A Synopsis on

Integrating Recommendation System to Creative Learning Web Framework

Submitted in partial fulfillment of the requirements
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Bachelor of Engineering

in

Information Technology

by

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CERTIFICATE

This is to certify that the project Synopsis entitled ***"Integrating Recommendation System to Creative Learning Web Framework"*** Submitted by ***"Pratik Dhumal (19104033), Kushal Todi (19104047),Ruchita Raut (19104031)"*** for the partial fulfillment of the requirement for award of a degree ***Bachelor of Engineering*** in ***Information Technology***to the University of Mumbai,is a bonafide work carried out during academic year 2022-2023

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Abstract

The Internet has an enormous amount and variety of educational resources. As multidisciplinary educational interest grows, it is becoming increasingly important to support students' course choices. This report recommends a collaborative filtering-based algorithm for the course recommender to aid students' decision-making. In this algorithm, the cosine similarity is used in accordance with the history of students' course selection records, and better accuracy is obtained in the recommendation task, which satisfies user needs. Furthermore, both the text vector and the user behaviour record are used to improve the course similarity calculation. This report discusses the design of an architecture for online education recommender systems, with a focus on promoting online creative learning courses and web-based creative learning material. The system employs item-based and user-based collaborative filtering approaches from an algorithmic standpoint. On creative learning sites, the proposed system will be able to provide effective recommendations to learners.

Introduction

With the advancement of big data, data analysis has become increasingly important in optimising online educational resources. In layman's terms, it is an algorithm that recommends relevant items to users. The number of courses in the framework of smart education has increased dramatically in recent years; thus, the corresponding course selection issue is playing an important role in the modern learning process. Accurate course recommendation service for online education platforms and users is provided through effective analysis and processing of existing data, and high-quality courses are provided, so that more students can learn at any time and any place, and their autonomous learning ability is enhanced, recognising that high-quality online education is of great importance. The rapid development of the Internet has aided the growth of online education. The explosive growth of curriculum resources on various online education platforms has resulted in an information overload that people meet. The disparity between users' diverse needs and massive educational resources has become increasingly apparent. At this time, a variety of online course recommendation systems based on user preferences emerge as the times require. Recommendation accuracy has emerged as a critical metric for assessing the major recommendation systems, and recommendation accuracy are dependent on the recommendation algorithm. Content-based recommendation and collaborative filtering recommendation are two popular recommendation algorithms. The collaborative filtering recommendation algorithm, which has no structural requirements for recommendation objects and is widely used in many personalized recommendations, is one of them.

One of the problems faced is the scalability of algorithms having real-world datasets under the recommendation system, a huge changing data is generated by user-item interaction in the form of ratings and reviews and consequently, scalability is a big concern for these datasets. Due to insufficient course descriptions, the relative importance of certain courses may not be fully understood. When students want to take courses closely related to their specific career path, certain courses in that field may be more relevant than others that are not immediately apparent to the student, resulting in poor decisions once again. To solve the scalability problem we will be using cosine similarity which consumes less computing power for the huge datasets. We propose a hybrid recommendation system, i.e. a combination of collaborative and content based filtering methods, that suggests courses by finding students similar to the target students and then searching for a pattern in their understanding of the domains and courses that they took.

Algorithms that are used to provide the list of suggestions are called recommendation systems or engines. The recommendation system in its core algorithm uses a fundamental mathematical metric called "similarity", which compares and quantifies the similarity between two items: the user selected vs the rest of the items in the catalogue. The list of items with high similarity values to the ones that the user selected is recommended as "You may also like". There are many similar metrics used in recommendation systems. Let us focus on the most commonly used similarity metric - "Cosine similarity".

Objectives

- To provide recommendations to the user based on the recorded information on the users' preferences, such as his searches, course visits, etc.
- To provide a collaborative-based recommendation after the user logs in to the portal, using Python.
- To provide a content-based recommendation to the user based on his searches, preferences, and the courses he is enrolled in, using Python with similarity methods.
- To classify the courses with specific keywords, learn what the customer likes, look up those terms in the database, and then recommend similar things with the help of a method i.e. cosine similarity.
- To filter the courses based on ratings, courses enrolled by the user, paid as well as a free subscription.

Literature Review

the paper [1], Zheng Chen has proposed a recommendation algorithm based on collaborative filtering for the course recommender to help students' decisions. In this algorithm, the improved cosine similarity is used, according to the history of students' course selection records, and better accuracy is obtained in the recommendation task, which meets the needs of users

In the paper[2], the article-based collaborative filtering algorithm is optimized and improved to improve the recommendation efficiency of the recommendation system.

In paper[3], Raghad Obeidat has presented a collaborative recommender system that recommends online courses for students based on similarities of students' course history. The proposed system employs data mining techniques to discover patterns between courses.

In the paper[4], Vishal Garg has proposed an effective and efficient Course Recommendation System based on Machine Learning. The proposed system will be able to provide effective recommendations to learners on e-learning sites.

In this paper [5], a new learning resource recommendation model is proposed, including a course recommendation sub-module based on statistics and a personalized course recommendation sub-module based on professional training requirements.

In reference [6], the improved collaborative filtering algorithm based on hybrid is adopted. By introducing the gradual forgetting curve based on the timeliness change of user interest are better solved the disadvantages of traditional collaborative filtering algorithm, such as low efficiency, weak adaptability and novelty rejection.

In reference [7], aiming at the problems of the rapid increase of learning platforms and course resources, and the poor quality of course recommendation due to the dispersion of online resources, the attention mechanism and deep learning are integrated into the course recommendation problem, and a deep collaborative online learning resource recommendation model based on attention is proposed to model the relationship between high-level course sets, which improves the recommendation performance. Although some scholars have improved the collaborative filtering recommendation model based on implicit behavior, there is still room for further improvement.

In the paper [8], a hybrid approach is taken between context based filtering and collaborative filtering to implement the system. This approach overcomes drawbacks of each individual algorithm and improves the performance of the system. Techniques like Clustering, Similarity and Classification are used to get better recommendations thus increasing precision and accuracy.

Problem Definition

When it comes to selecting courses to study, several factors come into play. One of these factors could be the perceived difficulty of a course that a student is thinking about taking. Of course, if the course is required, the student has no choice but to enroll. However, if there are numerous subjects to choose from, the student may be hesitant to take optional courses that may present a significant challenge in terms of workload or being unable to fully understand the course content. These courses would have a negative effect on academic performance. However, there may also be some students who are looking to be challenged, and for whom choosing more difficult courses would be an exciting challenge.

Furthermore, there are external factors to consider that may or may not be directly related to a student's personal preferences. A large number of possible courses, for example, may place a burden on students. Because there are so many courses to choose from, a student may not make the best decision. Students may miss out on critical courses related to their academic interests and thus be unable to take the courses they desire. Furthermore, due to insufficient course descriptions, the relative importance of certain courses may not be fully understood. When students want to take courses closely related to their specific career path, certain courses in that field may be more relevant than others that are not immediately apparent to the student, resulting in poor decisions once again. Students' chances of failing would rise as a result of poor decision-making on their part. As a result, a more effective method of selecting courses is required, both for student satisfaction in terms of what they want to learn and to ensure their likelihood of good academic performance in terms of marks and grading.

Proposed System Architecture/Working

Existing research on collaborative filtering often uses methods such as fuzzy reasoning and genetic algorithms to solve the sparsity and cold start problems, while ignoring the fuzziness of users' choices. We propose a hybrid recommendation system, i.e. a combination of collaborative and content based filtering methods, that suggests courses by finding students similar to the target students and then searching for a pattern in their understanding of the domains and courses that they took. Finally, the system recommends courses whose association with the target student's job profiles is high. This system uses information filtering techniques to process information and provide the user with potentially more relevant items.

In Collaborative Based Filtering, we recommend new items based on the interest and preferences of the user. For example, Amazon shows us recommendations based on the user's wishlist. In Content-Based Filtering, relevant items are shown using the content of the previously searched items by the users. For example, Youtube shows recommended videos based on the videos you watch. Calculate the Similarity according to the learning behavior records of users, the similarity between items is calculated, and the item plan with higher score of the user in the item set generated by the target user is filtered. According to the item similarity matrix, the most similar items of each item in the set are found, and the items that have been generated by the target user are filtered by sorting, and finally recommended to the target user. Cosine similarity measures the similarity between two vectors of an inner product space. It is measured by the cosine of the angle between two vectors and determines whether two vectors are pointing in roughly the same direction. It is often used to measure document similarity in text analysis. For example, if we have two vectors, A and B, the similarity between them is calculated as:

$$\text{Similarity(A,B)} = \cos(\theta) = \frac{A \cdot B}{\|A\|\|B\|}$$

Where

θ is the angle between the vectors,

$A \cdot B$ is dot product between A and B and calculated as
$A \cdot B = A^T B = \sum_{i=1}^{n} A_i B_i = A_1 B_1 + A_2 B_2 + \ldots + A_n B_n,$

$\|A\|$ represents the L2 norm or magnitude of the vector which is calculated as
$\|A\| = \sqrt{A_1^2 + A_1^2 \ldots A_1^n}.$

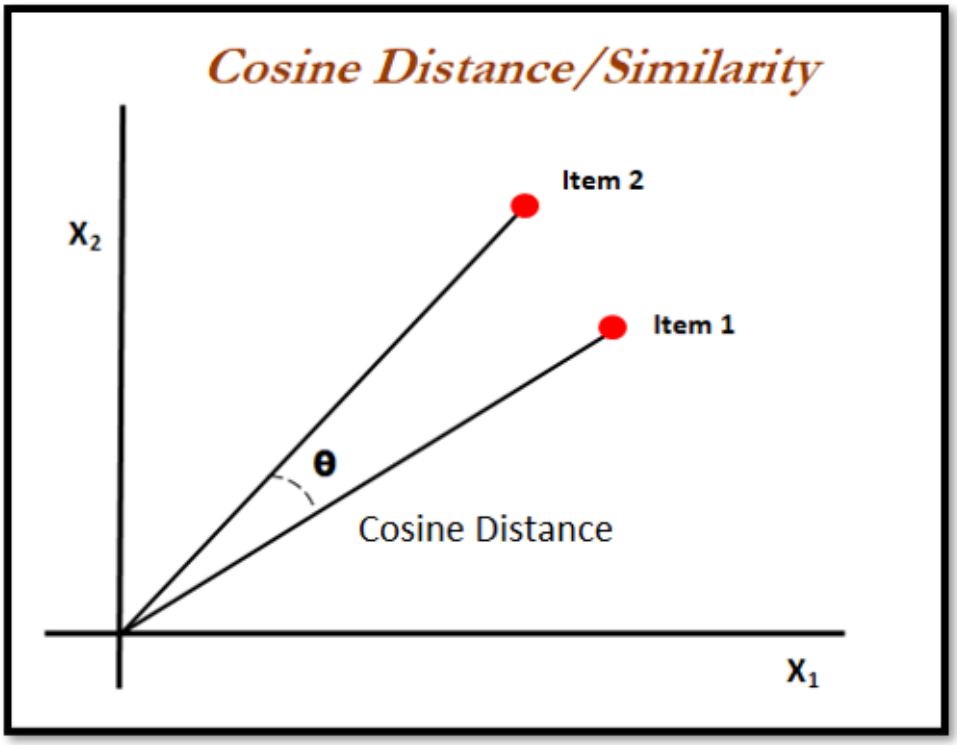

Figure 1: CosineSimilarity

Design and Implementation

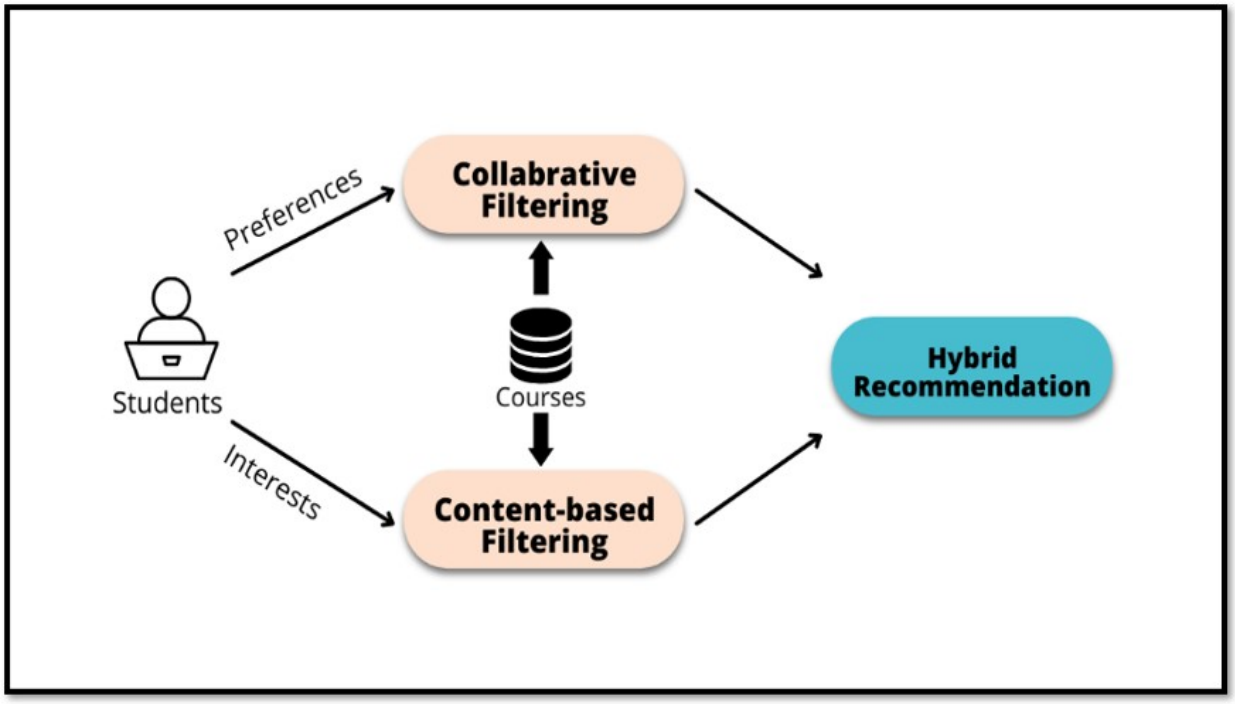

Figure 2: Architecture of the Hybrid Recommendation System

Summary

This Report proposes a collaborative filtering optimization algorithm based on text similarity calculation. The model's feasibility is demonstrated by experimental results. One of the most important considerations is course selection, not only in terms of students' individual learning desires but also for practical reasons related to the knowledge required to succeed. An ill-advised combination of courses can have a negative impact on the students themselves. The system has been trained to minimize the error. But as the online crowd increases it becomes computationally expensive to generate recommendations in real-time. To counter this problem collaborative recommendation, based on cosine similarity, has been proposed. Thus the resultant system can generate useful recommendations for the Learners in real-time.

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