Models

1) Decision Trees: One of the machine learning algorithms we decided to use is the Decision Tree, which is a graph with nodes and branches, similar to a tree and its roots. They represent choices and their results, to which their nodes in the graph represent the decision rules or conditions [11]. A tree is formed using yes or no questions, and depending on the answer, it moves to a new node with a new question. This will be helpful in detecting AI generation because it can compare AI the generated work we have already given our program to the data we collected, so the questions can regard grammar or any other common mistake that is in an AI-generated paper. Also, it will help determine patterns using the datasets collected and provide a conclusion to the hypothetical student based on the algorithm's results.

2) Random Forests: One model that is similar to decision trees is the random forest model. Biau and Scornet (2016) [12] explain that it is a prediction algorithm used to collect a certain number of regression trees, and it generates a random number of trees from the base of the tree. Overall, it is a bigger and more efficient version of a decision tree.

3) Naive Bayes: Another machine learning algorithm we decided to use was the Naive Bayes algorithm. It is classified from the Bayes theorem, which is able to describe the probability of something that can happen. A Naive Bayes classifier looks to see if there is a specific feature in a class that does not relate to any of the other features within the class [11]. Given the variety of the datasets, we specifically have an interest in Multinomial and Gaussian. This algorithm will be beneficial for us because using it should allow us to determine if there is any information that is unrelated to the prompt that the AI generated and to help determine the outcomes of specific situations for students.

4) Recurrent Neural Network: The final machine learning algorithm our group decided to use is the recurrent neural network. It is very efficient at detecting patterns regarding languages and different speech models. Overall, this algorithm is a good choice for detecting possible AI generation and predictive analysis because it detects pattern recognition with sequences being the inputs and outputs. Speech recognition and synthesis, named-entry recognition, machine translation, and language modeling are essential when developing methods that map sequences to sequences [**?**].

B. Datasets

Below are the three data sets used for our model performance evaluation. All models were trained on these datasets.

1) ChatGPT and Student Detection: This supervised learning dataset comes from "Distinguishing Human-Written and ChatGPT-Generated Text Using Machine Learning" [14]

The dataset consisted of 500 rows and three columns. The three columns are Answer, Question, and Label. A label is a target to be predicted as it had ChatGPT and Student. All three columns had 500 rows that consisted of two aspects: - 250 questions involved in computer science classes that ranged from short answers to code. - 250 answers were given by students in response to the questions, and 250 answers were given from ChatGPT 3.0 in response to the questions. The data collectors mentioned that a random student responded to each question. We preprocessed this data set by using drop to remove any Na variables and the Sklean count vectorizer to convert text into a numerical format for machine model analysis.

2) Student Success Prediction: This supervised learning dataset comes from "Predict students' dropout and academic success" [15]

The dataset consisted of 4424 rows and 35 columns. The columns included many identifiers, but most noteworthy were course, daytime/evening, attendance, curricular units 2nd semester (various aspects like grades), Gross Domestic Product (GDP), unemployment rate, and target (the column to be predicted). The target included dropouts, graduates, and those who were enrolled. The dataset is affiliated with:

- 1. VALORIZA - Research Center for Endogenous Resource Valorization, Portalegre, Portugal [15]
- 2. Polythecnic Institute of Portalegre [15]

The data collectors stated that the set was created by a higher education institution based on students of different majors and information during enrollment.

3) University Admission: This supervised learning regression dataset comes from "Data for Admission in the University" [16]

The dataset consisted of 400 rows and nine columns. The columns included many identifiers,, but most noteworthy were University Rating, GRE Score, Cumulative Grade Point Average (CGPA), and Chance of Admit (the variable to predict). The chance of admittance was 0 to 1, meaning the percentage

chance of acceptance. The dataset looks at many aspects of admission amongst various universities. The author of the dataset mentions that their findings came from the internet.

IV. Results of Machine Learning Evaluation

A. Supervised Dataset Accuracy

The two supervised datasets of ChatGPT vs student and student success have outcomes that the models in training must predict. Below are the scores based on the accuracy of prediction:

TABLE I
ChatGPT and Student Detection Score

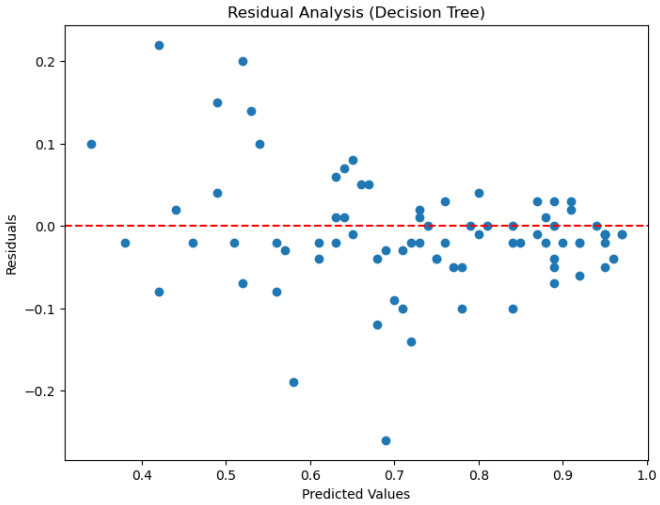
Decision Tree	62%
Random Forest	71%
Multinomial Naive Bayes	40%
Gaussian Naive Bayes	46%
Neural Network	42%

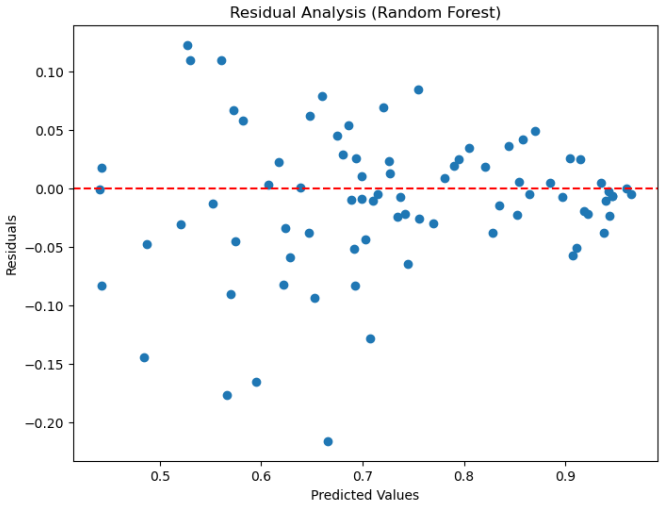
TABLE II
Student Success Prediction Score

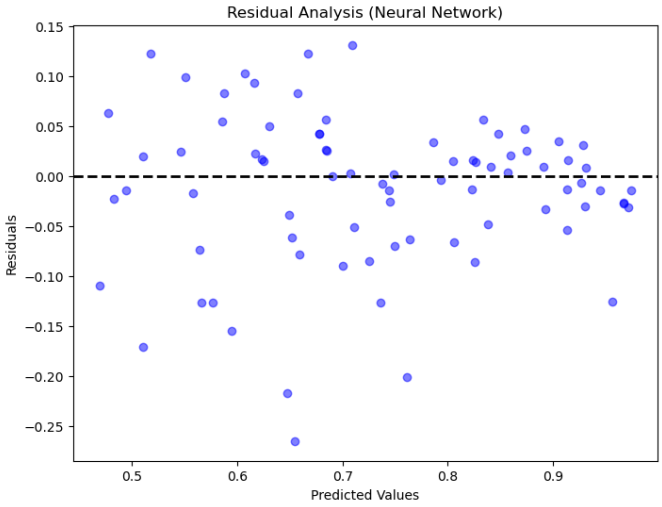
Decision Tree	69%
Random Forest	77%
Multinomial Naive Bayes	54%
Gaussian Naive Bayes	70%
Neural Network	72%

B. Residual Analysis

The third dataset of student admission is looked upon with residual analysis since the desired outcome of prediction isn't a matter of categorizing but rather percentage chance. Naive Bayes was not measured as we found it unsuitable for linear regression. Below are the results:







V. Discussion

As shown in Table 1, we found that the Random Forest had the most optimal performance with an accuracy score of 71. Meanwhile, the Multinomial Naive Bayes scored the lowest at 40. For Table 2, we can see Random Forest leads with 77 and Neural Network not far behind with 72. When looking at Naive Bayes, Multinomial performed with 54 while Gaussian had a 70. This is likely due to the dataset used for Table 2 having a number-focused dataset rather than complex answers in word format like Table 1. As for the residual analysis, we see the residual of the university admission. Most of the models performed well here, with improved prediction across the three. Given the nature of each dataset, as expected from our research, models are situational in terms of their strengths and weaknesses. Before adjustment, the Neural Network during testing was reaching an accuracy of 93, but would output 12. This could be linked to over-fitting, where the model does better on the test but not the prediction. Overall, the models show their ability to recognize a pattern and come to a conclusion that we can work off of. Dataset analysis for Table 2 was especially interesting as we witnessed models look upon students' marital status, parental status,

gender, age, and background with pure numerical value to determine their performance outcome. The individuality of a student vanished. We would like to recognize once again that the results aren't definitively inheritable. It's possible that with proper adjustments and advisement, we could see the models perform exponentially better. However, these results are based on the pure implementation of the model with slight feature extraction and other considerations. What's important to us is their usage for academic-based datasets. Our research has allowed us to understand and conduct the same analysis techniques found in other scholarly journals on the subject. It encapsulates the exploration of machine learning in academic analysis, focusing on its benefits, dangers, and effects within educational institutions.

VI. Conclusion

Through the analysis of integrating artificial intelligence into the educational system and the evaluation of machine learning models, it is evident that careful consideration is imperative in navigating the ethical, practical, and strategic implications associated with this integration. Ethically, the collection and potential sharing of student data by AI and machine learning models raise significant concerns regarding privacy and data security, as highlighted in various studies. School boards and educational institutions must conduct thorough assessments to weigh the benefits against the risks, ensuring compliance with privacy regulations and safeguarding students' sensitive information. Transparency in data usage and privacy policies is essential to building trust and addressing concerns among students and stakeholders.

Practically, implementing AI in education offers numerous benefits, including cheating detection programs, predictive analytics for student success, and personalized learning experiences through intelligent tutoring systems. These AI technologies have the potential to enhance teaching practices, support student achievement, and provide valuable insights for educators. However, challenges such as the cost of implementation and potential job displacement for educators must be carefully addressed and mitigated. Strategically, efficient utilization of AI requires thoughtful planning and alignment with educational goals. School boards must identify areas where AI can enhance learning experiences and support student achievement, collaborating with educators to develop relevant lesson plans, activities, and assessments that promote critical thinking and problem-solving skills. Continuous evaluation and improvement are essential for optimizing learning outcomes and ensuring AI technologies effectively support educational goals.

In conclusion, integrating AI into school curricula demands creating an Education AI Framework and Policy that considers ethical, practical, and strategic factors to ensure its successful implementation and meaningful impact on education. By addressing concerns related to privacy, cost, and job displacement while leveraging the benefits of AI technologies, educational institutions can create a conducive learning environment that fosters student success and prepares them for future challenges.

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