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A Survey of Azure ML Recommender System

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Abstract: large amount of data in the websites today has made it difficult for the user to access the data which he wishes to view. Recommendation systems are tool or technique which helps user to find the most suitable products. So, the recommendation system plays very important role and helps user to get according to their need and interest. It was not so easy or straightforward to build a recommender but azure machine learning makes it very easy to build one as long as you have your data is ready. Major task of recommender system is to present recommendations to users. Hybrid Recommendation technique use multiple techniques together content based and collaborative filtering.

Keywords: *Recommender system; Azure machine learning; Hybrid recommendation; content based; collaborative filtering*

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I. INTRODUCTION

Recommendation Systems, a type of Information Filtering Technique have got lot of attraction in the ecommerce field. Hybrid recommendation techniques are generally considered in research communities in the field of Information Retrieval, Machine Learning and Data Mining.In early days, not very many individuals were composing audits who were master in that field.Now with the rapid growth and easy access of the internet to common people thousands of reviews are coming about the product. This scenario has completely changed the trend of product review sharing [1].At present a huge number of individuals are doing web based shopping. To make onlineShopping more convenient many recommendation techniques Are used to recommend product to the buyer.With the changing patterns in advancements, day by day life of an Individual has also changed at a very fast pace. Individuals favor web based looking for their requirements to an ever increasing extent. Online shopping for their needs more and more. To make online shopping easy and reliable a good number of product recommendation techniques are proposed by many researchers in last few years [2, 3, 4].Recommendation Systems have been successfully deployed in industry; Amazon and Flipkart use this for Product recommendation, Netflix for movierecommendation etc.Than majorblockbusters From customer point of view, recommendations are Helpful suggestions for them and decrease load on them for Searching relevant contents from large amount of data Present online. But from vendor's point of view, the Recommendations are targeted advertisements to increase their profit.

II. BACKGROUND THEORY

Recommendation systems apply data mining techniques and prediction algorithms to predict users' interest on information and products among the large amount of available items. Customers are faced the problem of information over-loaded. Recommender systems typically produce a list of recommendations in one of two ways - through collaborative or content-based filtering. Content based algorithm
Recommender system [5] is the recommender system which works with profiles of users that are created at the beginning. A profile has information about a user and his taste. Taste is based on how user rated items. In the recommendation process, the engine compares the items that were already positively rated by the user with the items he didn't rate and looks for similarities.

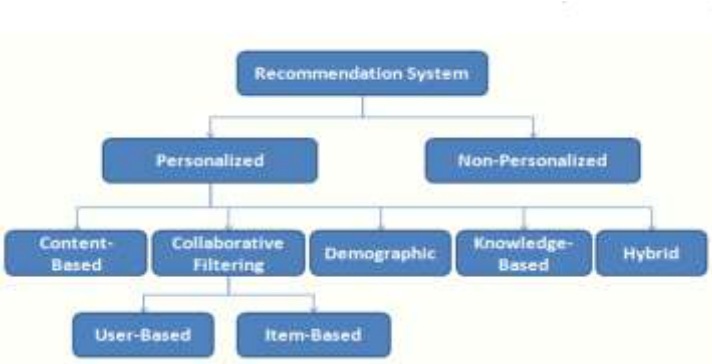

Figure 1: Types of recommendation system [10]

A.Collaborative filtering Algorithm [5,6] recommender system became one of the most researched techniques of recommender systems since this approach was mentioned and described by Paul Resnick and Hal Varian in 1997 [7] If two users have same or almost same rateditemscommon, then they have similar tastes [8].

Collaborative Filtering

- User-based approach

This approach was proposed in the end of 1990s by the professor of University of Minnesota Jonathan L.Herlocker. In the user-based approach, the users perform the main role. If certain majority of the customers has the same taste then they join into one group. Recommendations are given to user based on evaluation of items by other users form the same group, with whom he/she shares common preferences. From the Fig. 4, first user related to third user instead of second because the rating given by third user is quite similar to the first one. That's why item 3 is recommended to the user as it's the only remained item.

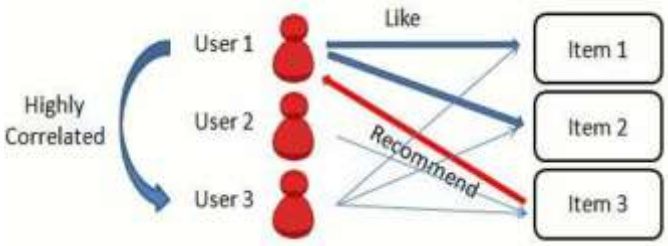

Figure 2: User-based recommendation system

- Item-based approach

This approach was proposed by the researchers of University of Minnesota in 2001 [10]. Referring to the fact that the taste of users remains constant or change very slightly similar items build neighborhoods based on appreciations of users.

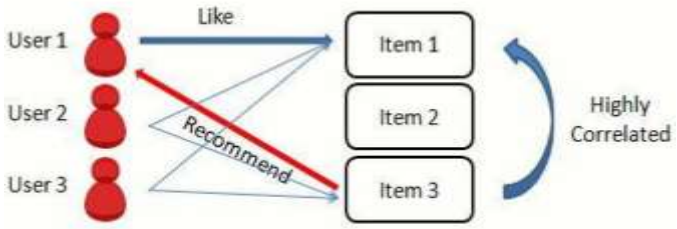

Figure 3: Item-based recommendation system

Advantages: Collaboration Filtering Approach does not need a representation of items in terms of features but it is based only on the judgment of participating user community. Example websites, movies, songs, books, jokes, etc. Scalability of the items database is large because it does not require any human involvement. They can have cross type recommendations for predictions which are different to users and does not require any domain knowledge which saves time. The recommendations can be improved over a period of time.

Disadvantages: The item cannot be recommended to any user until the item is either rated by another user(s) or correlated with other similar items of the database. In practice, in many e-commerce applications the active users rate only few items. In spite of having a large item database which leads to very sparse results.

B.Content-Based Filtering

Content-based recommendation method is based on the information about item content and ratings a user has given to items. This technique combines these ratings to profile of the user's interests based on the features of the rated items. Here in Content-based recommender systems deal with profiles of users that are created at the beginning. A profile has information about a user and histaste which is based onhow user rates the items. In the recommendation process, the engine compares items that were already rated by user with items he did not rate and looks for similarities. Those items that are mostly similar to the positively rated ones and the one which are positively rated by the users are recommended to the users [11].

Table: 1 Advantages and Disadvantage of CF &CBF [12]

Technique	Advantage	Disadvantage
Collaborative filtering (CF)	B.Can identifycross-genre niches. C.Domain knowledge not needed. D.Adaptive: quality improves over time. D.Implicit feedback sufficient.	I.New user ramp up Problem J. New item ramp up problem K. Quality dependent on large historical data set. L.Stability vs. plasticity problem M. Gray sheep problem
content based (CN)	B, C, D	I, K, L

C.Hybrid Based Filtering

Here in Hybrid Recommendation it is a combination of both collaborative approach and content based approach .With the help of Hybrid Recommendation different types of problems can be easily overcome the problem such as Cold-Start problem can be handled using the hybrid recommendations[11].Hybrid filtering technique combines different recommendation techniques in order to gain better system optimization to avoid some limitations and problems of pure recommendation systems. The idea behind hybrid

techniques is that a combination of algorithms will provide more accurate and effective recommendations than a single algorithm as the disadvantages of one algorithm can be overcome by anotherAlgorithm.Using multiple recommendation techniques can suppress the weaknesses of an individual technique in a combined model. The combination of approaches can be done in any of the following ways: separate implementation of algorithms and combining the result, utilizing some content-based filtering in collaborative approach, utilizing some collaborative filtering in content-based approach, creating a unified recommendation system that brings together both approaches.

Seven hybridization techniques:

- Weighted: The score of different recommendation components are combined numerically.
- Switching: The system chooses among recommendation components and applies the selected one.
- Mixed: Recommendations from different recommenders are presented together.
- Feature Combination: Features derived from different knowledge sources are combined together and given to a single recommendation algorithm.
- Feature Augmentation: One recommendation technique is used to compute a feature or set of features, which is then part of the input to the next technique.
- Cascade: Recommenders are given strict priority, with the lower priority ones breaking ties in the scoring of the higher ones.
- Meta-level: One recommendation technique is applied and produces some sort of model, which is then the input used by the next technique.[13]

*D.*Demographic

Demographic recommendation technique uses information about user only. The demographic types of users include gender, age, and knowledge of languages, disabilities, ethnicity, mobility, employment status, home ownership and even location.

The system recommends items according to the demographic similarities of the users.

E.knowledge-Based Filtering

Knowledge based recommendation system is based on the explicit knowledge about item classification, user interest and recommendation standard (which item should be recommend in which feature) [14].

It is an alternative approach to the collaborative filtering and content-based filtering.

III. MICROSOFT AZURE MACHINE LEARNING

A.MICROSOFT AZURE

Azure is a Cloud Computing Platform, Infrastructure by Microsoft. Microsoft maintains data centers across the world. Azure supports many programming languages. Azure offers Infrastructure as a Service, Platform as a Service. It is useful for companies who do not have enough infrastructures to do large scale computing Example: SQL Azure, Document DB (NoSQL), Azure Machine Learning. Azure Machine Learning: Microsoft Azure provides a platform for Machine Learning Computing called Azure Machine Leaning Studio. It provides inbuilt machine learning libraries. For our recommendation system model we make use of the Matchbox recommender module provided by Azure. The main aim of a recommendation system is to recommend one or more items to users of the system. Examples of an item could be a movie, restaurant, book, or song [15].

B.AZURE MACHINE LEARNING

One of the central themes of Azure Machine Learning is the ability to quickly create machine learning "experiments," evaluate them for accuracy, and then "fail fast," to shorten the cycles to produce a usable prediction model.The overarching goal of predictive analytics is to always be able to achieve a better chance of success than what you could achieve with a purely random guess. The basic process of creating Azure Machine Learning solutions is composed of a repeatable pattern of workflow steps that are designed to help you create a new predictive analytics solution in no time.The basic steps in the process are summarized in Figure 4.

Figure 4: Azure Machine learning workflow

- *Data*:It's all about the data. Here's where you will acquire, compile, and analyze testing and training data sets for use in creating Azure Machine Learning predictive models.
- *Create the model*: Use various machine learning algorithms to create new models that are capable of

making predictions based on inferences about the data sets.

- *Evaluate the model*: Examine the accuracy of new predictive models based on ability to predict the correct outcome, when both the input and output values are known in advance. Accuracy is measured in terms of confidence factor approaching the whole number one.

- *Refine and evaluate the model*: Compare, contrast, and combine alternate predictive models to find the right combination(s) that can consistently produce the most accurate results.

- *Deploy the model: Expose* the new predictive model as a scalable cloud web service, one that is easily accessible over the Internet by any web browser or mobile client.

- *Test and use the model*: Implement the new predictive model web service in a test or production application scenario. Add manual or automatic feedback loops for continuous improvement of the model by capturing the appropriate details when accurate or inaccurate predictions are made.

IV. AZURE MACHINE LEARNING ALGORITHM

There are several different categories of machine learning algorithms that are provided in the Azure MachineLearning toolkit.

- *Classification algorithms*: These are used to classify data into different categories that can then be used to predict one or more discrete variables, based on the other attributes in the dataset.
- *Regression algorithms*: These are used to predict one or more continuous variables, such as profit or loss, based on other attributes in the dataset.
- *Clustering algorithms*: These determine natural groupings and patterns in datasets and are used to predict grouping classifications for a given variable.

V. MATCHBOX RECOMMENDER SYSTEM

The Microsoft Research Matchbox recommender engine was designed to learn about people's preferences from observing how they rated items such as movies, content, or other products. Based on those observations, the Matchbox recommender was then able to recommend new items to users on request. The Matchbox recommender was designed to use the available data for each user as efficiently as possible. Its learning algorithm is designed specifically for the large streams of data typical for web-scale applications. One of the main features is that the Matchbox recommender takes advantage of metadata available for both users and items. This meansthe Matchbox recommender combines collaborative filtering with a content-based approach. It is therefore considered a hybrid recommender. When a user is relatively new to the system, predictions are improved by making use of the feature information about the user, thus addressing the well-known "cold-start" problem. However, once you have collected a sufficient number of ratings from a particular user, it is possible to make fully personalized predictions for them based on their specific ratings rather than on their features alone. Hence, there is a smooth transition from content-based recommendations to recommendations based on collaborative filtering. Even if user or item features are not available.
Matchbox will still work in its collaborative filtering mode [15].
When constructing Azure Machine Learning experiments using the Matchbox recommender algorithm, the following modules will typically be incorporated into the design.

- *Train Matchbox Recommender:*This module trains the model for the Matchbox recommender engine. The recommendation algorithm is based on the Matchbox model developed by Microsoft Research. This module takes a dataset of user-item-rating triples and returns a trained Matchbox recommender.
- *Score Matchbox Recommender*: This module supports four different kinds of predictions:
- Predict ratings for a given user and item.
- Recommend items to a given user.
- Find users related to a given user.
- Find items related to a given item.
- *Evaluate Recommender*: This module can measure the accuracy of four different kinds of predictions made by a recommendation model:
  - Ratings predicted for a given user and item.
  - Items recommended for a given user.
  - A list of users potentially related to a given user. The users are predicted to have similar preferences.
- A list of items potentially related to a given item.
  To evaluate a set of predictions, you need two datasets as inputs:
- *A test dataset*: This set contains user-item-rating triples. If you have an existing dataset that is used to train a model, you can create a test dataset by using Split and choosing Recommender Split as the splitting mode.
- *A scored dataset*: You can create this dataset by using Score Model and selecting one of the options in the Recommender Scorer.

VI. CONCLUSION

We explored the exciting world of recommendation engines, which is one of the most popular uses of predictive analytics and machine learning today.

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BOOK

Microsoft Azure Essentials: Azure Machine Learning
Jeff Barnes