myresearchgo

myresearchgo Volume 2, Issue 6, June 2026, ISSN: 3107-3816 (Online)

An Intelligent Recommendation System Regarding The Undergraduate Program In The Indian Universities Before Joining Any Educational Institution Using Collaborative Filtering Approach

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Abstract— In this paper, we provide a sophisticated recommendation system for students considering enrolling in an undergraduate programme at an Indian university. The recommended system contains a predictive model that predicts students' academic achievement in addition to the functional elements of the collaborative filtering approach. The recommendation system may provide better suggesting techniques in accordance with the model's output values, and a sentiment analysis of the pupils is conducted. Based on the concept of a knowledge-based recommender system, this essay explored a high-level framework for an intelligent recommender system. Knowledge is applied, new information is discovered, and preferences and criticisms are inferred by the intelligent recommender system. An intelligent recommender system is built on a foundation of knowledge representation paradigms, learning processes, and reasoning mechanisms. It also includes five knowledge models for the many factors we might consider while making recommendations: users, things, domain, context, and critiques. The combination of the elements, among other things, uses the information, refreshes it, and makes inferences.

Keywords—Recommendation system, predictive model, academic performance prediction, student relationship management (SRM)

1. Introduction

Certain the plethora of resources available online nowadays, it's crucial to design educational recommendation systems that include the input of both parents and students when determining which institution would be ideal for a given learner.

In this analysis, we develop a smart recommendation system for college students. One of the most important aspects of these recommendation systems is the student model, which captures the students' perception of themselves. Examining the methods and tools currently used by students in the modelling process is the primary focus of the literature review.

To aid in academic administration and foster better communication between faculty and students, a number of Indian institutions have developed state-of-the-art information systems and services. It has been recommended that the system first initialise the student model to determine the students' level of knowledge before making a recommendation for an educational institution.

Four components of the student model is analysed:

- Using a performance model that takes into account knowledge, needs, and interests,
- It generates a questionnaire to assess student competency.
- History of student responses;
- Information on each student's preferences, including how many students have them.
- The plan history and the discourse history are both parts of the history model.

There are chances for significant management and information system improvements as a result of the complexity of technology in educational institutions rising. The performance of a university is also increasingly taken into account when determining its standing and reputation [1]. Student counselling is one kind of service that is typically offered by all colleges.

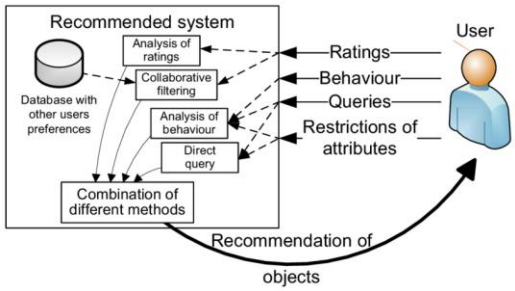


Fig. 1. Recommendation System

Archer and Cooper [2] argue that the accessibility of counselling services is a significant factor in predicting students' academic success. Urata and Takano [3] add that these areas, together with the discovery of learning strategies, the management of interpersonal relationships, and a knowledge of one's own mind and body, should be the backbone of student counselling.

On the other hand, many students have made specific course choices based solely on expected employment possibilities, peer pressure, and parental guidance. A student may have problems if they are not engaged in the subject or if the course or job is not well suited with their abilities[4].

Due to a heavy workload and poor resources, the teaching staff in India's education system may not have enough time to advise the pupils.

The Student Recommendation System is one of the programmes intended to assist both students and faculty (SRM). In order to better match a student's aptitude and performance in completing a course, such a system might be utilised to provide course suggestions and counselling to newcomers.

2. Literature Review

This section presents a literature review in a tabular format. The table is grouped on methodology. The features and challenges of each methodology is presented with references.

TABLE I. LITERATURE REVIEW

References	Methodology	Features	Challenges
Castellano et al. [5]	Neuro-fuzzy	High accuracy	Real-time performance is poor due to the model's inefficiency.

Crespo et al [6].	K-means clustering	Provides a satisfying interaction for its users and fixes issues plaguing online shopping	Dataset sizes too large for the model.
Lin et al. [7]	GA, k-means, DT and BN	Increases both revenue and product sales in real time applications.	Lacks in operation efficiency
Wang and Wu [8]	Association rule mining	Useful for real-time ubiquitous-learning applications	There is no consideration for the learner's actions in the model.
García-Crespo et al [9].	Fuzzy logic	Powerful scalability and precision in recommendations	Not applicable on large datasets
Dong et al. [10]	Semantic similarity model	Resolves the challenge of software-based service supply ecosystems	Low overall performance
Li et al. [11]	Fuzzy linguistic modelling	Excellent professional suggestions for KM systems	neglects the user's prior choices
Lorenzi et al [12].	Content-based filtering	This approach may help recommender systems deal with their sparsity problem.	Low accuracy
Huang et al. [13]	Rough set model	It helps recommender systems perform better.	The model is too complex for use in time-sensitive systems.
Chen et al. [14]	Semantic web rule language	Dataset characteristics can be extracted effectively by the model.	Data from domain ontologies are essential to the model.
Mohanraj et al. [15]	Foraging Bees algorithm	A fast, adaptable model that takes less processing time	ignores the possibility that users' preferences may shift
Hsu et al. [16]	Artificial bee colony algorithm	As a result, it is now more precise and can be executed more quickly.	As the technology is tailored to a single use, it cannot be used for other tasks.
Gemmell et al. [17]	Linear-weighted hybrid approach	Extremely efficient and adaptable, the model can take advantage of a strong correlation across several dimensions of data.	Since the model is so intricate, a lot of space in the computer's memory is needed

Choi et al. [18]	Sequential pattern analysis	High accuracy and performance	However, this approach is not suitable for usage with massive data sets.

3. Recommender System

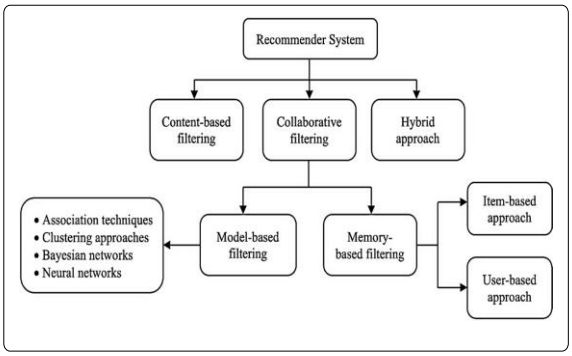
Recommender systems aid users in decision-making [3] by providing them with recommendations.

A recommender system is the point where IR, DM, AI, and QA all meet. One way to formally define a recommendation problem is with the help of a utility function denoted by the name rec. It estimates how likely it is that user u will find some item I from a group of things I to be beneficial to them. U has a function called Rec.

$$R \leftarrow U\chi I \qquad (1)$$

The item's utility score, denoted as R, is numeric, between 0 and 1, inclusive. Rec is a measure of how well a product can satisfy buyer needs. Suggestions are objects, and items are defined by their level of intricacy and practicality. Therefore, it is the responsibility of a recommender system to anticipate this utility score for a particular user and item. "RSs strive to filter objects to users by predicting a rating value for unseen products by such users," so that the "best" unrated commodities may be filtered and ranked in terms of their prediction value. RS makes personalised suggestions for each user by taking into account their unique profile. RS chooses and ranks things according on their projected worth, based on an estimated rating value for products that people have not yet seen [18].

The original aim of Recommender Systems (RS) was to facilitate user decision-making. This section advocates for the development of RS so that high-quality recommendations may be made in a variety of conditions. The term "recommender system" is often used to refer to software that does just that [15]. There have been a lot of studies on different recommendation strategies. Artificial intelligence, data and semantic mining, and information retrieval are only few of the domains that have inspired RS methods.



Types of Recommender Systems

Content-based, collaborative, knowledge-based, and hybrid RS are common classifications. One may say that a knowledge-based recommender system uses the knowledge in a nave fashion. We argue that a

recommender system's intelligence is manifested if it employs the following knowledge representation, learning, and reasoning techniques. Knowledge can be capitalised on, information can be kept current, and inferences can be made with the use of these abilities working together.

IRS considers topics like learning algorithms, knowledge representation systems, and reasoning engines. Among other things, this article defines an IRS, explains its components, and discusses the relationships between them. An IRS may be built using any kind of artificial intelligence (fuzzy logic, ontological approaches, etc.).

The Fuzzy Cognitive Models are grounded on the CMs hypothesis, which proposes that the best way to model complex systems is to use concepts that characterise the most salient features of the system being modelled (variables or states) and the relationships between them. The notion of fuzzy logic is the basis for describing FCMs and how they draw conclusions from specific input data. Political analysis and group decision-making [2] are only two examples of the many applications of fuzzy-cognitive models (FCMs).

4. Types of Recommender Systems

Content-based recommender systems, collaborative recommender systems, and hybrid recommender systems are the three main categories under which recommender systems fall.

TABLE II. TYPES OF RECOMMENDATION SYSTEM AND THEIR DESCRIPTION

Type	**Description**
Content-based recommendation approach	The RS will suggest products that are comparable to those already selected by the user. Calculating the degree of similarity requires knowledge about the attributes of the things being compared.
Collaborative recommendation approach	make predictions about what a user will be interested in buying based on the views of their social network or their historical behaviour data. It's the method that most people use.
Demographic recommendation approach	Based on the user's personal information, it makes product suggestions. It's presumed that there are distinctions in the kind of suggestions best suited to certain demographic subsets.
Utility-based or knowledge-based recommendation approach	In order to better serve its consumers, it takes use of the information available in the area of knowledge by making product recommendations based on how well those qualities of the products fit their wants and requirements. This may be one of two situations: case-based, whereby the system makes suggestions based on similarity metrics using information it has gathered about the user and the goods in question. Knowledge bases containing sets of recommendation rules regarding how to link user needs with item attributes are the foundation of constraint-based recommenders.

Community-based recommendation approach	People are more likely to trust the advice of friends than that of complete strangers, which is the premise around which this strategy is built. This RS has gained attention because of how well-liked social media platforms have become.
Hybrid approach	To take full use of the strengths of each method, a hybrid approach integrates elements from many of them. When used together, these methods provide more accurate suggestions and make more efficient use of existing data.

5. Discussion

This study introduces a Student Learning Recommendation (SLR) for use in Institution recommendation system for undergraduate students. The study's stated goal was to assess the efficacy of course recommendation tools for electives. The secondary goal was to identify unanticipated data mining trends that may be investigated further to improve recommender systems that guide students in making Institution selection decisions. Eighteen articles from the corpus were analysed altogether, and the findings are presented in a number of ways. The findings revealed an increase in research on recommender systems, with the bulk of papers appearing in scholarly publications. Additionally, Higher Education Institute (HEIs) use recommendation systems to deal with a wide range of issues. Given the enormous influence recommender systems have had in other fields including business, health, and the arts, this result shouldn't come as much of a surprise. Because of the proliferation of social media, HEIs have access to vast troves of data, both organised and unstructured [12].

6. Conclusion

The suggested framework for the intelligent recommendation system is presented in this study. The predictive model is the primary element of the suggested system. Prior to enrolling in any educational institution, the model enables predictions about undergraduate programmes at Indian institutions using a collaborative filtering technique, with recommendations for each student based on her/his knowledge, need, and interests. The recommendation system creates multiple recommendation scenarios and suggestions for learners based on the categorization findings.

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