



International Journal of Innovative Research in Computer and Communication Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijirce.com

Vol. 7, Issue 5, May 2019

A Study on Recommendation Systems

Deekshya Mohapatra¹

Former Student, Dept. of CSE, New Horizon College of Engineering, Bangalore, Karnataka, India

ABSTRACT: This paper briefly explains about the recommendation system, its types and applications. Data handling, machine learning, and Artificial Intelligence are the few most important concepts that are implemented in developing a recommendation system. Here we explain briefly about Content based and Collaborative Filtering RSs.

KEYWORDS: Recommendation System, Collaborative Filtering, Content Based, Neighbourhood based, Model based, Content Analyser, Profile Learner, Filtering component

I. INTRODUCTION

Recommendation Systems are system or software tools that generate recommendations or suggestions to a user for items that might interest them.

A recommendation system compares the user's profile to some reference characteristics. These characteristics are based on user characteristics such as social environment or item characteristic.

For example: item characteristic: Movies of a particular director is previously rated well. User characteristic: A user's friend with similar taste might have rated the movie well.

Recommendation Systems are in demand due to excessive and variety of information available and provides user with item that they might prefer to use.

Data is the centre of analysis and decision making in RSs. It mainly focuses on three data objects: item, users and transaction.

Item: These are objects or products that are suggested to the user based on his previous interactions. Items have a value. It is considered positive if the item may be useful to the user and negative otherwise.

Users: For providing personalised recommendation, wide range of information about the User will be acquired by RSs. Information such as demographic location for local product or item suggestion. Age and gender also play a crucial role.

Transactions: It is the log data that holds vital information when there was a human interaction with the computer. Feedback might be one such information available with logs.

II. TYPES OF RECOMMENDATION SYSTEMS

There are six types of Recommendation Systems

1. Content based: System analyses the item based on the previous ratings or reviews provided by the user. For example: A new horror movie can be considered a good suggestion if the user has previously rated many horror movies well.
2. Collaborative Filtering: In this RSs recommends an item to the user based on the likes of another user with similar taste.
3. Demographic: Item is recommended to the user based on his location. For example: A Bollywoodi.e., aHindi movie is recommended to a user living in India. There are higher chances of such user viewing the movie.
4. Knowledge based: These are systems that exploit the logs of computer. Such systems implement similarity functions that estimate how much the user needs match the recommendation
5. Community based: This technique follows the epigram "Tell me who your friends are, and I will tell you who you are" [1]. Such models acquire information about the social relations of users and their preferences.

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6. Hybrid Based: This type combines two or more techniques, uses the advantage of one to fix the disadvantage of the other.

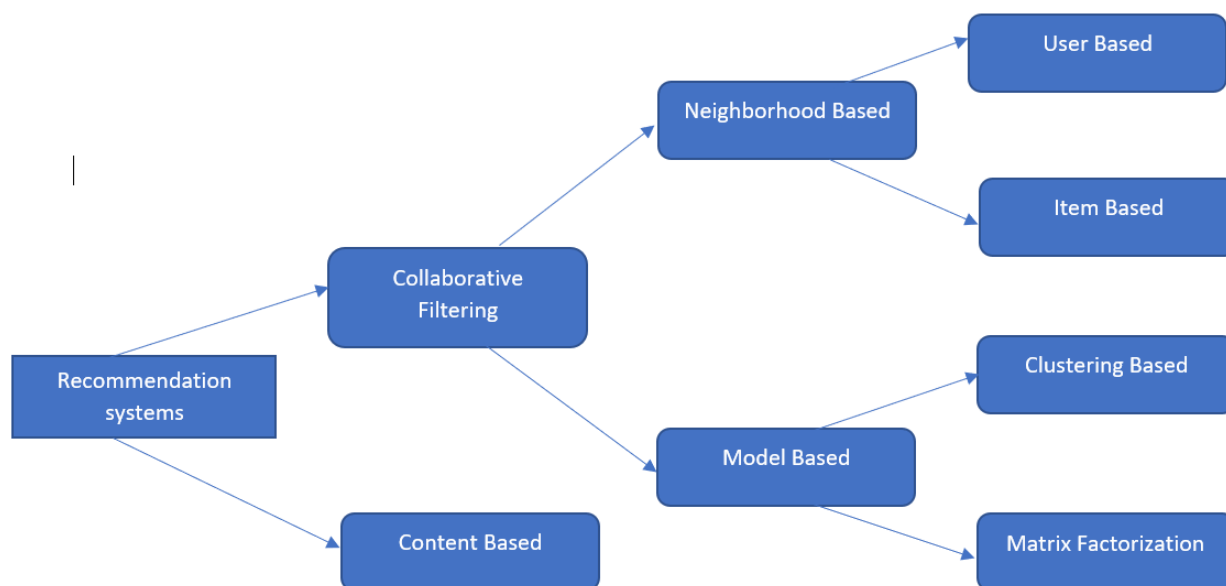


Fig.1. Types of recommendation systems

III. COLLABORATIVE FILTERING

Collaborative Filtering (CF) systems use the feedback of an item provided by the user in a particular domain. This is compared with the ratings or feedback of that item by other users and to derive similarities which is then used to recommend an item to the user.

CF methods can be further classified as neighbourhood and model based.

1. Neighbourhood-Based Method: In this method, recommendations for an active user are provided based on the ratings of a subset of similar users. It can be further classified into user based and item-based recommendation
 - a. User Based systems assess the interest of a user U for an item I based on the ratings of item I in the past by other users, called neighbours that have had similar rating patterns as U .
 - b. Item Based systems anticipate the ratings for an item I by user U depending on the ratings of U for items similar to I .
2. Model-Based Method: Such methods use machine learning techniques to train the system to predict the ratings of items that are unrated. In the model-based approach, the algorithm can be subdivided into two types
 - a. Clustering-Based systems rely on static data to provide recommendations. The recommendations are unsupervised. Data is classified into clusters based on similarities. Each cluster differs from another in terms of properties and data within a cluster is similar. This helps to derive a homogenous observation.
 - b. Matrix Factorization models are superior to classic nearest-neighbour techniques for producing item recommendation allowing incorporation of additional information such as implicit feedback, temporal effects and confidence levels. [8]

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IV. CONTENT BASED RECOMMENDATION SYSTEMS

Content based systems analyse and evaluate documents of items previously rated a by user, which is used to construct a profile of user interests.

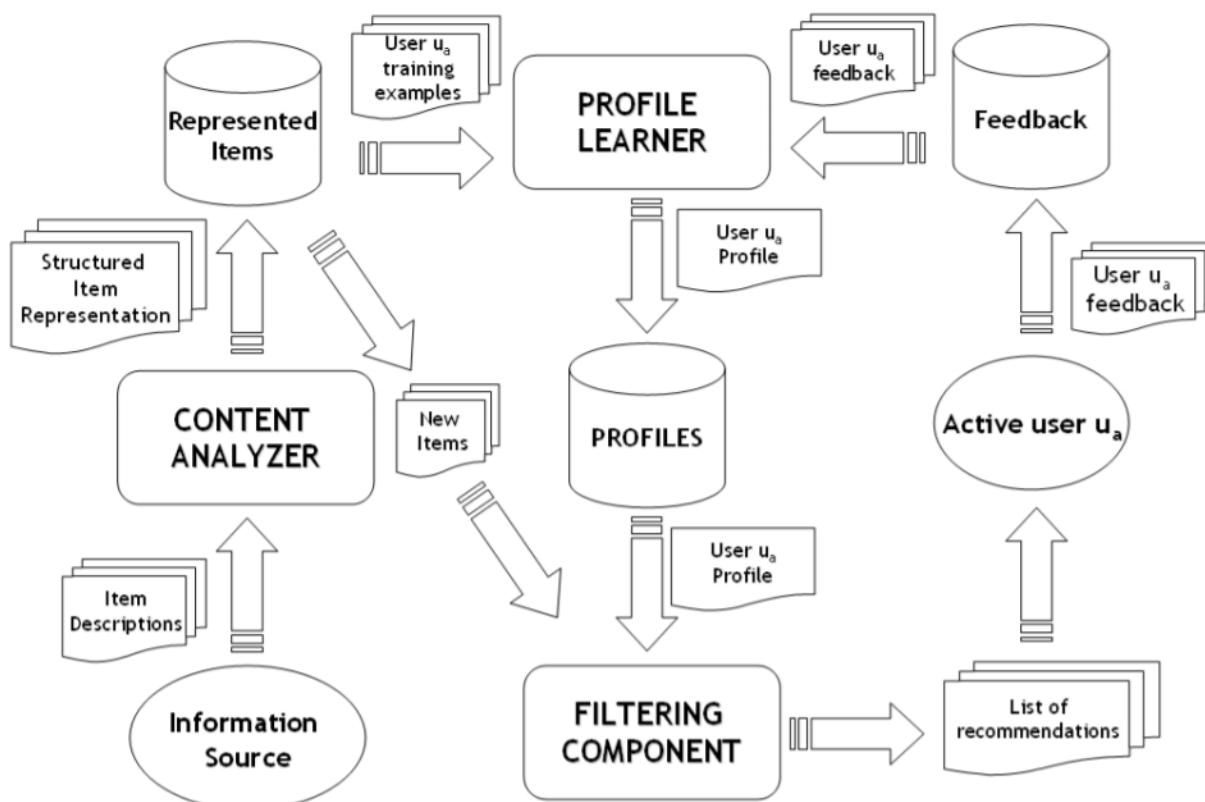


Fig.2.High level architecture of content-based recommender[1]

In content based certain techniques are required to compare a user profile with item representation. The recommendation is done in three steps by three main components.

1. **Content Analyzer:** In this step, unstructured information is subjected to pre-processing techniques such as sampling, reducing dimensionality, denoising etc to extract structured information. This structured information is analysed by feature-extraction techniques. The structure of an item consists of set of features that represent its content. These features represent the relevance of an item. Each feature is associated to a weight to represent how unique or close it is to a particular item. Similar items contain similar features. Features that more commonly shared across items lose their uniqueness.
2. **Profile Learner:** The module collects data representative of the user preferences and tries to generalize this data to construct the user profile. Usually the generalization strategy is realized through machine learning techniques. The profile learner considers the collection of represented items together with feedbacks given by the user to generate profiles.
3. **Filtering Component:** This component compares new items with the user profiles to provide a recommendation. This judgement uses techniques such as cosine similarity and Pearson correlation.



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V. APPLICATIONS OF RECOMMENDATION SYSTEMS

1. E-commerce recommendation systems: These systems are most popular and widely n among recommendation systems. Feedback and rating are widely performed by active users, this in turn contains a lot of information that can be used in recommendation systems. Example, e-commerce websites like Myntra and Amazon provide suggestions using such feeds.
2. Entertainment Recommendation systems: Such systems are more complex in nature as process of filtering depends on several factors. Example, videos or movies are suggested based on the age and demography of users. Netflix suggests Hindi movies to an Indian user or animated movies to children.
3. Recommendation systems in Defence: Recommender systems can be used for generating a prioritized list of defence actions, for detecting insider threats, for monitoring network security, and for expediting other analysis. [15]
4. Stock trading recommendation systems: Such recommenders can be found very useful to laypersons in improving their decision-making capabilities. Suggestions will be made depending on the stock trends and patterns.

VI. ARTIFICIAL INTELLIGENCE BASED RECOMMENDER SYSTEMS

Various Artificial Intelligence techniques like Artificial Neural Networks (ANNs), Artificial Immune Systems, Evolutionary computing, Image Detection etc. have proved to enhance the accuracy of recommender systems and help overcome the challenges faced by current recommendation systems. AI has helped to recommend items to users based on visual preferences rather than just item description, which in turn has helped to improve the performance and productivity of recommendation systems. With the use of AI in recommender systems, dynamic recommendation has become more large-scale, therefore practical and time efficient.

VII. CONCLUSION

In this survey, we have discussed the various types of recommendation systems. Neighbourhood based, one of the earliest techniques used for recommendation is the most popular among the other methods as it is simple and easy to implement. Content based RSs are more complex and require a certain set of techniques for their implementation, which makes their recommendation capabilities more accurate. We have also discussed the applications of recommendation systems across several platforms, e-commerce being the most popular.

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ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

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