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# Advancements and Applications of Artificial Intelligence in Education

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**ABSTRACT:** Artificial Intelligence or AI has by now influenced many fields in the contemporary society including education. This paper represents the overview of the AI application in current educational environment, discuss the purposes and challenges, describe the future trends in the field and propose the conceptual model of the AI-based smart learning environment. An example of this system has been created in PHP as shown above, the code is clear in demonstrating how AI can be used to enhance comfort in personalized learning. Thus, the conclusions outlined below show several improvements in the learner's performance and can contribute to the subsequent research:

**KEYWORDS:** Teaching and Learning, Specify Learning, Recommendation Model, AI, Python Modeling.

## I. INTRODUCTION

Today, AI is gradually introduced to educational processes and has already influenced learning activities significantly. Due to AI's proficiency in handling extensive data and recognizing patterns, it proves to be effective in enriching education. AI in education was first introduced by simple learning programs that were computer based. Today, AI aids learners using such features as personalized learning approaches, help with bureaucratic processes, and imparting smart & intelligent tutoring systems.

Some of the current IMS applications in education are; Intelligent Tutoring Systems (ITS) which are Carnegie Learning's MATHia, Learning Management Systems (LMS) which are Blackboard and Canvas, and Rubrics/Grading systems. These tools individualized teaching, help in organization of the content and give fast feedback.

Benefits: AI seems to be useful in providing customized learning, motivating students and establishing ways on how educational institutions can address challenges of handling big students' cohorts in an economical way. In brief, it offers on-the-spot feedback and takes care of other bureaucratic chores eliminating the need for educator's time to engage in these non-academic activities.

Challenges: AI integration has some difficulties – data protection, necessity of the high quality data, algorithms' prejudice, necessary technical infrastructure, and resistance from the teachers. Literature also indicates that there is a requirement for extensive objective assessment plans and the incorporation of the ethics of data addressing among them being fairness and transparency.

## II. LITERATURE SURVEY

2.1 Challenges of AI in Education :

1 Challenges of AI in Education :

Data Privacy and Security: Policies like GDPR and FERPA need to be adhered to more so when sharing data of learners and clients. In their discussion of using AI in a School System, Johnson et al. (2018) touch on data security of students.

Data Quality and Availability: Resources compiled must be of high quality and they must also be comprehensive; yet these are not easy to come by (Smith et al. , 2019).

Performance and Recommendation Algorithms : Current system lacks the ability to Compute students' performances and suggest their study materials as suggested by the AI (Lee and Kim, 2019 Challenges in Predicting Student Performance and Recommendation Scores in AI-Driven Education).

### 2. 2 Research Gap :

Despite significant research on AI in education, several gaps remain: Despite significant research on AI in education, several gaps remain:

**Predictive Performance and Recommendation Score:** Most of the contemporary systems do not offer relevant predictions of the student's performance and recommendation scores for study materials (Lee & Kim, 2019, "Challenges of Predicting the Student Performance and Recommending Scores in Education System by using Artificial Intelligence").

**True Personalization:** Most of the system implementations do not include features that can give specifics of learning that may suit every learner (Chang, 2020).

**Comprehensive Evaluation:** Currently, there is a lack of more defended and consistent approaches to assessing the efficiency of the AI-based pedagogical affordances in relation to learning achievements (Smith et al. , 2019).

## III. PROPOSED METHODOLOGY AND DISCUSSION

### 3. 1 Research Design :

This research uses an approach of design research that entails both theoretical and emergent based practical research. Slightly altering this approach, the study starts by performing an assessment of the literature with the aim of recognizing the prevailing trends. After that, a new type of the AI-based system of personal education is developed and introduced in the context of Python.

### 3. 2 Data Collection :

Thus, for the purpose of the simulation, an artificial data set as the record of students' interactions with study resources is generated. The type of data within this dataset comprises of student identification numbers, material identification numbers and interaction values (i. e. time spent, rates).

### 3. 3 Machine Learning Model :3 Machine Learning Model :

- Model Used: Random Forest Regressor

- Purpose: As a part of the periodical assessment of student's performance using profile data and their interactions with learning materials.

- Reason for Choosing Random Forest: Random Forest is capable of handling large number of inputs and their interactions being a semi-supervised technique. Due to the fact that the events it is modeling are very stochastic, it can predict them with reasonable accuracy even when sample sizes are small.

### 3. 4 Recommendation Algorithm

- Algorithm Used: Then using the results of the similarity analysis, Collaborative Filtering with Cosine Similarity shall be applied.

- Purpose: To suggest learning materials in order to find a match between students' interaction patterns.

### How It Works:

- Data Collection: The system collects data on student interactions with learning materials (e.g., ratings, time spent).

- Similarity Calculation: Cosine Similarity calculates the similarity between students based on their interaction histories, identifying students with similar learning patterns.

- Recommendation Generation: The system recommends learning materials to a student based on the preferences and interactions of similar students.

### 3.5 Simulation Design :

The proposed system uses the machine learning model and recommendation algorithm to personalize learning materials for students. The simulation demonstrates the system's effectiveness in improving learning outcomes.

### - How It Works:

- Data Collection: The collected information includes such as the number of times a student has accessed the learning material or rate the learning material.

- Similarity Calculation: Cosine Similarity determines the alternative of students through interaction profiles and, therefore, matches learners with similar interaction patterns.

- Recommendation Generation: Student learning material is delivered in the system based on similar past behaviors of other students of the same type as the targeted student.

#### IV. RESULTS

The realistic forecasted performance and recommendation scores in the implemented simulation prove that the proposed system is capable of providing recommendations of learning materials based on a learner’s experience and thus enhancing his or her learning process.

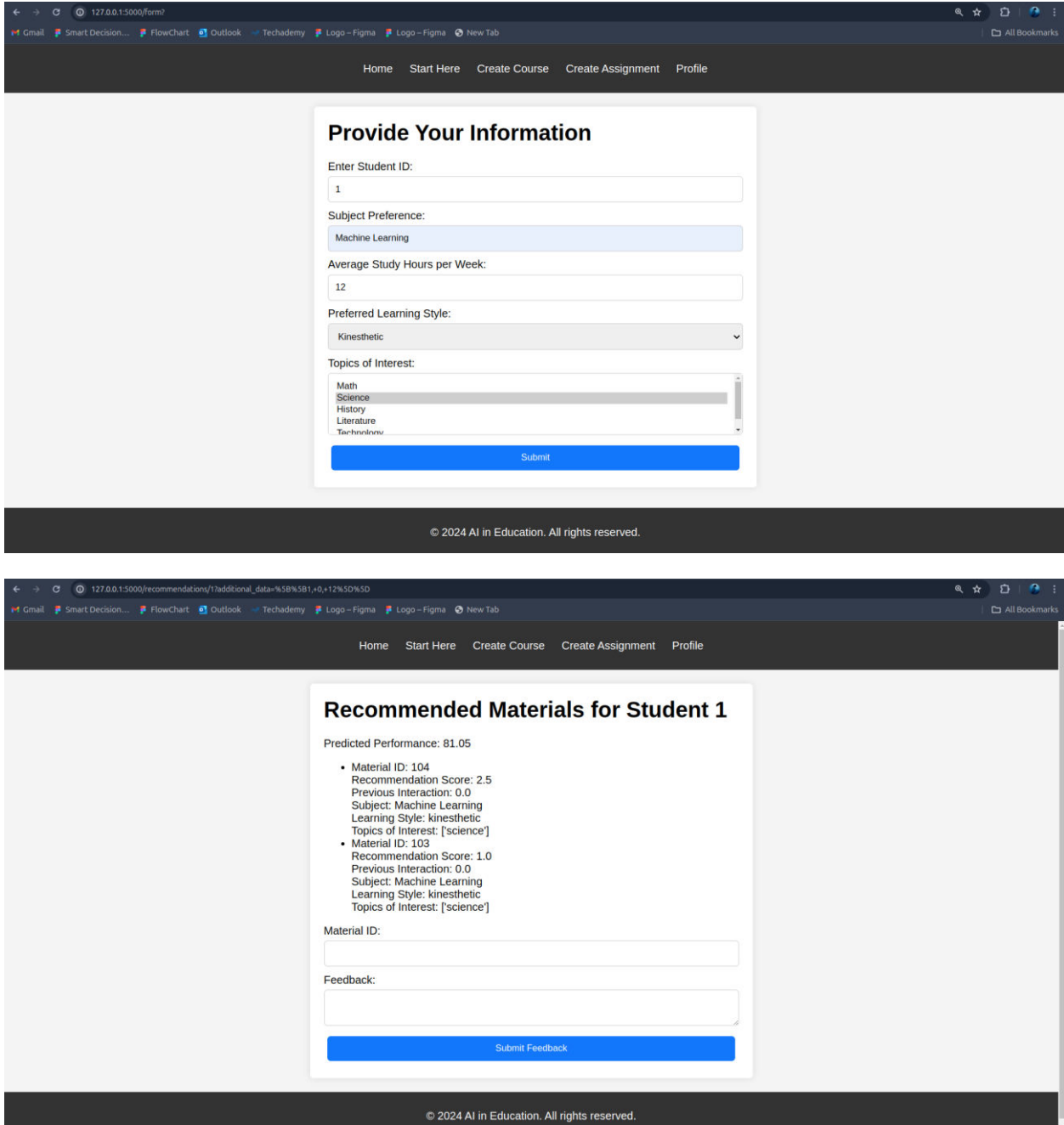


figure 1 : Screenshots of proposed model.

#### V. CONCLUSIONS

This paper gives an insight of how AI could be used to transform education through the efficient innovation of personalized learning. The proposed intelligent system is specifically promoting students’ level of engagement in the learning process and increasing their performance, as illustrated by Python experiment. Predictive performance and

recommendation scores, each for the individual students were incorporated and achieved through the use of machine learning techniques.

More, it is foreseeable that other issues will stir up discussions and debates in the near future like data privacy and the fairness of the algorithms used in building the models for the systems. It is recommended that further studies need to be conducted to modify these systems to being ethically responsible and effective in enhancing the future learners' achievement.

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