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Overview On Recommender systems

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Abstract

Recommender systems are the hot technology which are changing the game of online businesses. Today e-commerce business or any business which are based on websites are reshaping the world. Any online commercial business are heating a market because they are providing everything to the user or customers in one basket. E-commerce was also facing a problem when it comes with a large item sets, users has to search a product manually and user should know have about the product first to find it in the sites. But when recommender systems comes into the game people gets the relevant products recommended by a system according to their preferences. A large datasets are extracted to find the pattern or behavior of the users.

Keywords

Recommender systems, Electronic commerce, Commercial

1. Introduction

Generally, recommender systems are the systems which is used to filter the information which predict the rating or the relevant products or items. As the business are attracting towards the web services to provide a service to a customers. When we use the websites for business then recommender systems comes into the picture. The big giant sites which that might be in the field of entertainment, social medias and product selling these all uses a recommender systems to recommend a relevant product to users according to their preferences. We can see the example of importance of recommender systems, in 2006 Netflix held a prize competition for the

recommendation engine, it was titled as “Netflix Prize” where its goal was to improve a recommendation systems from its own which prize money was worth to 1 million US dollar. We can see that how much the big company are paying attention to these technology to improve the businesses. Same as that Amazon, Shopify, Youtube, Facebook, Spotify etc. company also uses these techniques. Recommender systems are being a backbone of the e-commerce.

1.1 problem Background

In this age of the technology, only the developed country are able to adapt a new technology to improve their living styles and for business. If we see to the under developing countries they are away from the new technology and are not able to take benefit of this technology. We can see the e-commerce are making a peoples life easier and happier. They are getting all the products in one basket so that they are getting a product of their wish in just one click. E-commerce business reduces a boundary. We can see the example like Amazon, Alibaba etc. which are doing the business globally. These e-commerce sites sales more than millions of products to millions of people all over the world. And user are getting a product from this large item sets according to their preferences. These all things are made easier by the recommendation engine. Many under developed countries are still away from these technology and these kinds of businesses.

1.2 Problem Statement

- To bring a advancement in a business by using a latest technology
- Attract a manual business system to e-commerce and make a e-commerce site more intelligence enough to provide a service

1.3 Objectives

The main objectives of this paper are as follows:

- To explain about the recommender systems and its advantages over the business
- To attract a people towards the e-commerce with recommender system to make a websites more intelligence
- To predict the ratings of the items based on users past taste of products
- Recommend a product based on similarities of interest of the users

There are many advantages of recommender systems over the e-commerce

- Helps to grow a business
- Users don't get a burden on searching a products
- Users get better experience and will to revisit a site for its features
- Saves a time and money
- Make a use of technology to serve a customer
- Increase an engagement of users to sites

We encourage all the new startups to go for virtual business via a websites which is called as e-commerce and use a recommender systems to make an e-commerce sites more intelligent.

2. Approaches

Although recommender systems has the following approaches:

- Content based filtering
- Collaborative based filtering
- Hybrid Approach

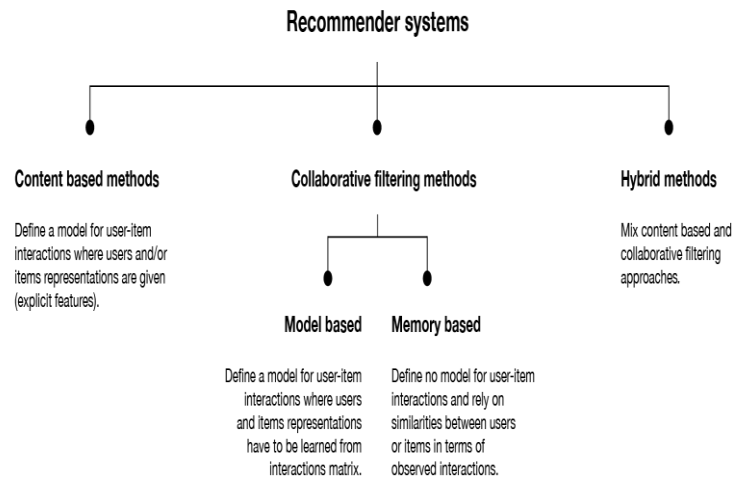


Figure 1 diagram of recommender system approaches

2.1 Content based filtering:

Content based filtering is also one of the recommender systems approaches which recommend a system based on a category or the description of the products. It works according to the content of the items. This approach also extends naturally to cases where item metadata is available e.g. movie stars, book authors and music genres. If we consider an example of a movie recommender system the additional information can be age, sex of the users, the star casts, movie duration, movie type etc. We can take a product recommender systems additional information might be the product price, product type, size, brand, description etc. when we search for a product of these categories it recommends a similar products which matches these categories.

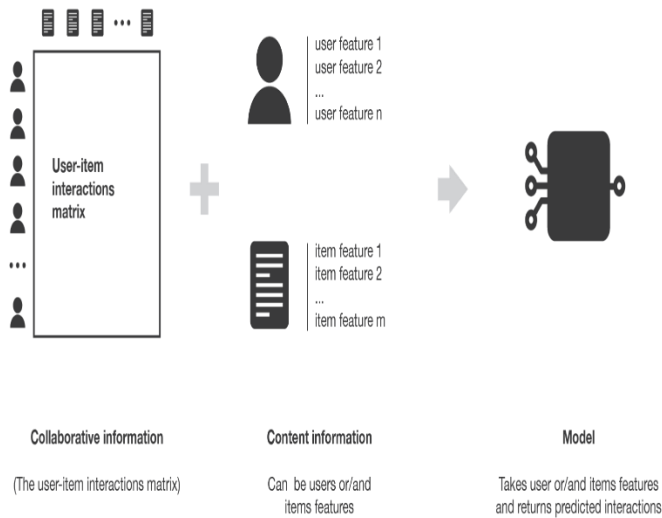


Figure 2 overview of content based method paradigm

Content based method suffer less with cold start problem then a collaborative based method. New users or items can be suggested according to their description, characteristics or the content. So we don't suffer from a cold start problem because the necessary data to recommend products will be already with us.

2.2 Collaborative based filtering

Collaborative based filtering are the most popular approaches of recommender systems. Collaborative systems basically works on the basis of past interactions recorded between users and items so that we can make a recommendations on the new product. These all interactions between the users like search, history, click history, purchased history are recorded, analyzed and make a decision for recommendation according to their preferences based on their past experience and interactions to the products or items.

The main advantage of the collaborative based filtering is that the systems do not requires the information about the product or users what it needed is the interactions that has done to the products by users. From this interaction they can find the preferences of the users towards a product or items.

Collaborative based filtering also further classified in two sub categories:

- Model Based
- Memory Based

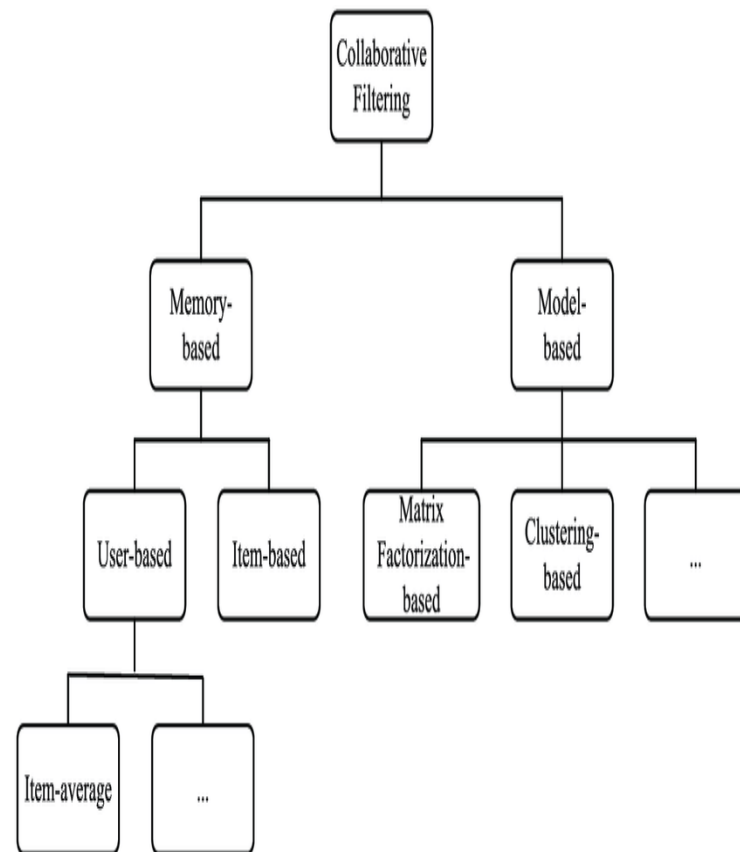


Figure 3 collaborative based filtering diagram

Memory Based Approaches

The main characteristics of the user-user and item-item approaches is that they only use the user-item interaction matrix to gain a knowledge or information. Hence it don't require any model to make a new recommendations.

User-User based

User-user based recommendation methods uses a technique of comparison of the interactions with products between the users and find the similarities between the user interactions with product and make a prediction or recommends a product by finding a similarities in interactions of users with products. Hence, this methodology is called as user-user based collaborative filtering.

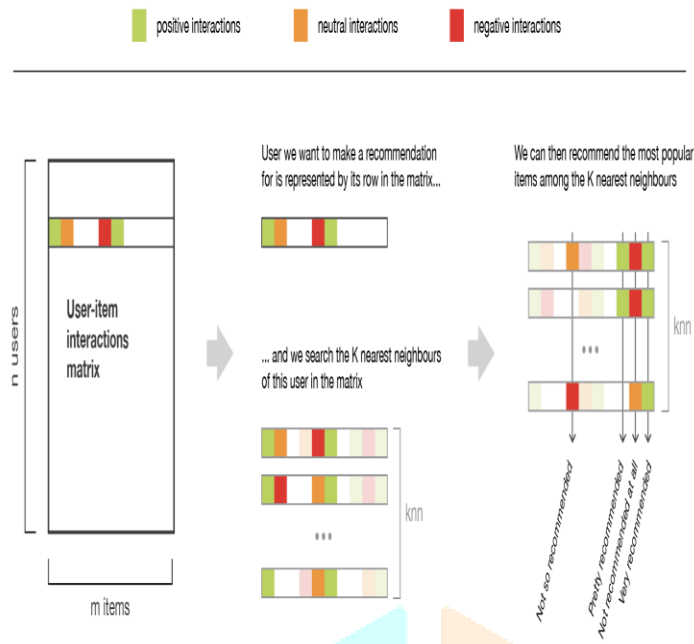


Figure 4 user-user based collaborative filtering

Item-item based:

Unlike user-user based, item-item based works on the basis of item similarities. It also uses the user-interaction matrix in order to find the user interest of items in which users has given a positive response and negative response. Two items are considered as similar if most of the users has interacted with both of them. This method is known as item-centered.

Model based collaborative filtering:

Model based collaborative filtering algorithms provide item recommendation by first developing a model of user ratings. Algorithm in this category take a probabilistic approach and envision the collaborative filtering process as computing the expected value of user prediction.

Matrix Factorization

Matrix factorization is one of the most popular and efficient model for recommendation since this model has won the challenge from "Netflix prize" which worth the prize money 1 million US dollar.

Matrix factorization is a class of collaborative filtering algorithms used in recommender systems. It works by decomposing the user-item interaction matrix into the

product of two lower dimensionality rectangular matrices.

$$P_{m \times n} = U_{m \times m} \sum_{m \times n} V_{n \times n}$$

U and V are unitary matrices. For 4 users and 5 items, it looks like

$$P_{4 \times 5} = \begin{bmatrix} u_{11} & u_{12} & u_{13} & u_{14} \\ u_{21} & u_{22} & u_{23} & u_{24} \\ u_{31} & u_{32} & u_{33} & u_{34} \\ u_{41} & u_{42} & u_{43} & u_{44} \end{bmatrix} \cdot \begin{bmatrix} \sigma_1 & 0 & 0 & 0 & 0 \\ 0 & \sigma_2 & 0 & 0 & 0 \\ 0 & 0 & \sigma_3 & 0 & 0 \\ 0 & 0 & 0 & \sigma_4 & 0 \end{bmatrix} \cdot \begin{bmatrix} v_{11} & v_{12} & v_{13} & v_{14} & v_{15} \\ v_{21} & v_{22} & v_{23} & v_{24} & v_{25} \\ v_{31} & v_{32} & v_{33} & v_{34} & v_{35} \\ v_{41} & v_{42} & v_{43} & v_{44} & v_{45} \\ v_{51} & v_{52} & v_{53} & v_{54} & v_{55} \end{bmatrix}$$

Where $\sigma_1 > \sigma_2 > \sigma_3 > \sigma_4$

The preference of the first user for first item can be written as

$$p_{11} = \sigma_1 u_{11} v_{11} + \sigma_2 u_{12} v_{21} + \sigma_3 u_{13} v_{31} + \sigma_4 u_{14} v_{41}$$

Problem with collaborative based filtering

Though there are many benefits of collaborative based filtering, it have some problems also which we have discussed below:

Cold start:

This problems come into the picture when we have a new user or item because we don't have enough data to make a predictions over that user or items. So, it would be a problem for new user or item to make a recommendation.

Scalability:

As a business size the systems are also differ in size, the large size business needs a large amount of computation power and often necessary to calculate a recommendation

Sparsity:

Sparsity comes with the problems with the ratings or reviews that user has provided to any item.

2.3 Hybrid Based Approach

Hybrid based approach is a mixed technology which uses both content based filtering as well as collaborative based filtering. Most of the business company used these technique because it provides a solution of the two approaches.

It says that it is not necessary that each and every user would provide a rating or review over any items. They might just buy and use an item but would not provide a rating over that item. By such scenario the popular item might also get a less no. of rating from the users which would be a problem to a recommender systems to make a recommendation over that item.

3. Conclusion

We can say that recommender systems are changing the game of e-commerce or any web services. So the more the intelligent recommender systems, more you increase your business value towards the customers. So, the e-

commerce with recommender systems might be the great idea for startup a new business in developing countries which satisfies the uses and advancement of the new technology and yes, the life of the people much easier.

4. References

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