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An AI-Powered Online Intelligent Tutoring System for Personalized Learning

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Abstract: In this project, we are employing machine learning and deep learning algorithms to search for automatic learning tutoring. E-learning is now a new trend in conductive and independent learning models because of the advancement of technology. The main goal of this research is to create an intelligent system for online tutoring that offers a platform for communication between teaching and learning activities. There are two modules implemented in this project as admin module and user module. In admin module we uploaded few study materials on different subjects like c language , java programming , etc and the material with its description is trained using machine learning and deep learning classifiers. Then user can search his query in the text and voice format to retrieve information from proposed application. Machine learning classifiers such as support vector machine , decision tree , random forest and naïve bayes. From the deep learning , convolutional neural network is used for retrieving the query data for user. Among these all classifiers we have selected random forest classifier for further testing of query text or speech from user.

Keywords: Online intelligent tutoring system, learning model, Streaming media, Servers.

I. INTRODUCTION

A computer programme that tutors pupils in a particular subject area is known as an intelligent tutoring system. Education software with an artificial intelligence component is referred to as an intelligent system. Intelligent tutoring systems draw conclusions and learn on their own using artificial intelligence's principles and techniques, such as neural networks.

In this project, we are employing machine learning and deep learning algorithms to search for automatic learning tutoring. ML and DL algorithms get trained on tutoring material, and then whenever users issue a tutoring query, the best-performing algorithm will predict close matching tutoring with the query and then suggest it to the user. The user can read details online and download tutoring materials[1].

For accurate prediction of tutoring, we have experimented with various ML and DL algorithms like SVM, Decision Tree, Random Forest, Naïve Bayes, and Convolution Neural Network (CNN). Each algorithm's performance is evaluated in terms of accuracy, precision, recall, and FSCORE. Among all algorithms, Random Forest and CNN performed

As information and communication technologies (ICT) advance quickly, the old model of teaching and learning activities is evolving into e-learning, which is now being referred to as "an effective mode" [7]. The e-learning strategy transcends the limitations of regular school hours. The Chinese government has adopted the facilitation of educational modernization through the application of ICT as an essential strategic action in response to the need for educational development and reform [1].

It increases the flexibility and interactivity of electronic resources that can be used to improve learning outcomes for students. One e-learning technology, the Intelligent Tutoring System (ITS), offers online communication between students and tutors. ITS algorithms have been successfully applied in a variety of contexts. [2] [3].

II. LITEARTURE SURVEY

This paper offers a comprehensive analysis of China's policy for the integration of ICT in basic education from 1988 to 2021 using a mixed-methods investigation of 179 policy documents. In order to assist educational reform and

modernization, which in turn supports fairness and quality in education, the plan places a strong emphasis on teaching innovation, infrastructure development, and ICT skill development. Throughout the last ten years, the policy has placed a strong emphasis on collaborative efforts and open communication in order to meet these goals. In order to comprehend policy change for the integration of ICT in basic education in China, this study offers a quantitative foundation. [1]

We have been constructing cognitive models of mathematics for the past 25 years, and these models now serve as the foundation for middle- and high-school courses. We go into the theoretical underpinnings of this method and the data showing that the resulting curricula are more successful than other teaching strategies. We also go over how incorporating a well-defined theory into our instructional software enables us to dynamically assess the success of our training in more detail than was previously feasible. We can test theories across a huge number of pupils because of the software's broad use. This, in our opinion, will give rise to fresh perspectives on how to better instruct and comprehend mathematical cognition. [2]

Teachers and students have both expressed the importance of better interactive tutoring features in educational software for tackling chemistry-related problems. Beyond the traditional computer-assisted training methodology is required to give the next generation of individualised interactive capabilities users want. N = 273 Duquesne University students enrolled in CHEM 121 during the fall 2001 semester took part in the study. A test group of students who used the AI tutor as part of their study activities and a control group of students who did not use the tutor were separated from one another. It was discovered that the tutor helped the weakest students the most and significantly improved their performance in the test group. This work illustrates the viability of developing sophisticated new tutoring software for addressing chemistry problems using an AI-based methodology. Sending an email to the associated author will provide you access to a web-based demonstration of the equation-balancing tutor. [3]

This article combines research on intelligent tutors with memory and math fluency and psychological studies. It discusses the effects of computer programmes intended to increase either math proficiency or strategic behaviour. These abilities address working memory issues while children solve arithmetic problems, which is essential for enhanced performance. This study assessed the relative impact of software interventions on arithmetic post-tutor performance in order to enhance techniques and fluency. We found that both interventions appear to impact math achievement and work well together. As a result of having greater available memory space, the results imply that training both strategy and fluency gives an advantage in accuracy and speed when solving mathematical problems. Mathematical fluency has an impact on the cognitive resources that students need to solve more difficult arithmetic problems. We propose that students' ability to perform calculations automatically and with little memory burden can be improved by adding math fluidity training exercises to intelligent tutors. [4]

It is not immediately obvious how to change a tutor's behaviour to make use of an emotion detection system once it is able to identify a student's feelings. For instance, if students say they are thrilled, giving them harder challenges in one situation might be appropriate, while in another, taking steps to help them calm down so they can concentrate better might be the best course of action. The tutor's activities depend on both their cognitive and emotional levels. This chapter's goal is to outline the components needed for a tutoring system that decides what to do depending on an identified emotional state. There are three sections to this. We begin by outlining numerous techniques for emotion recognition. After that, we offer a study in which Wayang Outpost, our math tutor, uses sensors to identify the student's emotional state and then responds accordingly. Then we talk about possible responses to the recognised emotions. We finish with the upcoming efforts required to enhance the general performance of tutoring systems. [5]

Students interacted with an intelligent tutoring system to learn the grammatical rules of an artificial language. One was based on a dynamic Bayes' network skill model that was developed from the performance of previous pupils. This strategy, along with other intelligent policies, fared better than random policies overall. While some policies provided students with a choice of three

issues to work on, others only gave them one problem to work on each iteration. In group statistics, the advantage of choice was not noticeable, but there was a significant interaction with gender. While men appeared unaffected by choice, overall, women learned less than men, but they did so in different ways under choice and no choice conditions. We look into the causes of these linkages between learning, decision-making, and gender. [6]

It is commonly known that most students lack the necessary skills for metacognition and inquiry, especially at higher levels of understanding that call for explanatory reasoning. It makes sense to use computer-based learning settings because teachers and regular tutors rarely offer these proficiencies. In this article, which introduces some of our most recent computer systems that facilitate explanation-centered learning, students use inquiry-based learning strategies and metacognitive strategies while studying science and technology curriculum. Animated conversational agents are used by AutoTutor and iSTART to scaffold inquiry, metacognition, and explanation-building processes. [7]

III. PROPOSED SYSTEM

Intelligent tutoring systems (ITS) are sophisticated, integrated software programmes that use artificial intelligence (AI) techniques to solve problems and meet essential requirements for learning and teaching. They provide models for assessing student knowledge levels and employ teaching techniques to improve or rectify students' knowledge. They are founded on the creation and application of artificial intelligence (AI) methodologies and techniques, and as a result, the content and method of teaching presentations of topics can be tailored to the individual learning styles of the pupils.

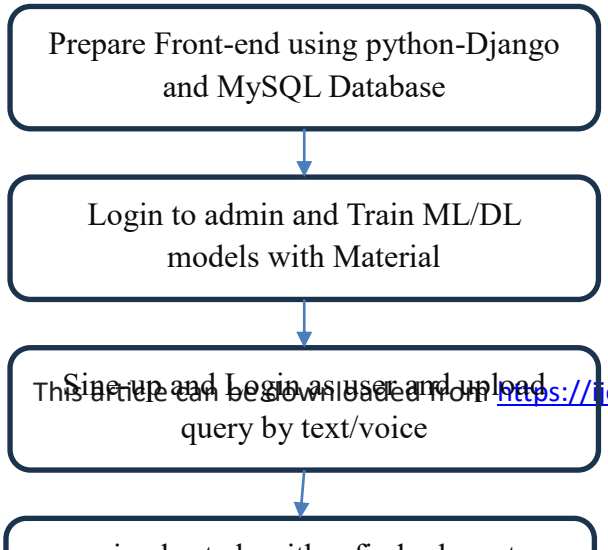

Fig.1 The general architecture of an intelligent tutoring system

For accurate prediction of tutoring we have experimented with various ML and DL algorithms like SVM, Decision Tree, Random Forest, Naïve Bayes and Convolution Neural Network (CNN). Each algorithm performance is evaluated in terms of Accuracy, Precision, Recall and FSCORE. Among all algorithms Random Forest and CNN performing

To implement this project we have designed following modules

1) Admin: admin can login to system using username and password as admin and admin and then can upload new material and can TRAIN all ML and DL algorithms model so user can perform search
2) User: user can sign up and login to system and then can enter query to search required tutoring material

IV. RESULT

Using python editor (IDLE) as a backend, frontend Django framework and database used is MySQL database, this application is designed.

Input: Search query by text or voice

Output: Required tutorial material searched by user

Fig. Table generated in MySQL database

In above figure , databases added as ‘tutoring’ and table is created for user registration with different

inputs like password, gender , qualification , contact , email and address. One more table created for uploading material with variables as material type , material name , material description and uploaded date.

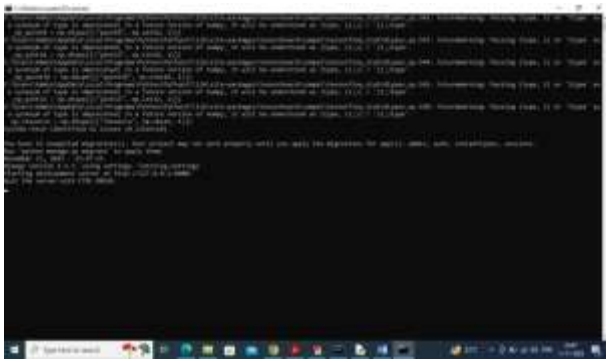

Fig. Using Django Framework local server has been started

As frontend we used Django framework for displaying results on local server. The obtained url link is pasted in any browser to start local server and to see results.

Fig. Main Page of Application

Proposed model main page which is generated using HTML files is shown and there are few more options in the main page as admin login, user login , new user sineup.

Fig. Admin Login using id as ‘’ admin’ and password as ‘admin’

Here admin can login and upload the material of different subjects. Admin has authority to train different machine learning and deep learning algorithms with uploaded data. Among all the ML and DL classifiers, one algorithm is selected for further testing query given by user.

Fig. Admin is training Model with different ML and DL algorithms with different material

There are different ML and DL classifiers such as svm , RF , NB , DT and CNN are used for training and testing. Among these all classifiers RF is selected for further query testing.

Fig. New User Sine-up screen

Here user can enter the details and which are authorised with database details to verify that the details entered are correct or no.

Fig. User Login Screen

User need to login to the application to understand the complete scenario of testing. User can enter the query details by either text or speech.

We trained ML and DL with different type of material , few are as mentioned below,

- Sql how to create table and query
- Java tutorial
- C programming network system
- CPP tutorial
- Javascript tutorial

Fig. User is searching for query using text data

User can enter any subject material details to get its retrieval in text or pdf file. The details are obtained using One of the most accurate classifier as random forest classifier. So for further testing by both text and speech , Random forest classifier is used.

Fig. Results obtained by RF classifier for query data

Using Random forest classifier the data is retrieved very fast and accurate. The data retrieved is more accurate and with less time so we preferred RF classifier.

Fig. Voice search by the user

User can either search material using text data or voice record. Above application window shows that the voice input from the user.

User need to record the sound and upload to the application , our application will find the words and retrieve the information.

Fig. Results for voice based search

The results obtained for voice search are as shown above figure. Voice will be recorded by user and

then uploaded to the proposed model to display relevant material.

V. CONCLUSION

The main goal of this research is to create an intelligent system for online tutoring that offers a platform for communication between teaching and learning activities. This essay offers a clever strategy for putting online tutoring and e-learning into practise. The system incorporates a number of modules, such as an intelligent quiz module for assessing learning outcomes, an adaptive navigation learning control module, and a video conferencing module for group discussions or presentations. The approach appears to favour students who attend classes off-campus, according to the promising data gathered. By using best ML (RF classifier) we are retrieving information for tutoring material by both text and voice.

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