

Delivering Relevant Product Recommendations in Finance*

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Abstract

To begin with why is that topic? One of my friends is working in a financing company, therefore I'm genuinely curious how does a bank recommend products to it's customers. It's a useful tool for a bank to increase it's revenue but can it be enhanced? And if yes then how?

Now to the points that I'm going to untangle in this article:

- What is a recommendation system
- Distribution of the systems based on thier architecture
- Usage cases in real life
- How does a recommendation system in a bank work
 - Architecture and ways of utilizing data
 - Algorithms applied
 - Data types used
- Conditions to be met before deployment of the system
 - Learning conditions
 - Duration of learning
 - And other conditions
- Issues with the system
 - Lack of data
 - New item introduction
 - Unability to recommend anything relevant to a user
 - And other issues
- Enhancement of the system
 - Possibility of merging a recommendation system with another system
 - Systems that can be merged with recommendation system
 - Resolving problems occuring in the system
 - Other improvements

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1 Recommendation system

1.1 Definition of a recommendation system and its objective

Nowaday people buy a lot of things on the internet, they watch a lot of films and do a lot of other stuff. Since there's such a rich amount of choises it's hard to find the ones people would choose. For that reason reommandation system was introduced. A recommendation system also called recommender system is a program which recommends user a product/service which he/she most probably would buy. The system is trained on huge amounts of data. Ultimately it tries to predict next probable choise of a customer and then recommends it. It could be next film watched, next purchase bought or next route on the road recommended. The data is provided by the customer's overall experience. It could be purchases, filmes watched, time used on app and so on. So it's a system adapting to each customer's needs and preferences. [1]

1.2 Distribution of the systems based on thier architec-ture

The systems are divided into few main categories. Some of them are content-based systems, collaborative systems and hybrid systems. Here is a graph of them in detail

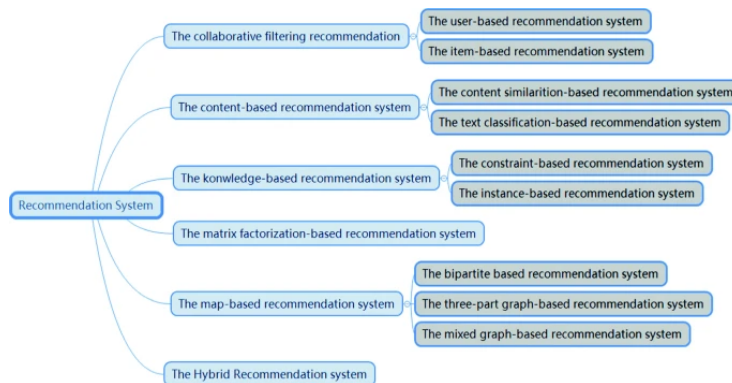


Figure 1: Distribution of systems based on the architecture [2]

Collaborative filtering is one of the most used types of recommendation systems in the world. Collaborative filtering recommends something based on preferences of another user which has common traits with the current one.

Advantages of the system type:

- Filtering complex information: It can filter information which is hard to analyze automatically by machines, that is music, art etc.
- Recommending completely new information: It's able to recommend utterly distinguish information to the one introduced prior

- Utilizing feedback of similar users: It effectively use info of other similar users to the current one and give out useful results

Disadvantages of the system type

- **Rarity:** Amount of projects and users is big and users don't rate each and every project used therefore there are no common scores between them, resulting in similarity cannot be calculated
- **Multiple Content:** Collaborative filtering doesn't take into account influence of categories onto the recommendation
- **Scalability:** The number of users and projects is increasing each day. Henceforth system needs more and more time to compute bigger and bigger matrices of users and projects. So the problem of scalability occurs.

Content-based filtering is the most used type of systems in academic search engines. The plain idea of it is to record which object user has chosen from list of recommended objects and then analyze it, based on that it recommends next the most relevant object. For example it can recommend an article with attributes academic, fresh and popular. The point is to recommend an object which has biggest similarity by description to the description provided by user. Content-based recommendations consists of the following three steps:

- Extracting features and build model that describe resources
- Compare current features's similarity with previous features's in order to decide if recommendation is viable
- In conformance to similarity of the items to current item an array of items is selected and recommended to user

Advantages

- It doesn't need data of other users, and can start working without it
- It's able to adapt to user's individual preferences in order to make personalized recommendations
- It can recommend any new projects, no problem with new objects recommendations
- It can be easily explained why objects are recommended based on their characteristics and current preferred characteristics

Disadvantages

- If user changes his profile his preferences are gone, and now system needs to adapt to user's preferences again
- There's a possibility that system will recommend the same product user liked before
- Problem of lack of the history, thus at the beginning there's no data provided by user which mean the accuracy is low

1.3 Usage cases in real life

Here are the main variations of recommendation systems which are used the most commonly.

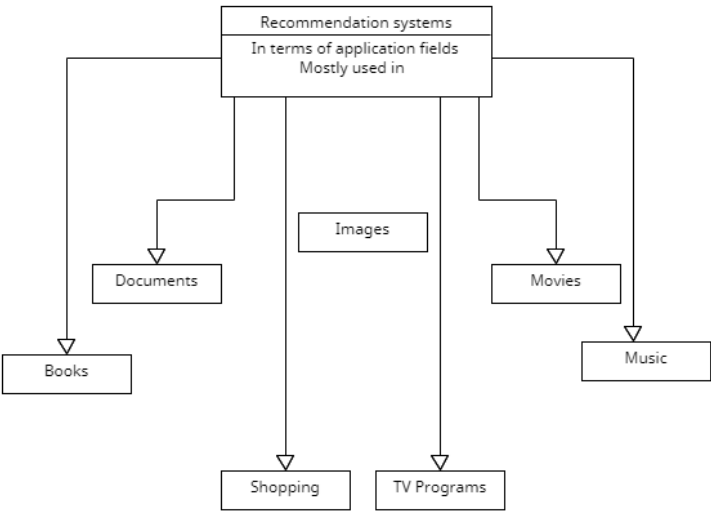


Figure 2: Most commonly used system types

2 Architecture and principles of workflow

2.1 Architecture

Blah blah blah...

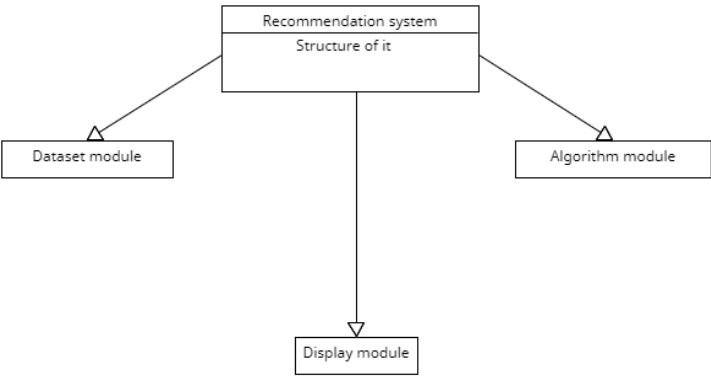


Figure 3: Structure of most systems

Some of the **greatest** discoveries in science were made by *accident*.

$$\begin{pmatrix} 1 & 3 & 5 & 23 & 09 \\ 23 & 10 & -19 & -12 & 4 \\ 0 & -15 & 2 & 11 & 8 \\ 56 & 7 & 19 & 16 & -2 \\ 40 & 7 & 9 & 0 & -5 \end{pmatrix}$$

References

- [1] Fayyaz Z.; Ebrahimian M.; Nawara D.; Ibrahim A.; Kashef R. Recommendation systems: Algorithms, challenges, metrics, and business opportunities. *appl. sci.* 2020, 10, 7748. <https://doi.org/10.3390/app10217748>, November 2020. Last accessed 24 October 2024.
- [2] Ning Wang, Hui Zhao, Xue Zhu, and Nan Li. The review of recommendation system. In *Geo-informatics in Sustainable Ecosystem and Society: 6th International Conference, GSES 2018, Handan, China, September 25–26, 2018, Revised Selected Papers 6*, pages 332–342. Springer, 2019.