GROUP RECOMMENDER SYSTEM
MINOR PROJECT – 1

Submitted By:-

Ayush Singh Chauhan (20104047)
Surya Pratap Singh (20104049)
Rishabh Srivastava (20104055)

Under the Supervision of:-

Ms. Deepti Singh

Department of CSE/IT
Jaypee Institute Of Information Technology, Noida

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Problem Statement

Comparing different aggregation strategies and providing best recommendation based on accuracy for different group profiles

1. Introduction

1.1 Recommender System

Suppose, you walk-up to the restaurant for the first time, since you don't have any idea what to order so you go through the menu and take some time to decide your order and in the meanwhile waiter comes to you and asks “what would you like to take?”. So in this case, you ask the waiter to recommend something to you, then on the basis of provided recommendations, you give your preferences. Similarly, people often use recommender systems over the web to make decisions for the items related to their choice. Recommendation systems are software tools and techniques whose goal is to make useful and sensible recommendations to a collection of users for items or products that might interest them. In other words, the recommender system belongs to a class of information filtering system that aims at predicting the ‘preference’ or ‘rating’ given to an item by any user. The most famous areas where the concept of recommender system is implemented are movies, music, news, books, social tags, products, restaurants, financial services, life insurance, persons (online dating), Facebook friends and Twitter followers. Recommendation algorithms are widely used on E-commerce websites where they use information about a customer's interests as input and generate a list of recommended items.

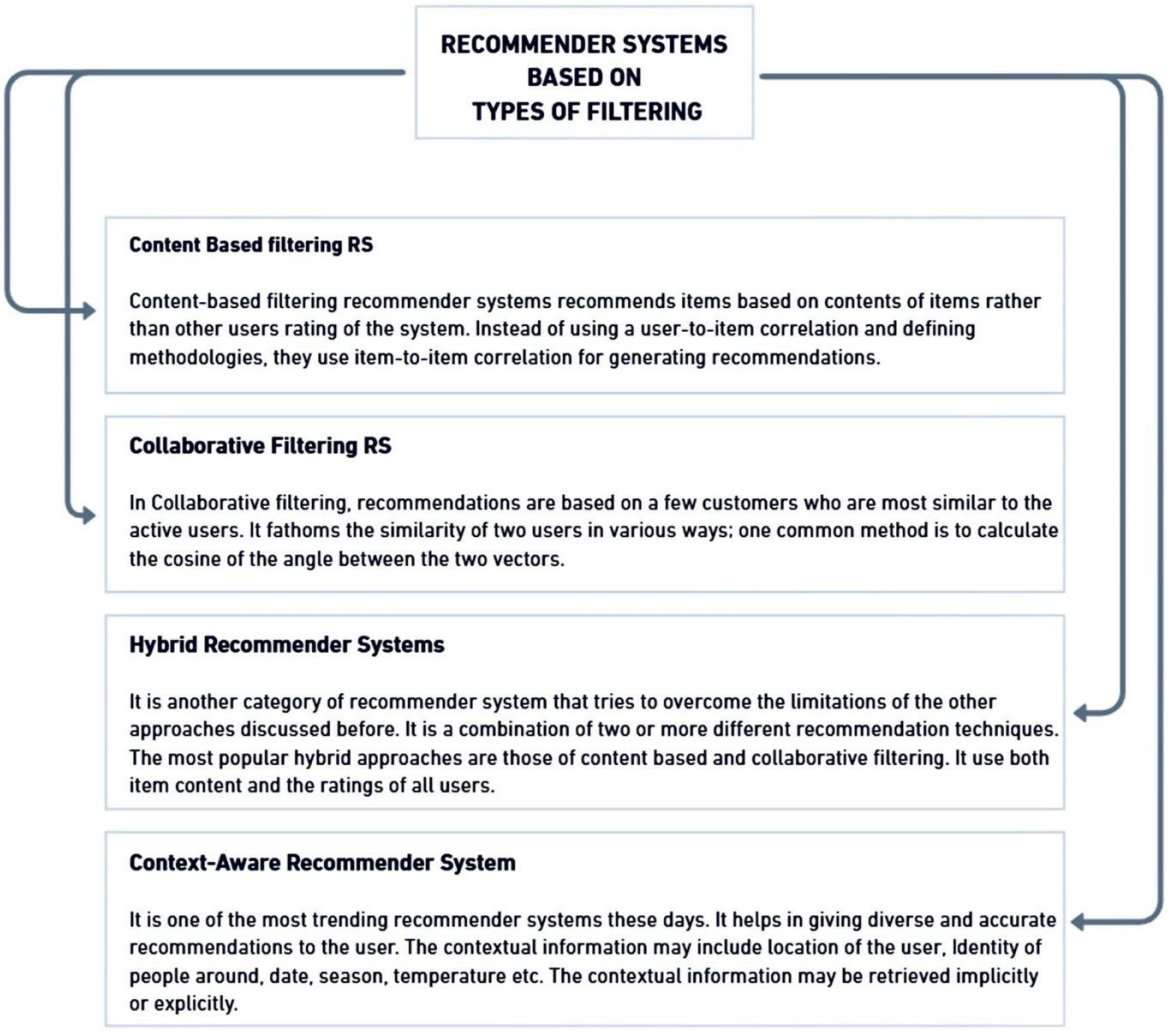

Figure 1 -RS Based on types of filtering

1.2 Group Recommender System

Recommender systems are increasingly used in various domains like movies, travel, music, etc. The rise in social activities has increased the usage of recommender systems in general and group recommender systems in particular. A group recommender system is a system that recommends items to a group of users collectively, given their preferences. In addition to the user preferences, using social and behavioural aspects of group members to generate group recommendations will increase the quality of the content recommended in heterogeneous groups. Group recommender systems also address the cold start problem that arises in an individual recommendation system. Many traditional recommender systems have concentrated only on single-user models. But in real life, there are many situations, where we interact mostly with groups like watching a movie with the family, having dinner with colleagues, planning a vacation with friends, etc. So, group recommendation is also an equally important problem to be addressed.
Group recommendation requires three subtasks to be tacked:

1. Acquiring user preference information.
2. Generating recommendations.
3. Helping group members to settle on a final recommendation.

2. Motivation behind Group Recommender System

Recommendation System belongs to the class of Information Retrieval, Data Mining and Machine Learning. Recommender systems play a major role in today's ecommerce industry. Recommender systems recommend items to users such as books, movies, videos, electronic products and many other products in general. Recommender systems help the users to get personalized recommendations, helps users to take correct decisions in their online transactions, increase sales and redefine the users web browsing experience, retain the customers, enhance their shopping experience. Information overload problem is solved by search engines, but they do not provide personalization of data. Recommendation engines provide personalization. There are different type of recommender systems such as content-based, collaborative filtering, hybrid recommender system, demographic and keyword based recommender system. Variety of algorithms are used by various researchers in each type of recommendation system. Lot of work has been done on this topic, still it is a very favourite topic among data scientists. It also comes under the domain of data Science.

3. Group Recommender System problem

A big problem for recommender systems is the so-called cold-start problem: to adapt to a user, the system needs to know what the user liked in the past. This is needed in content-based filtering to decide on items similar to the ones the user liked. It is needed in social filtering to decide on the users who resemble this user in the sense that they disliked the same items in the past. So, what if we do not know anything about the user yet, because they only just started using the system? Recommender system designers tend to solve this problem by either getting users to rate items at the start, or by getting them to answer some demographic questions (and then using stereotypes as a starting point, e.g. elderly people like classical music).
Both methods require user effort. It is also not easy to decide which items to get a user to rate, and stereotypes can be quite wrong and offensive (some elderly people prefer pop music and people might not like being classified as elderly).
The group recommendation provides an alternative solution. When a user is new to the system, we simply provide recommendations to that new user that would keep the whole group of existing users happy. We assume that our user will resemble one of our existing users, though we do not know which one, and that by recommending something that would keep all of them happy, the new user will be happy as well. Gradually, we will learn about the new user's tastes, for instance, by them rating our recommended items or, more implicitly, by them spending time on the items or not. We provide recommendations to the new user that would keep the group of existing users happy including the new user (or more precisely, the person we now assume the new user to be). The weight attached to the new user will be low initially, as we do not know much about them yet, and will gradually increase. We also start to attach less weight to existing users whose taste now evidently differs from our new user.

4. Challenges faced by group recommender system

4.1 How should the different type of group be handled in the recommendation process?

- An established group who shares the same long-term interests, like a group of fans of an artist
- An occasional group who has a common specific aim, like visiting a museum
- A random group of people who do not have anything in common (e.g., the recommendation of background music in a room)

4.2 Should the preference be collected for each user in the group?

- A system can acquire implicit or explicit preferences
- They can be collected either way as considering person to be part of group or not
- Studies show that preference changes when individual users interact
- The type of preference acquisition leads to completely difference ways in which information is handled by the system.

4.3 How should the individual preference be merged for one item in a group?

- In order to derive a group preference for the item, group modelling strategies combine the individual user models. The strategy that is best models a group has to be evaluated in the context in which the group is modeled. There are 11 existing strategies, they are:-

Strategy	How it works
Plurality Voting	Uses 'first past the post': repetitively, the item with the most votes is chosen.
Average	Averages individual ratings
Multiplicative	Multiplies individual ratings
Borda Count	Counts points from items' rankings in the individuals' preference lists, with bottom item getting 0 points, next one up getting one point, etc
Copeland Rule	Counts how often an item beats other items (using majority vote) minus how often it looses
Approval Voting	Counts the individuals with ratings for the item above an approval threshold
Least Misery	Takes the minimum of individual ratings
Most Pleasure	Takes the maximum of individual ratings
Average Without Misery	Averages individual ratings, after excluding items with individual ratings below a certain threshold

Fairness	Items are ranked as if individuals are choosing them in turn.
Most respected person	Uses the rating of the most respected individual.

4.4 Should rating be predicted for each user or for the group?

Ratings can be predicted using one of the following 3 approaches:-

- Based on a group model: combine individual preferences and use it to build predictions for the group
- Merging recommendations built for the users in a group
- Aggregating all the predictions built for the users in a group

4.5 Who should choose the item to recommend to the group?

Three strategies are usually employed to select the items to recommend to the group:

- The system suggests the items with the highest predicted ratings, without consulting the group
- A member of the group is responsible for the final decision.
- The users in the group have a conversation, in order to achieve consensus.

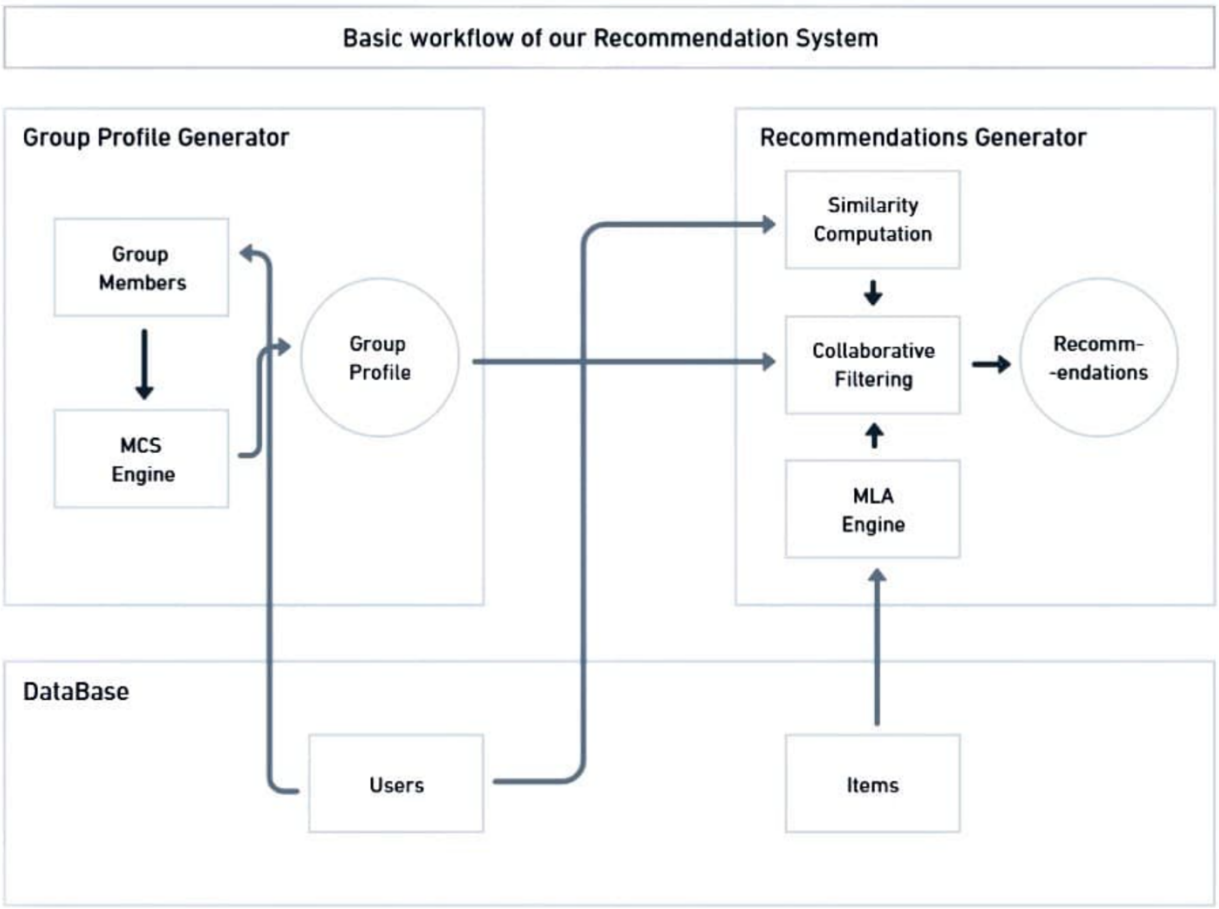

Figure 2 – Workflow of our recommender system

5. Applications

5.1 e-Commerce

Is an industry where recommendation systems were first widely used. With millions of customers and data on their online behaviour, e-commerce companies are best suited to generate accurate recommendations.

5.2 Retail

Target scared shoppers back in the 2000s when Target systems were able to predict pregnancies even before mothers realized their own pregnancies. Shopping data is the most valuable data as it is the most direct data point on a customer's intent. Retailers with troves of shopping data are at the forefront of companies making accurate recommendations.

5.3 Media

Similar to e-commerce, media businesses are one of the first to jump into recommendations. It is difficult to see a news site without a recommendation system.

5.4 Banking

A mass-market product that is consumed digitally by millions. Banking for masses and SMEs are prime for recommendations. Knowing a customer's detailed financial situation, along with their past preferences, coupled with data of thousands of similar users is quite powerful.

5.5 Telecom

It Shares similar dynamics with banking. Telcos have access to millions of customers whose every interaction is recorded. Their product range is also rather limited compared to other industries, making recommendations in telecom an easier problem.

5.6 Utilities

Similar dynamics with telecom but utilities have an even narrower range of products, making recommendations rather simple.

6. Related Works

6.1 INTRIGUE

- Recommends places to visit for tourist groups taking into account characteristics of subgroups within that group (such as children and the disabled) .
- It basis its recommendations on the basis of subgroups (children and differently abled)
- Uses weighted form of Average strategies .

6.2 MusicFX

- Chooses a radio station for background music in a fitness centre, to suit a group of people working out at a given time.
- Uses Average without misery aggregation strategy.
- Users rate all radio stations, from +2 (really love this music) to -2 (really hate this music). These ratings are converted to positive numbers (by adding 2) and then squared to widen the gap between popular and less popular stations.
- To avoid starvation and always picking the same station, a weighted random selection is made from the top stations of the list.

6.3 YU'S TV RECOMMENDER

- Recommends a television program for a group to watch.
- It bases its recommendation on the individual's preferences for program features (such as genre, actors, keywords).
- It recommends on individual ratings of program features: -1 (dislikes the feature), +1 (likes the feature) and 0 (neutral).
- Recommender takes the average of all user ratings and then recommends on the basis of the average of the group.

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