# Individualized approach for Course Recommendation using Machine Learning*

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***Abstract*—With the introduction of online learning platforms, students now have access to a diverse range of courses on a variety of topics. However, the quantity of alternatives can be overwhelming for students, and selecting the correct course can be difficult. Personalised course recommendations can assist students in finding courses that are a good fit for their interests and learning objectives. The suggested system is designed to give individualised course recommendations based on the learner's skill set, learning objectives, and previous learning experiences.In this paper, we describe a personalised course recommendation system for online learners that is skill-based. The suggested system will make customised course recommendations depending on the learner's abilities. The system employs a machine learning algorithm that examines the learner's skill set as well as previous learning experiences.**

***Index Terms*—Recommendation system , Machine learning ,Feature extraction , Data Modeling.**

## I. INTRODUCTION

In response to the global digital transformation, the education sector has made strides over the past few years to adopt e-learning or online learning. The incidence of adoption has increased since the Covid-19 outbreak. Schools, universities, and other organisations must move their operations online in order to comply with the safe distance requirement. Naturally, this has led to a boom in the market for online education. People are searching for alternatives to traditional educational institutions and starting to accept the convenience of online learning. These days, there are many online learning platforms that provide classes in a wide range of subjects and languages. They encourage people to learn anything, anytime, and anywhere as long as they have access to the internet. But because there are so many options and learning environments to pick from, option fatigue is a common problem for eager learners seeking for online courses. Finding the appropriate course to start learning from usually takes more time and effort as a result. To address this inefficiency, we want to develop a Personalised Course Recommender System that will act as a one-stop platform. Based on a learner's preferences, our algorithm may offer useful cross-platform courses. Learners would no longer have to spend countless hours scouring each online course platform in search of the best course for their needs.

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## II. PROBLEM DEFINATION AND SCOPE

PROBLEM DEFINATION : Develop an online system that offers course suggestions tailored to individual students' requirements and interests. This platform aims to assist students in discovering relevant skills and courses aligned with their specific career interests through personalized recommendations.

SCOPE:The system will become a one-stop platform for users looking for e-learning courses on skills they want to learn. Currently , courses from computer science domain are supported. Web application provides a user friendly interface to clients. The user can choose an interest related to computer science.

## III. LITERATURE REVIEW

Y. Ren, Z. He and T. Han ; The research provides a better design for an online education course recommendation system, which includes data gathering, pre-processing, feature extraction, and the recommendation process. The proposed design attempts to improve the recommendation system's quality and the user experience. They propose a hybrid recommendation algorithm for course recommendation systems in online education. To overcome the limits of each strategy and improve the accuracy of the recommendations, the proposed algorithm combines collaborative filtering and content-based filtering strategies.[1]

M. Rekha Sundari , she proposed a system that would create personalised course recommendations for software engineering students by combining content-based filtering and collaborative filtering techniques.The authors gathered information on students' academic performance, course enrollments, and course content evaluations to create a knowledge graph that depicts the links between courses and skills. The CRS makes course suggestions based on this knowledge graph and a hybrid recommendation algorithm that matches students' talents and interests. The CRS can help students make more educated course enrollment selections and improve their learning results.[2]

Jiang, Pardos, and Wei suggests a Goal-based course recommendation system (GCRS) that uses learners' goals and preferences to suggest courses. The work entailed gathering information from a significant online learning platform and

developing a recommendation engine using this information. To find courses that were pertinent to the learner's choices and goals, the authors combined collaborative filtering with content-based filtering. They also included a goal model, which allowed students to identify their educational objectives and get tailored course recommendations based on these objectives.The authors discovered that their algorithm was particularly good at suggesting courses to students who had certain learning preferences and goals. In order to increase the usefulness of the recommendations made by the GCRS, the study also emphasised how crucial it is to provide students the freedom to identify their learning preferences and goals.[3]
Gulzar, Deepak, and A suggests a personalised course recommender system (PCRS) that makes course recommendations to students by combining collaborative filtering and content-based filtering. The authors contend that this strategy can increase the precision and applicability of the advice given to students.The authors utilised a content-based filtering algorithm to suggest courses that were appropriate for the learner's interests and skill levels and a collaborative filtering method to find courses that were popular among users who shared similarities. To increase the accuracy of the PCRS's suggestions, the authors additionally used a rating normalisation technique.The authors discovered that their algorithm was especially good at suggesting courses to students with different backgrounds and interests. The study also emphasised the significance of including both collaborative and content-based filtering for creating tailored course recommendation systems.[4]
Zhao and Pan suggest a collaborative filtering algorithmbased methodology for recommending online courses.To find courses that were pertinent to the learner's interests and preferences, the authors employed an updated collaborative filtering algorithm that took into account a user's implicit input, such as click behaviour and time spent on a particular course. To guarantee that the suggested courses were varied and not overly identical to one another, they additionally included a variety constraint.The authors discovered that their method was very good at suggesting courses to students with a variety of interests and preferences.[5]

## IV. METHODOLOGY

The proposed methodology consists of five main steps: data collection, data pre-processing, learner profiling, course profiling, and recommendation model development.

Data Collection: The first stage is to collect data on the competencies of the learners. Data about the learner's domain knowledge, technical skills, soft skills, and other important information that can aid in the suggestion process should be included.For this web scraping is used to collect course data.

Data Pre-processing: To ensure the quality and usefulness of the obtained data, it must be pre-processed. Data cleaning, normalisation, feature extraction, and other procedures are used in this step to prepare the data for analysis and modelling.

Recommendation Model: The next phase is to create a recommendation algorithm that can match learners' talents with the most appropriate courses. To create such a model, different machine learning and data mining techniques, such as content-based filtering, collaborative filtering, or hybrid models that include both, can be used. To provide the most relevant recommendations, the model should take into account the skill profiles and course data.

Evaluation: The final stage is to assess the performance of the recommendation model. This can be done by measuring the model's performance in generating accurate and relevant recommendations using measures such as accuracy, precision, recall, or F1-score. The findings of the evaluation can be used to fine-tune the model and improve its accuracy and efficacy.

## V. COMPARATIVE STUDY OF RECOMMENDATION ALGORITHM

| Algorithm | Description | Pros | Cons |
|---|---|---|---|
| Collaborative Filtering | Recommends items based on user-item interactions (user ratings, behavior). | 1. Doesn't require explicit item features. 2. Can capture complex user preferences. 3. Effective for user-based or item-based. 4. Scalable with matrix factorization. | 1. Cold start problem for new users. 2. Cold start problem for new items. 3. Sparsity of user-item interaction. 4. Privacy concerns. |
| K-Nearest Neighbors (KNN) | Recommends items based on user similarity (user-item interaction or content-based). | 1. Simple and easy to implement. 2. Effective for small to medium datasets. 3. Can handle sparse data. 4. Interpretable results. | 1. Scalability with large datasets. 2. Cold start problems for new users. 3. Requires choosing the right 'K.' 4. Sensitive to noisy data. |
| Hybrid Recommen-dation | Combines collaborative and content-based filtering to provide recommen-dations. | 1. Overcomes limitations of each approach. 2. Can provide more accurate recommen-dations. 3. Addresses cold start problems better. 4. Increases recommendation diversity. | 1. Complexity in designing and tuning. 2. Resource-intensive. 3. May require more data and features. |

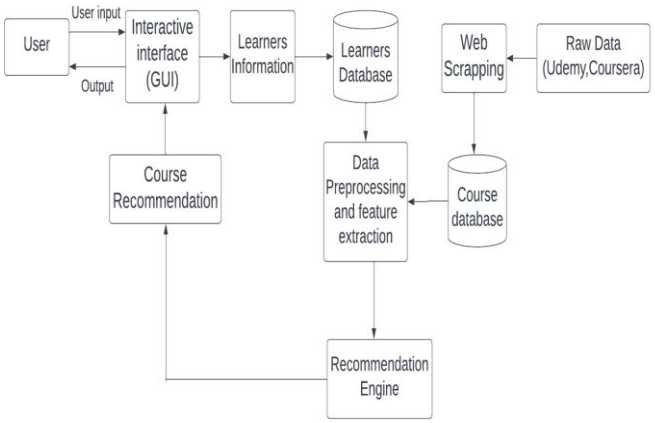
TABLE I
COMPARISON OF RECOMMENDATION ALGORITHMS

Collaborative Filtering: It is a well-liked recommendation method that gathers user preferences from numerous users (collaborating) to automatically filter content based on the user's interests. The fundamental premise is that if two users A and B have comparable preferences on some goods, then A and B probably have similar preferences on other items as well.Content-based filtering uses an item's explicit features to generate suggestions. It takes into account characteristics like metadata, keywords, and genre.The personalization element is enhanced by content-based filtering, which provides recommendations based on particular item features.

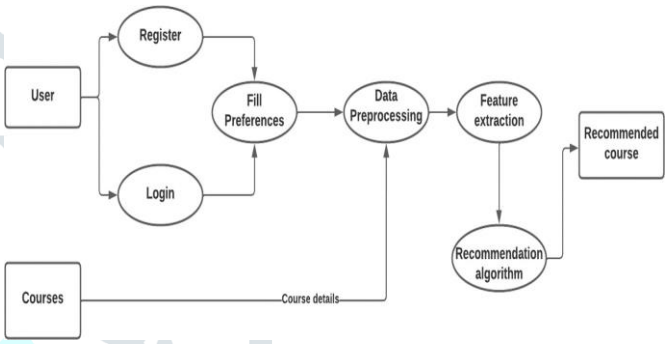
K-Nearest Neighbors: The basic concept is to identify a certain number (K) of items or users that are most like the target item or user, and then base suggestions on the preferences of those users or objects.KNN finds neighbors based on their closeness in feature space and concentrates on local patterns.Because KNN depends more on local neighborhoods than on global structures, it can function well in scenarios when the data is sparse.Because KNN concentrates on local patterns rather than being greatly influenced by extreme values, it is resistant to outliers in the data.

Hybrid recommendation:It is algorithms that combine multiple recommendation techniques, such as collaborative filtering, content-based filtering, and occasionally other approaches like matrix factorization or deep learning.The goal of hybrid models is to combine the benefits of various recommendation systems. Collaborative filtering, for instance, excels at identifying user preferences derived from interactions, whereas content-based filtering delivers relevant recommendations for products that align with the user's past preferences.

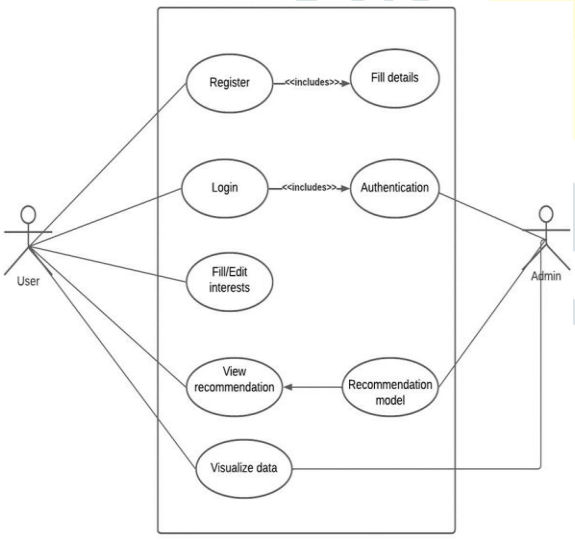
## VI. SYSTEM ANALYSIS AND DESIGN



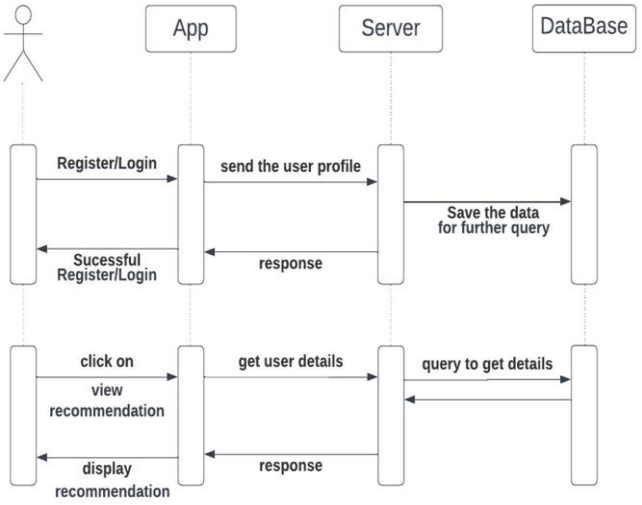

System-Architecture




Data Flow Diagram




Use case diagram




Sequence Diagram

## VII. Functional Requirement

Register and Authenticate :The system should allow a new user to register. The system must have functionality of verifying the registered user based on username and password.

Record the User Data: The system must take input feed from the user and record it securely in a proper database to facilitate its further use.

Store Course Details: The system should have functionality to record and store the course details.

Generate Appropriate Recommendation: The system must have the ability to suggest courses to the user depending on the data it receives as input.

## VIII. Gaps

The recommendation is solely founded on previously added data, however occasionally we need to conduct research using recent data.

instead of emphasizing user skill level and learner interests, the recommendation is primarily concerned with the user question They paid more attention to other users' comments and specific users' browsing patterns and online behaviour. instead of placing greater emphasis on a specific user's talent, performance, and outcome.

The recommendation is solely based on a student's performance, which may not fully reveal their potential. Only expected-to succeed courses are available.

## IX. Conclusion

In this paper, we proposed a personalised course recommendation system that uses machine learning techniques to provide course recommendations based on the learner's skills and interests. The suggested system collects data on the student's skills and interests, develops learner and course profiles, and uses a hybrid recommendation,collaborative filtering and KNN models to generate tailored course recommendations. The suggested method has the potential to increase learners' learning outcomes and engagement by giving tailored course recommendations that fit their abilities and interests.

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