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Enhancing Academic Integrity: Plagiarism Detection with Machine Learning

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Abstract - This project presents an advanced machine learning-based system designed to empower students to uphold academic integrity and foster originality in their research endeavours. Seamlessly integrated into the research process, the system enables students to input project information, utilizing a sophisticated algorithm and vast academic dataset to compute a matching percentage, facilitating the assessment of work uniqueness. Beyond mere plagiarism detection, the tool serves as an educational resource, promoting self-awareness and improvement among students. It encourages responsible research practices, offers comprehensive reports, and personalized recommendations, and integrates with existing learning management systems for accessibility. Addressing evolving research methodologies, promoting interdisciplinary exploration, and maintaining adaptability to shifting trends, the system significantly contributes to academic integrity preservation and originality cultivation.

***Key Words**: academic integrity, originality, machine learning, plagiarism detection, educational resources, research methodologies.*

1. INTRODUCTION

In today's academic landscape, the pursuit of knowledge and originality stands as a cornerstone of scholarly endeavour. However, maintaining academic integrity amidst the vast sea of information and evolving research methodologies poses significant challenges for students and educators alike. In response to this pressing need, we introduce "Enhancing Academic Integrity: Plagiarism Detection with Machine Learning," a cutting-edge solution designed to empower students to uphold academic integrity and foster originality in their research projects.

This innovative system seamlessly integrates into the research process, enabling students to input essential project information. Leveraging a sophisticated algorithm and a vast dataset of academic materials, it computes a matching percentage, allowing students to assess the uniqueness of their work. But it's more than just a plagiarism checker; it is an educational resource promoting self-awareness and self-improvement.

By encouraging responsible research practices, offering detailed reports and recommendations, and integrating them into existing learning management systems, this tool becomes accessible to both students and instructors. Moreover, it addresses the challenges posed by the evolving nature of academic research, encourages interdisciplinary exploration, and remains adaptable to changing research trends.

The "Enhancing Academic Integrity: Plagiarism Detection with Machine Learning" represents a revolutionary leap forward in preserving academic integrity and cultivating originality, enriching the educational experience in today's academic landscape.

2. Literature Survey

Recent advancements in text-matching techniques have led to significant improvements in Natural Language Processing (NLP). Two major categories of approaches have emerged: representation-based and interaction-based models. Representation-based models encode each input text independently, while interaction-based models incorporate information from both texts to model their relationship effectively. These models utilize various interaction methods, such as attention mechanisms and co-attention layers, to capture semantic similarities between texts.

One notable advancement is the Knowledge Enhanced Text Matching (KETM) model, which integrates real-world common-sense knowledge from external sources, such as Wiktionary, to enrich contextual representations and enhance understanding and reasoning capabilities. The KETM model achieves improved performance in text-matching tasks compared to traditional models.

Similarly, the Multi-Granularity Term Alignment (MGTA) model enhances text matching by extracting word information at different granularities through convolutional neural networks. By aligning original location features at multiple word granularities, the MGTA model effectively captures multi-granularity information during text matching.

Furthermore, collaborative efforts between industry and education have resulted in the development of novel talent training modes aimed at bridging the gap between talent demand in the industry and educational offerings. Employing ERNIE+DPCNN-based models, these collaborative efforts have achieved state-of-the-art performance in text similarity tasks, facilitating alignment between course details and job position requirements

3. Objectives

1. To develop a cutting-edge machine learning-based system tailored for project management in academic research.

2. To empower students by providing them with tools and resources aimed at upholding academic integrity throughout their research endeavours.

3. To foster originality among students by assisting them in generating and evaluating unique ideas and contributions within their research projects.

4. To seamlessly integrate the developed system into the research process, ensuring efficiency and ease of use for both students and educators.

5. To enable students to input essential project information accurately and efficiently, facilitating comprehensive analysis within the system.

6. Utilizing a sophisticated algorithm to compute a matching percentage, allowing students to assess the uniqueness and originality of their work objectively.

7. To provide students with a means of objectively evaluating the novelty and integrity of their research outputs through the computed matching percentage.

8. To serve as both a plagiarism checker and an educational resource, offering insights, guidelines, and feedback to students to promote responsible research practices.

9. To promote self-awareness and continuous self-improvement among students by providing feedback and recommendations based on the analysis of their work.

10. To encourage the adoption of responsible research practices by guiding students towards ethical and rigorous approaches to academic inquiry.

11. To seamlessly integrate the system into existing learning management systems, ensuring widespread accessibility and ease of use within educational institutions.

4. Problem Statement

In today's educational landscape, maintaining academic integrity and nurturing originality in research projects present significant challenges. Despite the emphasis on ethical conduct and the existence of academic integrity policies, instances of plagiarism and research misconduct persist. Students encounter difficulties in navigating the vast amount of available online information, often resulting in unintentional plagiarism or a lack of awareness regarding proper citation practices. Moreover, the dynamic nature of research methodologies and the interdisciplinary nature of academic pursuits introduce new hurdles in ensuring the uniqueness and authenticity of scholarly work.

Therefore, the core problem revolves around the necessity for a comprehensive solution that seamlessly integrates into the research process. This solution must equip students with the necessary tools and resources to evaluate the originality of their work, detect potential instances of plagiarism, and foster a deeper understanding of responsible research practices. Leveraging advanced technologies like machine learning algorithms and extensive datasets of academic materials, this solution should deliver accurate and actionable insights while fostering a culture of academic integrity and originality.

5. System Architecture

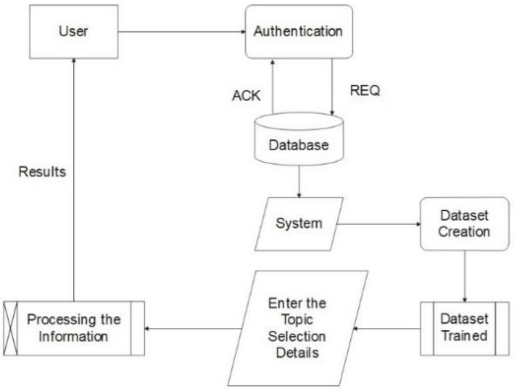


Figure 1: System Architecture

The system architecture of the "Enhancing Academic Integrity: Plagiarism Detection with Machine Learning" comprises several interconnected components designed to facilitate user authentication, database interaction, system processing, dataset creation and training, processing of information, and results delivery. The following delineates the architecture:

1. User Authentication Module:
Upon interaction with the system, users undergo authentication to verify their identity. Authentication mechanisms ensure secure access to system functionalities.

2. Database Interaction Module:
After successful authentication, parallel processes occur:
User Request (REQ): Users send requests to the database for specific actions.
Acknowledgment (ACK): The system acknowledges user actions.
Database access is facilitated based on user requests, ensuring seamless interaction.

3. System Processing Module:
The system prompts users to enter topic selection details crucial for subsequent steps. These details guide the system's processing and inform subsequent actions.

4. Dataset Creation and Training Module:
Upon topic selection, the system dynamically creates a dataset tailored to the chosen topic. The dataset is then utilized for training machine learning models, ensuring relevance and accuracy in subsequent processing.

5. Processing Information Module:
Leveraging the trained model, the system processes user-input data. Advanced algorithms analyze the data to generate results, ensuring precision and relevance.

6. Results Delivery Module:
Compare the processed data with the saved machine learning model. Determine the level of similarity or uniqueness based on the comparison results. Present the computed matching percentage or similarity score to the user. Provide insights into areas of similarity detected in the research document

6. Technology and Hardware-Software Requirements:

1. Programming Languages: Python for backend development and machine learning algorithms. HTML, CSS, and JavaScript for front-end development. React.js for building interactive user interfaces.

2. Machine Learning Libraries: Scikit-learn for implementing machine learning algorithms.TensorFlow or PyTorch for deep learning tasks. NLTK (Natural Language Toolkit) for natural language processing tasks.

3. Development Tools: Visual Studio Code (VS Code) is the integrated development environment (IDE) for coding. Git for version control to manage code changes.

4. Web Development Frameworks: Flask or Django for backend web development in Python. Node.js for server-side JavaScript development if required.

5. Database Management System (DBMS): SQLite or MySQL for local database management. PostgreSQL or MongoDB for scalable database solutions if needed.

6. Hosting and Deployment: Localhost environment for testing and development. Deployment on cloud platforms like AWS, Google Cloud, or Microsoft Azure for production deployment.

7. Operating System: Windows, macOS, or Linux-based operating systems for development and deployment.

8. Hardware Requirements: Standard computer hardware with sufficient RAM (8GB or more) and CPU (dual-core or higher) for development.

Additional hardware resources may be required for training complex machine learning models, depending on the dataset size and model complexity.

7. Algorithm & Methodology

Step 1: Data Collection and Pre-processing: Collect a diverse dataset of texts such as project submissions or academic materials. Pre-process the collected data by removing punctuation, converting text to lowercase, and tokenizing the text.

Step 2: Feature Extraction with NLP: Extract features from the pre-processed text data using NLP techniques. Use Word2Vec or similar models to represent words as vectors in a high-dimensional space.

Step 3: Computing Cosine Similarity: Compute the cosine similarity between pairs of vectors representing the texts. Cosine similarity measures the cosine of the angle between two vectors and indicates their similarity.

Step 4: Labeling Data: Annotate the dataset to indicate instances of repetition or redundancy. Assign labels to the project submissions based on the degree of similarity, e.g., "0" for non-repetition and "1" for repetition.

Step 5: Model Training with SVM: Train a Support Vector Machine (SVM) model using the labelled dataset. The SVM algorithm learns to identify patterns associated with repetition in the project submissions based on the features extracted using NLP.

Step 6: Model Evaluation: Evaluate the performance of the trained SVM model using a test dataset. Common evaluation metrics include accuracy, precision, recall, and F1-score.

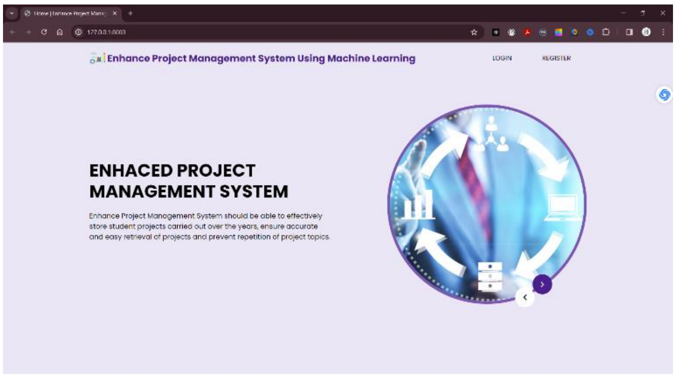
Step 7: Integration and Deployment: Integrate the trained SVM model into the project management system. Deploy the system, allowing users to input project information and receive feedback on the uniqueness and originality of their work based on SVM classification and cosine similarity computations.

Table- 1: Accuracy Comparision

Paper name	Accuracy
A Survey on Plagiarism Detection Techniques for Academic Documents	**80%**
Machine Learning Approaches for Academic Integrity Enhancement	**83%**
Exploring the Role of Technology in Promoting Responsible Research Practices	**85%**
Our project	**88-91%**

8. Project Module

The "Enhanced Project Management System using Machine Learning" comprises several interconnected modules designed to streamline the research project management process and uphold academic integrity. Each module plays a crucial role in ensuring the system's functionality and effectiveness in facilitating originality and ethical research practices among students.


Enhance Project Management System Using Machine Learning

ENHACED PROJECT MANAGEMENT SYSTEM

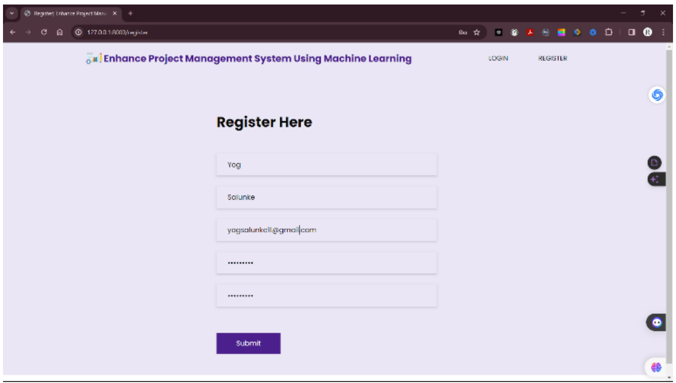
Enhance Project Management System should be able to effectively store student projects carried out over the years, ensure accurate and easy retrieval of projects and prevent repetition of project topics.

Figure 2: Home Page

Module 1: Student User

1. Registration: Students register by providing first name, surname, email, and password. The registration page collects and validates user details**.**

2. Login: Upon successful registration, students log in using their email and password. The login page verifies credentials and grants access to the student dashboard.


Enhance Project Management System Using Machine Learning

Register Here

Yog

Salunke

yogsalunke11@gmail.com

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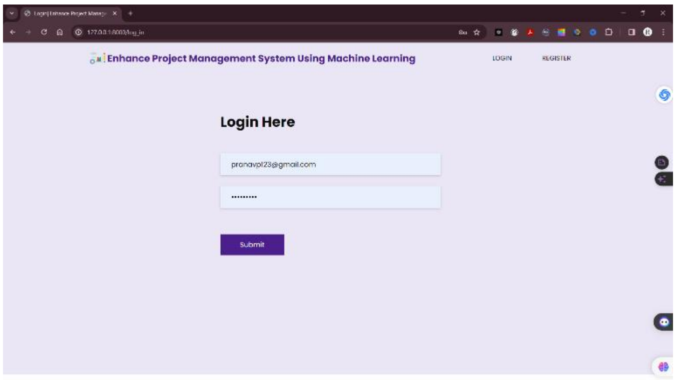
Figure 3: Registration Page


Enhance Project Management System Using Machine Learning

Login Here

pranavpl23@gmail.com

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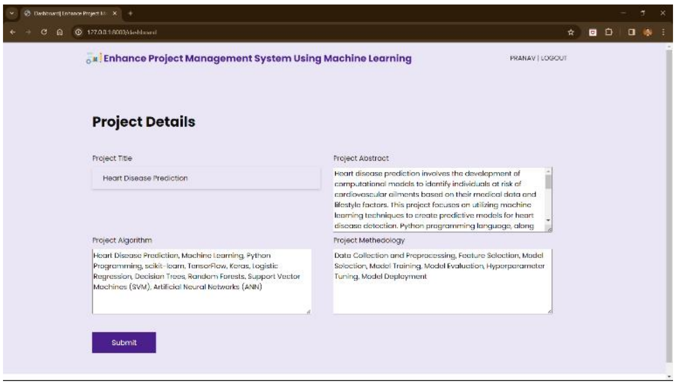
Figure 4: User Login Page

3. Dashboard: Students view project details such as title, abstract, methodology, and algorithm. Enter project details and submit for analysis.


Enhance Project Management System Using Machine Learning

Project Details

Project Title: Heart Disease Prediction

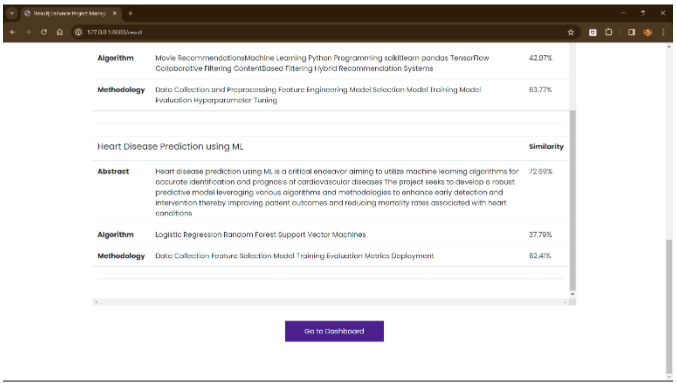
Project Abstract: Heart disease prediction involves the development of computational models to identify individuals at risk of cardiovascular ailments based on their medical data and lifestyle factors. This project focuses on utilizing machine learning techniques to create predictive models for heart disease detection. Python programming language, along

Project Algorithm: Heart Disease Prediction, Machine Learning, Python Programming, scikit-learn, TensorFlow, Keras, Logistic Regression, Decision Trees, Random Forests, Support Vector Machines (SVM), Artificial Neural Networks (ANN)

Project Methodology: Data Collection and Preprocessing, Feature Selection, Model Selection, Model Training, Model Evaluation, Hyperparameter Tuning, Model Deployment

Figure 5: User dashboard

4. Analysis Report: After submission, students receive a detailed report on matching percentages. The report highlights similarities and offers recommendations for improvement.



Algorithm	Movie RecommendationsMachine Learning Python Programming scikitlearn pandas TensorFlow Collaborative Filtering ContentBased Filtering Hybrid Recommendation Systems	42.07%
Methodology	Data Collection and Preprocessing Feature Engineering Model Selection Model Training Model Evaluation Hyperparameter Tuning	83.77%

Heart Disease Prediction using ML		**Similarity**
Abstract	Heart disease prediction using ML is a critical endeavor aiming to utilize machine learning algorithms for accurate identification and prognosis of cardiovascular diseases The project seeks to develop a robust predictive model leveraging various algorithms and methodologies to enhance early detection and intervention thereby improving patient outcomes and reducing mortality rates associated with heart conditions	72.69%
Algorithm	Logistic Regression Random Forest Support Vector Machines	37.79%
Methodology	Data Collection Feature Selection Model Training Evaluation Metrics Deployment	82.41%

Figure 6: Report Page

Module 2: Admin User

1. Login: Admins (teachers, professors, etc.) log in with their login ID and password. The login page authenticates admin credentials.

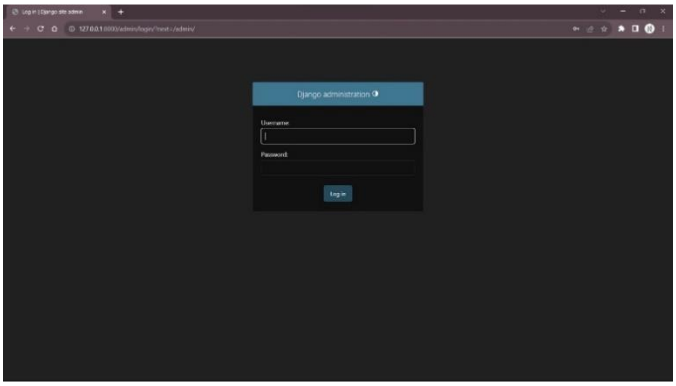
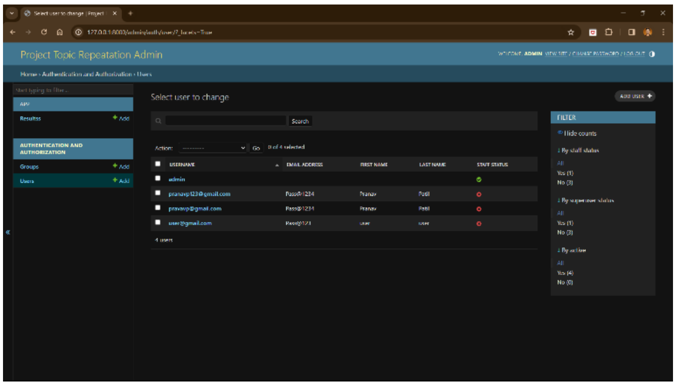

Log in | Django site admin
127.0.0.1:8000/admin/login/?next=/admin/
Django administration
Username:
Password:
Log in

Figure 7: Admin Login Page

2. Admin Dashboard: Upon login, the admin accesses the database of registered students and their project details. Admin can view, edit, and delete student records.

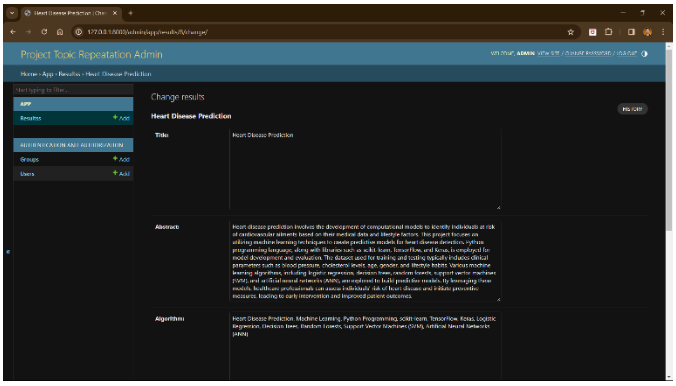
3. CRUD Operations: Admin performs CRUD operations on student records. Create, read, update, and delete student information as necessary.


Select user to change | Project
127.0.0.1:8000/admin/auth/user/?_facets=True
Project Topic Repeatation Admin
WELCOME, ADMIN. VIEW SITE / CHANGE PASSWORD / LOG OUT
Home › Authentication and Authorization › Users
Start typing to filter...
APP
Resultss
+ Add
AUTHENTICATION AND AUTHORIZATION
Groups
+ Add
Users
+ Add
Select user to change
ADD USER +
Search
Action: ---------
Go
0 of 4 selected
FILTER
Hide counts
↓ By staff status
All
Yes (1)
No (3)
↓ By superuser status
All
Yes (1)
No (3)
↓ By active
All
Yes (4)
No (0)

	USERNAME	EMAIL ADDRESS	FIRST NAME	LAST NAME	STAFF STATUS
□	admin				✓
□	pranavp123@gmail.com	Pass@1234	Pranav	Patil	⊗
□	pravavp@gmail.com	Pass@1234	Pranav	Patil	⊗
□	user@gmail.com	Pass@123	user	user	⊗

4 users

Figure 8: Admin Panel


Heart Disease Prediction | Chan
127.0.0.1:8000/admin/app/results/8/change/
Project Topic Repeatation Admin
WELCOME, ADMIN. VIEW SITE / CHANGE PASSWORD / LOG OUT
Home › App › Resultss › Heart Disease Prediction
Start typing to filter...
APP
Resultss
+ Add
AUTHENTICATION AND AUTHORIZATION
Groups
+ Add
Users
+ Add
HISTORY

Change results

Heart Disease Prediction

Title: Heart Disease Prediction

Abstract: Heart disease prediction involves the development of computational models to identify individuals at risk of cardiovascular ailments based on their medical data and lifestyle factors. This project focuses on utilizing machine learning techniques to create predictive models for heart disease detection. Python programming language, along with libraries such as scikit-learn, TensorFlow, and Keras, is employed for model development and evaluation. The dataset used for training and testing typically includes clinical parameters such as blood pressure, cholesterol levels, age, gender, and lifestyle habits. Various machine learning algorithms, including logistic regression, decision trees, random forests, support vector machines (SVM), and artificial neural networks (ANN), are explored to build predictive models. By leveraging these models, healthcare professionals can assess individuals' risk of heart disease and initiate preventive measures, leading to early intervention and improved patient outcomes.

Algorithm: Heart Disease Prediction, Machine Learning, Python Programming, scikit-learn, TensorFlow, Keras, Logistic Regression, Decision Trees, Random Forests, Support Vector Machines (SVM), Artificial Neural Networks (ANN)

Figure 9: Admin Dashboard

9. CONCLUSION

The "Enhancing Academic Integrity: Plagiarism Detection with Machine Learning" system is a pivotal advancement in addressing challenges in academic integrity and originality. Seamlessly integrated into research processes, it empowers students to assess work uniqueness and detect plagiarism effectively. Serving as both a detection tool and educational resource, it fosters self-awareness and responsible research practices, aiding students' scholarly growth. Compatibility with existing learning systems ensures widespread accessibility, while adaptability to evolving trends ensures continued relevance and impact. Ultimately, it safeguards integrity, fosters originality, and enriches the educational experience for all stakeholders involved.

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