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Hybrid Book Recommendation System Integrate with Association Rule Mining

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Abstract

The best knowledge management systems are recommender systems, which let consumers filter out irrelevant data and provide tailored recommendations based on their past historical data and related products they are looking for online. A recommender system provides suggestions to customers in various circumstances. Online book sellers today engage in a number of competitive activities. One of the more powerful techniques for increasing earnings and keeping customers is the recommendation system. Books that will attract buyers must be recommended by the book recommendation system. This study proposes a system for recommending books that combines association rule mining, collaborative filtering and content filtering.

Keywords: Book Recommender System (BRS), Collaborative Filtering (CF), Content Based Filtering (CB), Association Rule (AR), E-Commerce Sites

Introduction

A possible problem of information overload that prevents timely access to online items of interest has been created by the exponential development in the volume of digital information available and the number of internet users. A recommender system's (RS) objective is to produce useful user recommendations regarding things or products that they might find interesting. Based on the user's profile, the RS can determine if a specific user will favour an item or not. They lower the transaction costs associated with locating and choosing products in an online buying setting (Jallouli, Lajmi & Amous, 2017). It has also been demonstrated that recommendation systems enhance the quality and process of decision-making. Because RS are efficient ways to sell more things in an e-commerce environment, they increase revenues. The real-world example of RS is the recommendation of books on Amazon, movies on Netflix or songs on Spotify. By filtering all available information to give the user the most useful information, RS were created to bridge the gap between information and analysis. It lessens the transaction costs associated with browsing and choosing products in an online purchasing environment and enhances the user's decision-making process (Isinkaye, Folajimi & Ojokoh, 2015; Malik & Bansal, 2019). A system with users, a user interface dataset and recommendation algorithms is referred to as RS. Another way to state RS is that it is made by, for and about the user. It can be further explained that the recommendations made by the RS are intended for the users, who can input their preferences, ratings or requirements using the user interface, with the recommendations being shown on the same platform. Fig. 1 show the recommendation process. The following three methods describe how RS improves the sales of e-commerce websites:

Transform Browsers into Buyers: Users occasionally visit websites merely to gather information before leaving them empty-handed. By offering the goods that people desire to buy at that time, RS plays a crucial role.

Cross-Selling Rates Rising: RS also assists the seller by boosting cross-sell by encouraging users to buy other products. Order size should go up if the user finds the recommendations to be helpful.

Building Loyalty: In a market where competitors are only a click away, user loyalty is crucial to corporate strategy. By fostering a relationship between them that adds value, RS aid in boosting and improving user and site loyalty (Malik & Bansal, 2019).

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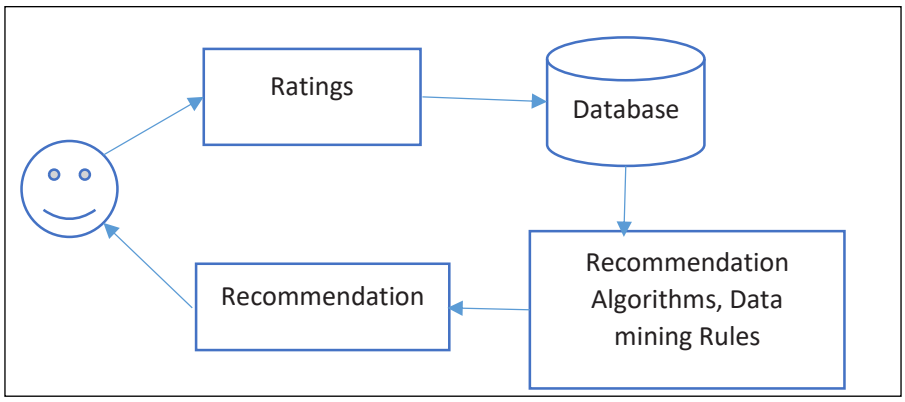

Fig. 1: Recommendation Process

In this article, a novel method for making book recommendations to customers is presented. To create effective and efficient recommendations, this system integrates the capabilities of collaborative filtering (CF), association rule (AR) mining and content filtering.

This article is further organised as follows: Section 2 includes the description of RS with is different techniques with their pros and cons, Section 3 contains the major point of AR of mining. Section 4 discusses the new approach of recommending books to the buyers. Section 5 includes the conclusion and future work.

Recommender System

Personalised recommendations allow for the online collection and storage of user data, analysis of the user's past and present interactive activity and presentation of content to the user based on those findings. Depending on the method used for suggestion, it can be divided into various types:

Collaborative-Filtering

The CF approach predicts the products for a certain user based on the items that other users have previously assessed. Essentially, this method filters information based on user recommendations. CF can employ either an item- or a user-based approach. The user is a key player in the user-based approach. Users with similar tastes are kept together in one group. In this method, suggestions are sent to users based on their peers' evaluations of the things (Murali, Vishnu & Victor, 2019).

The dataset's similarities between various items are determined via the item-based CF algorithm. The recommendation is then calculated by taking a weighted average of the target user's ratings on the similar goods once the most similar things have been identified (Mathew, Kuriakose & Hegde, 2016). Fig. 2 shows the some challenges and benefits of CF technique.

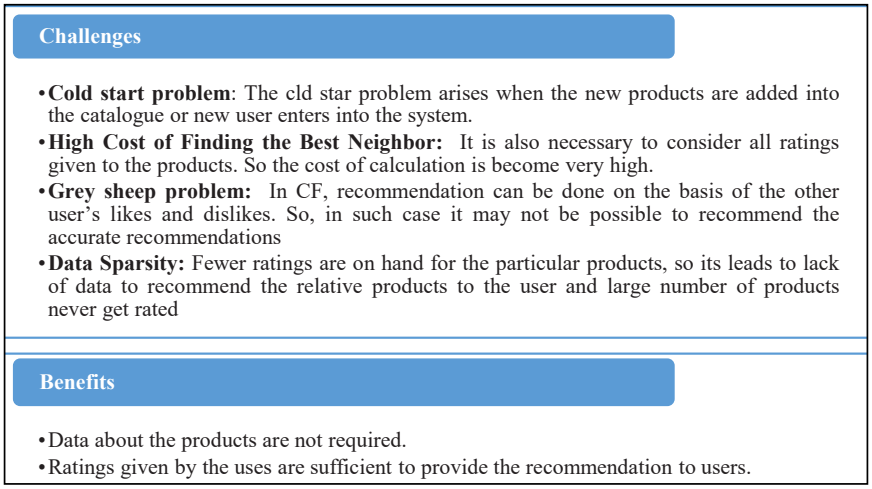

Fig. 2: Challenges and Benefits of Collaborative Filtering

Content-Based Filtering

The user's personal information and the item description are the foundation of the CB filtering suggestion technique. It depends on the user's prior online preferences for the products in question. The user profiles of other users are not necessary for this type of strategy because they have no bearing on the suggestion process. Two categories of users exist:

- Explicit users and
- Implicit users.

Explicit users employ the feedback technique to express their ideas by choosing a value, while implicit users have their personal information change automatically when they interact with the system online (Malik & Bansal, 2019; Zhao, 2019). Fig. 3 shows the challenges and benefits of CB technique.

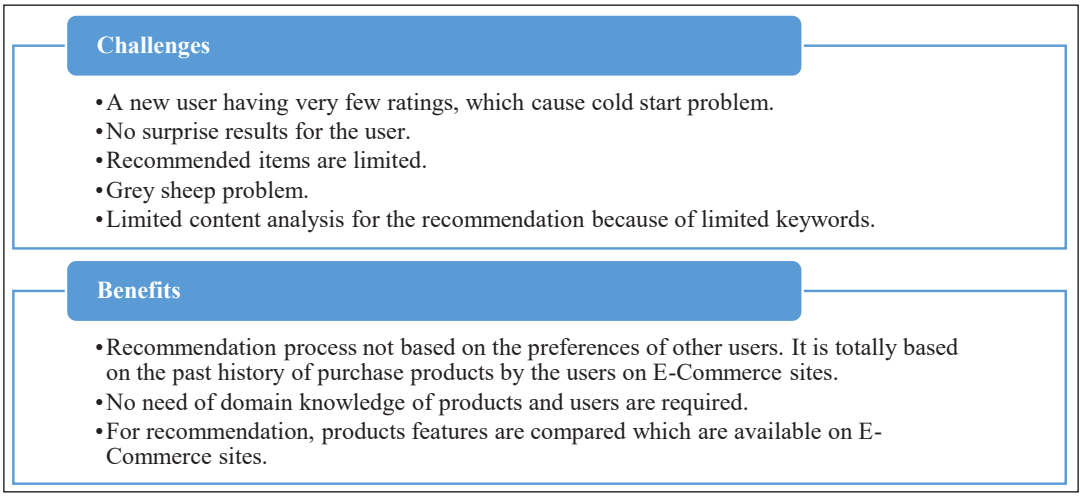

Fig. 3: Challenges and Benefits of Content Based Filtering

Hybrid Approach

The hybrid filtering strategy combines several different filtering techniques, however CF and CB filtering techniques are the most frequently employed. It was primarily developed to address issues with individual approaches. Fig. 4 includes the benefits and challenges of hybrid technique of recommendation.

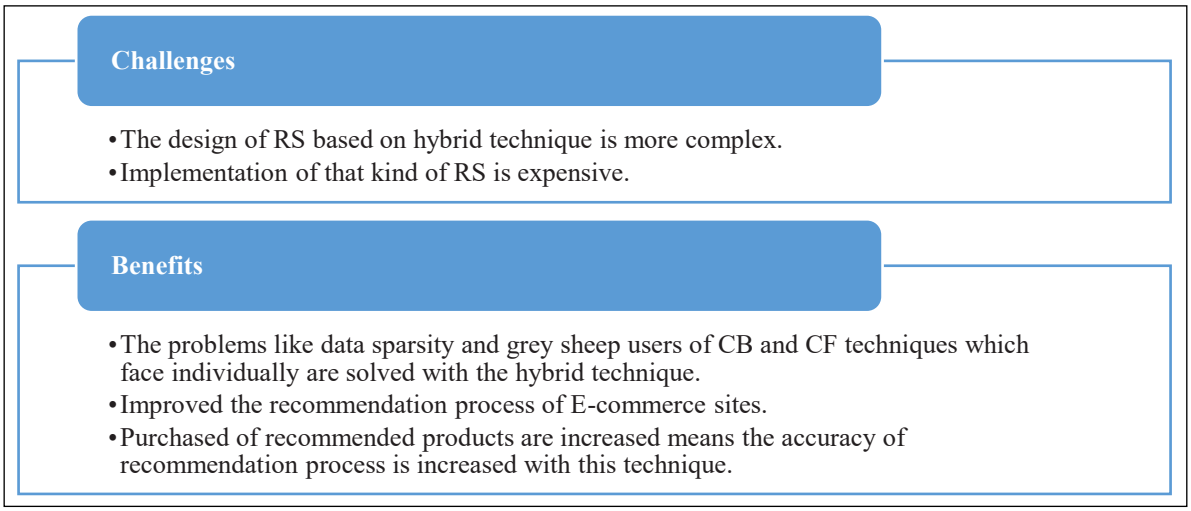

Fig. 4: Challenges and Benefits of Hybrid Recommendation

Association Rule

Among a big data set of elements, AR mining reveals intriguing associations and correlations. This rule displays the number of times an item set appears in a transaction. A market-based analysis serves as a common illustration. In market-based analysis, the purchasing patterns of customers are examined to identify relationships between the various things they combine in their shopping cart.

A rule of association has two parts:

- a predicate (if) and
- a result (then).

An item found in data is called a predicate, and an item found in combination with a predicate is called a result. Look at this rule, for example:

"A client is 70% more likely to purchase milk if he purchases bread."

Bread is the predicate and milk is the consequent in the AR above. Simply said, it is the association guideline for retail stores to better target their clients. If the aforementioned rule is the outcome of a careful examination of particular data sets, the company's revenue can be increased in addition to customer service.

The process of developing ARs involves carefully reviewing data and searching for recurring if/then patterns. The significant associations are then seen to depend on the following two parameters:

Support: Support describes how frequently the database contains instances of the if/then relationship.

Confidence: The number of times these associations have been verified to be accurate is indicated by confidence.

Let I = {i1, i2….. im} be a set of items.

An AR can be represented by this form

$A \rightarrow B$, where $A \subseteq I$, $B \subseteq I$ and $A \cap B = \phi$

Support $(A \cup B) = P(A \cup B)$

Confidence $(A \rightarrow B) = P(B \mid A)$

Generally speaking, AR mining can be seen as a two-step procedure.

- Generating all items sets with support above or equal to the minimum support specified by the user.
- Produce all the rules whose confidence factor is greater than or equal to the minimal confidence set by the user (Tewari, Kumar & Barman, 2014).

The main drawback of the AR is slower and not very effective for recommendation when lots of mining rules are implemented (Gil & García, 2005). Fig. 5 represents some challenges and benefits of AR.

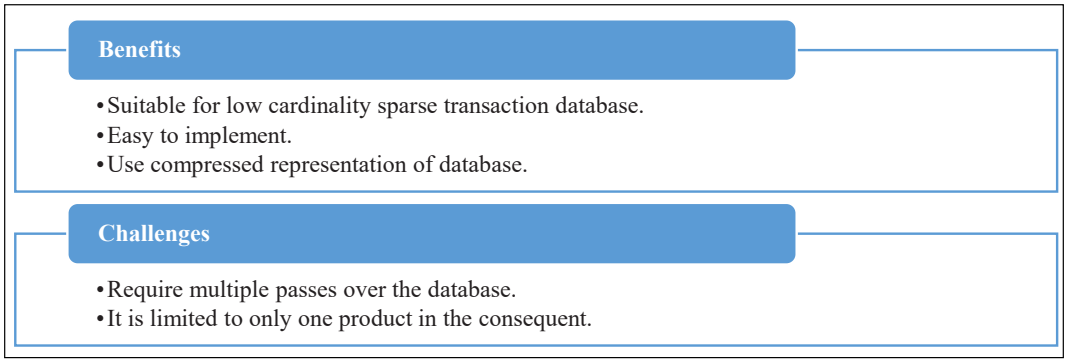

Fig. 5: Challenges and Benefits of Association Rule

Proposed Book Recommendation System

This book recommendation system's goal is to suggest books to buyers based on their areas of interest. This offline recommendation system keeps suggestions in the web profile of the customer. The steps in this system are as shown in Fig. 6:

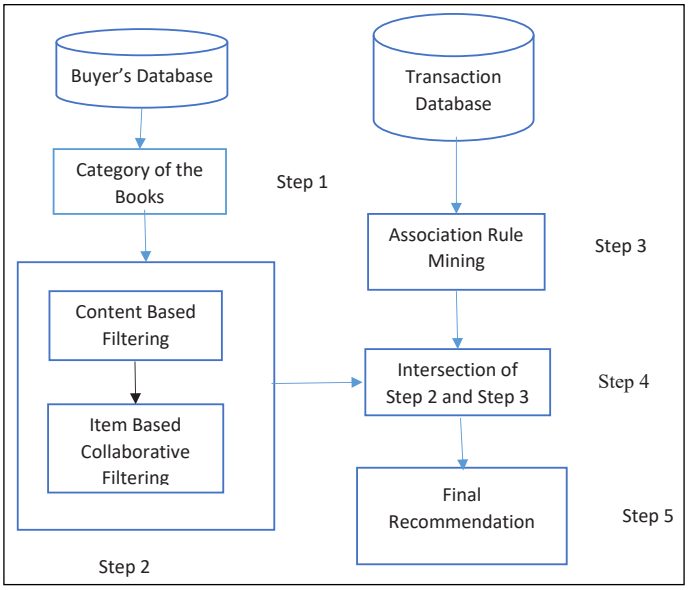

Fig. 6: Block Diagram of Proposed Book Recommendation System

Step 1: Find out from the buyer's web profile what book category they have previously purchased, such as novels, science, engineering, historical fiction, horror, etc.

Step 2: To locate books that are significantly similar to books that the buyer has already purchased, use CB in the category found in step 1 and the books overview material from the customer's past history record. The list of books is then compiled using item-based CF, with recommendations listed in descending order. The quality of the recommended books is actually evaluated in this step's system based on the ratings that other customers have given them. In this step, hybrid recommendation technique is implemented to overcome the disadvantages of individual techniques of recommendation like CF and CB.

Step 3: Find all of the transactions from the book transaction database that fall under the same category as those found in step 1. Apply the AR to those transactions to determine which books the buyer can subsequently purchase. To obtain stronger rules, change the confidence and support settings.

Step 4: Find out the intersection of the result of steps 2 and 3. The intersection results should be arranged in the step 2 provided descending order of recommendations. Actually, the recommendations produced by step 2 are being refined even further in this stage.

Step 5: The final recommendations for the buyer are the step 4 result. All of these actions are carried out while the customer is not online, and the outcomes are saved in the web profile of the buyer. The recommendations will be automatically created when the customer returns to the website the following time.

Conclusion and Future Work

Most recommendation systems attempt to anticipate the buyer's interests and make book recommendations in line with those predictions. The hybrid recommendation system for this book has taken into account a variety of factors, including the book's content and quality, by performing CF of other buyers' ratings and integrating them with CB. To make recommendations that are more persuasive, this RS also uses an associative model. In the future work, the book data is implemented in the proposed book recommender model to check the efficiency of the model.

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