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## Recommendation System in E-commerce

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**Abstract:** - A recommendation system is a type of engine which helps the user to provide a suggestion that is related to their interest. This paper provides an all-inclusive study on approaches and techniques generated in the recommendation system. The recommendation system is divided into three classes: - collaborative filtering, content-based, and hybrid-based approaches. This paper categorizes, collaborative filtering into two types: - Memory-based and model-based recommendation systems. This paper develops these approaches and their techniques with their limitations. This survey shows the road map for research during this area.

**Keywords:** - Recommendation system, Collaborative filtering, Model-based, Memory-based, Content-based, Hybrid-based, machine learning, research-trends, future direction.

**Introduction:** - Recommendation engines are nothing but just a tool used by the developer to forecast the user's choice in a large list of suggested items on every e-commerce website. It provides an idea about an item to users that might interest them. It was first widely used in the e-commerce industry but now it is used in different areas, with commonly recognized examples are Amazon.com, movies on Netflix, songs by Saavan. In this paper there are some approaches with their techniques are mentioned to compare the limitation of each technique in a proper manner to provide proper future recommendations. the usage of recommendation algorithms has become the main part[1].

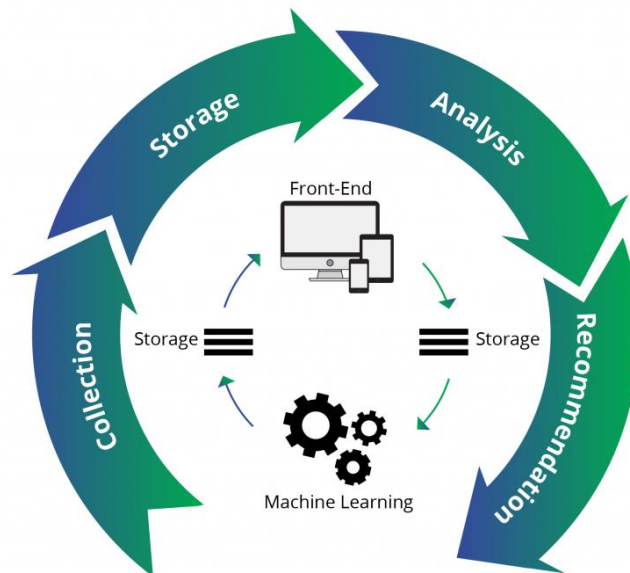
**Background:** - Some different methods have been used to provide recommendations like collaborative filtering, content-based and hybrid approaches. Different Algorithms and approaches are there to provide a recommendation that may use rating or content information; however collaborative filtering and content-based method suffer from some limitations. Several researchers have tried to beat these limitations by combining both collaborative filtering and content-based method as a hybrid approach that combined ratings also as content information. The recommendation system will always remain a lively search area for researchers [2].

**How does recommendation work:** - Shopping has been a need for humanity from past times and still, it is. We usually asked our friends or relatives for a recommendation for purchasing this or that product. Hence, it is the essence of the citizenry to shop for items recommended by our friends, whom we trust more. Thus engineers found an opportunity in this digital age has taken into consideration this ancient habit. Therefore, in any online shop, you visit today; definitely, there'll be some recommendation engines that are working in the background that are processing your data. With the usage of algorithms and user data, recommendation engines filter and recommend the foremost relevant products to a targeted user. In fact, it's like an automatic employee who is serving the most relevant product to their customers. When posing for something, also suggests another one that you simply could also be curious about. Developing product recommendation algorithm models may be a research area that grows hour by hour [2].

## Phases of Recommendation engines: -

There are four phases used by the recommendation engine: -

- a. Collecting the data
- b. Storing the data
- c. Analyzing the data
- d. Filtering the data



**Fig 1 Phases of Recommendation engines[2]**

**Collecting the data:** - Collecting the data is the first phase of creating a recommendation system. In reality, the data is evaluated into explicit and implicit ones. When a customer buys a product or rates a product or gives a like or dislike to a post then that kind of data is called explicit data. Whereas, implicit data may contain an inquiry log, order and return history, clicks, page views, and cart events. This kind of knowledge is collected from any users who visit the given website. Collecting behavioral data isn't difficult, since you'll keep user activities logged on your website. As each user likes or dislikes the various item, their dataset is different. During a while, when the recommender engine is feed with more data, it becomes cleverer and the recommendation becomes more relevant too, therefore the visitors are more inclined to click and buy[2].

**Storing the user data:** - To have better recommendations, you ought to create more data for the algorithms you employ. It means you'll turn any recommender project into an excellent data project quickly. You can decide what sort of storage you would like to use with the assistance of the info you employ for creating recommendations. It is up to you whether to use a NoSQL database or a typical SQL database or maybe some kind of object storage. However all these variants are practical and conditioned with whether you capture user behavior or input. A scalable and managed database decreases the number of required tasks to a minimum and focuses on the advice itself [2].

**Analyzing the data:** - To seek out items with similar user engagement data, it's necessary to filter it with the utilization of varied analyzing methods. Sometimes it's necessary to supply recommendations immediately when the user is viewing the item, therefore the sort of analysis is required. Some of the ways to research this type of knowledge are as follow [2]:

## Real-time system

In case you would like to supply fast and split-second recommendations you ought to use the real-time system. It is ready to process data as soon because it is made. The real-time system generally includes tools having the ability to process and analyze event streams.

## Near-real-time analysis

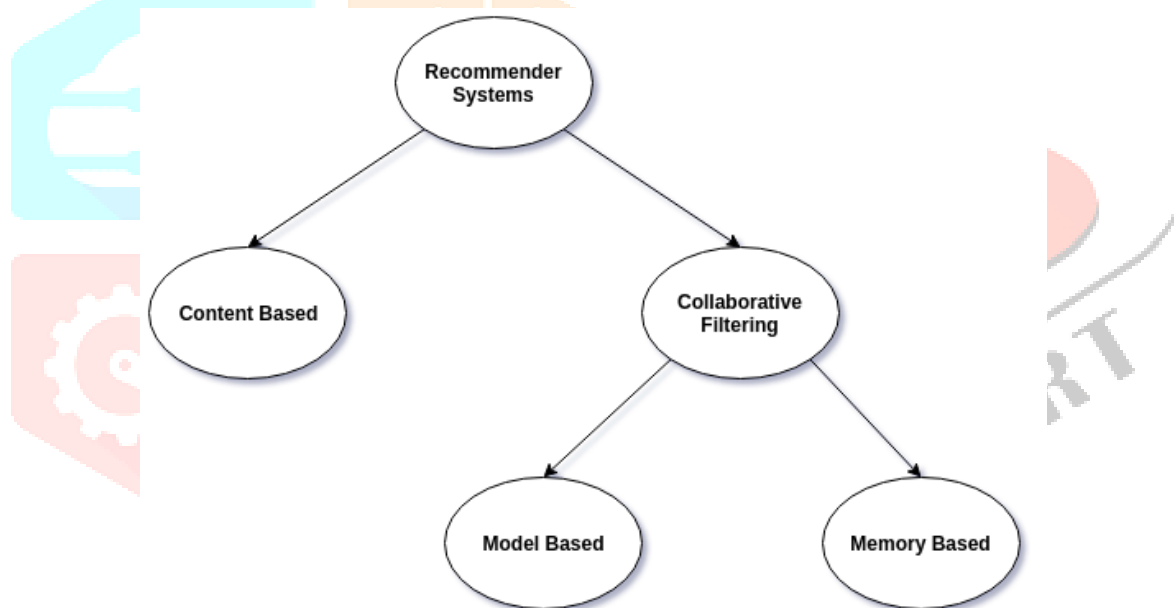
It is found that the best method to analyzing recommendations during an equivalent browsing session is that the near-real-time system. Generally, near-real-time analysis is capable to collect data quickly and refreshing the analytics within seconds.

## Batch analysis

This method is more fitting for sending an e-mail at a later date since it processes the data periodically. This kind of approach suggests that you simply got to create a substantial amount of knowledge to form the right analysis like daily sales volume

**Filtering the data:** - Several recommendation approaches are proposed and adopted in different applications. during this section, we present a quick overview of the popular recommendation/filtering approaches in RSS. the recommendation system is typically classified on rating estimation

- Collaborative Filtering system
- Content-based system



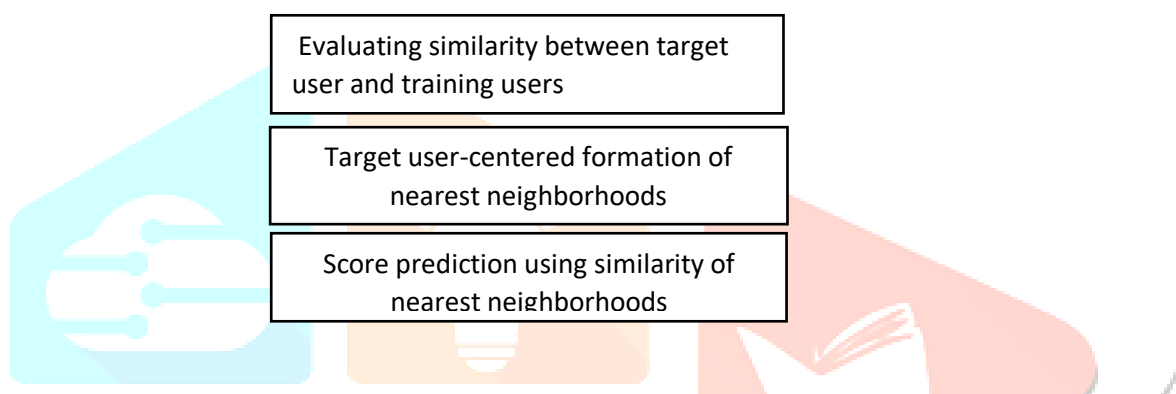
**Fig 2 Types of recommendation system**

In a content-based algorithm, similar products to those users who preferred in the past are going to be recommended to those targeted users. On the other side in collaborative filtering algorithm, products that are liked by similar group people with similar tastes and preferences likely are going to be recommended to targeted users. However, to overcome the restrictions of both content-based and collaborative filtering, hybrid systems are proposed that mixes both approaches in some manner [3].

**Collaborative filtering system:** - In collaborative filtering system it's working by collecting user choices within the sort of ratings of items during a given user inputs and exploiting similarities in rating actions among several users in determining the way to recommend an most relevant items. Collaborative filtering systems work by recommend an item to the user-supported opinions of other users. For example, during a movie recommendation application, a Collaborative filtering system tries to seek out other like-minded users then recommends the films that might be also likelihood to similar category of users. However there are many different collaborative filtering techniques, furthermore they are divided into two major categories [3].

1. Memory Based approaches
2. Model-Based approaches

**Memory-based Technique:** - In memory-based technique, it regularly analyzes the user data and then extracts the data to calculate recommendations. Memory based technique may be classified within the following main groups: CF techniques, Content-Based (CB) techniques, and hybrid techniques. In the CF technique, it collects the data of similar users based on their recommendations through social, community-driven information (e.g., user behavior like ratings or implicit histories) and all these items will be processed and will be shown to similar users. On the other side in CB techniques recommends items to those users whose past browsed or liked and will be shown particular recommended data to individuals and ignores the offerings from other users. However, in Hybrid techniques, it combines both techniques to offer more accurate recommended items. A hybrid RS might combine CF (or social-based) techniques with CB (or information-based) techniques. But in case if no efficient information is available there to hold out CF techniques, it might switch to a CB technique [4].



**Fig 3 Block Diagram of Memory Based RS[4]**

**Model-Based Approach:** - In this algorithm, a theoretical model suggests user rating behavior. Instead of using the raw rating data directly in making predictions, but, the parameters of the model are estimated from the available rating data and the model is used to make accurate predictions. Many model-based CF algorithms are studied over the last years. For example, discusses two probabilistic models, which are clustering and Bayesian networks. In four partitioning-based clustering algorithms are wont to make predictions, resulting in better scalability and accuracy as compared to random partitioning [5].

**CONTENT BASED APPROACH:** - In a content-based approach, any system analyzes a group of documents or descriptions of things previously rated by a user and builds a model or profile of user interests supported by the features of the objects rated by that user. Basically the recommendation includes to process matching up the attributes or trend of the user profile against the attributes of a content object. The result's a relevant judgment that represents the user's level of interest therein object. If a profile correctly reflects user preferences, it's of tremendous advantage for the effectiveness of an information access process [3].

**CONCLUSIONS:** - Several recommendation systems have been anticipated are based on collaborative filtering, content-based filtering, and hybrid recommendation methods then far most of them are ready to resolve the issues while providing improved recommendations. However, thanks to the information explosion, it's required to figure on this research area to explore and supply new methods that can provide recommendations in a wide range of applications while considering the quality and privacy aspects. That's why, the current recommendation system needs enhancement for present and future requirements to better the recommendation accuracy. We know that recommendation engines have gained more popularity and play a big role in the digital world. To be competitive within the market and obtain more efficient customers with a recommendation engines are in your best interests. Especially with the utilization of AI, in-the-moment recommendations are more widespread, which is time-efficient and

pragmatic. Thanks to AI, the advice engines have improved their productivity, and that they are supported the customer's visual preferences instead of on the outline of the things.

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