Content Based Recommendations and Collaborative Filtering (*Documentation*)

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***Abstract* - In this paper we'll represent two tehnique use by recommender systems in E-Shop . A recommender system or a recommendation system is a subclass of information filtering system that seeks to predict the desired item which user would like to buy.**

***Content-bas* recommendation system try to recommend items similar to those a given user has liked in the past. Indeed, the basic process preformed by a content-based recomebder consists in matching up the attributes of a user profile in which preferences and iterest are stored.**

***Collaborative filterin* is technique used by recommending systems. It is a method of making automatic predictions about the intrests of the user by collecting preferences or taste information from many users.**

I. Introduction

Recommender Systems (RSa) are software tools and techinques providing suggestions for items to be of use to a user. The suggestions relate to various decision-making processes, such as what items to buy, what music to listen or what online news to read.

In this context "Item" is the general term used to denote what the system recommends to users (like some product, or news article).

RSs are primairly directed towards individuals who lack sufficient personal experience or competence to evaluate the potentially overwhelming number of alternative item sthat given Web site has to offer. In the simplest form, personalized recommendations are offered as ranked lists of items. In performing this ranking, RSs try to predicts what the most suitable products are, based on the user's prefernces and constraints. Preference can be almost anything, example is simple navigation to particual product page.

RSs development initiated from a rather simple observation: individuals often rely on recommendations provided by others in making routine, daily decisions. For example it is common to rely on what one's peer recommend when selecting a book to read.

As e-commerce Web sites began to develop, a pressing need emerged for providing recommendations derived from filtering
the whole range of available alternatives.
Users were finding it very difficult to arrive at the most appropriate choices from the immense variety of items(products and services) that these Web sites were offering.

RSs have proved in recent years to be a valuable means for coping with the information overload problem. Ultimately a RS addresses this phenomenon py pointing a user towards new, not-yet-experienced items that may be

relevant to the users current task. Upon a user's request, which can be articulated, depending on the recommendation approach, by the user's context and need, RSs generate recommendations using varius types of knowledge and data about users, the available items, and previus transactions stored in customized databases, The user can then browse the recommendations. He may accept them or not and may provide, immediately or at a next stage, an implicit or explicit feedback. All these user actions and feedbacks can be stored in the recommender database and may be used for generating new recommendations in the next user-system interactions.

Content Based Recommendation System – try to recomend items similar to those give user has liked in the past, whereas system designed according to the *collaborative* recommendation paradigm indetify users whose preferneces are similar to thoes of the given user and recommend items they have liked.

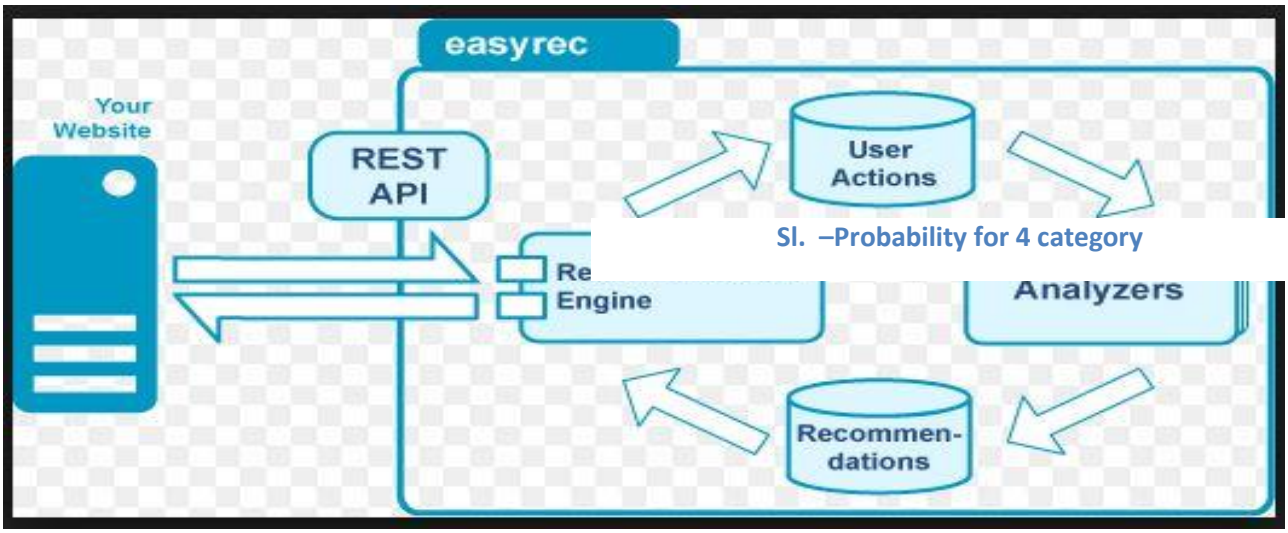
Systems implementing a content based recommendation approach analyze a set of documents and/or descriptions of items previously rated by a user, and build a model or profile of user intrests based on the features of the objects rated by that user. The profile is a structure represntation of user intrests, adopted to recommend new intresting items. The recommendation process basically consists in matching up the attributes of the user profile against the attributes of a content object. The result is a relevanace judgment that represents the user's level of interest in that object. If a profile accurately reflects user prefernces, it is of tremendous advantage for the effectiveness of an information access process. For instance , it could be used to filter search results by deciding whether a user is intrested in a specific Web page or not and, in the negative case, preventing it from being displayed.

Collaborative Filtering Recommendation System – is the process of filtering or evaluting items using the opinions of other people. While the term collaborative filtering has only been arounf for a little more than a decade, CF takes it's roots from something humans have been doing for centurie – sharing options with others.

Computers and the web allow us to advence beyond simple word-of-mouth. Insted of limiting ourselves to tens or hundreds of individuals the Internet allowas us to consider the opinions of thousands. The speed of computers allows us to process these opinions in real time and determine not only what a much larger community thinks of an item, but also develop a truly personalized view of that item using the opinions most appropriate for a given user or group of users.

In the more general sense, collaborative filtering is the process of the filtering for information or patterns using techinques involving collaboration among multiple agents, viewpoints and data sources. Applications of collaborative filtering typically involve very large data sets. It can be applied to many different kinds of data like: financial sources, enviromental sensing and in electronic commerce.

II. Implementation E-Commerce Web Shop



Sl. –Probability for 4 category

Sl. 1 - Rest Api for Recommendation

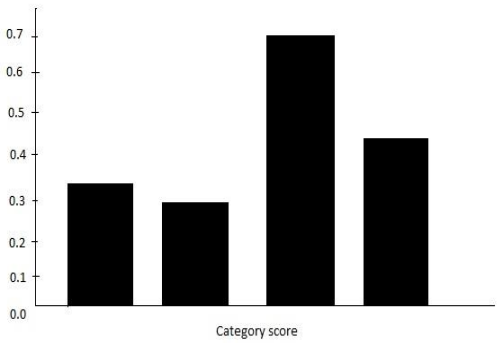
Content Based Recommendation System

In our Web Shop applications we use conteded based recommendation to predict best fitting items category. Input data is collected from all previous user's purchases stored in side database. This data collection contains all items purchased by user – and grouped by category. It should calculate the category from which is items purchased most frequently, CB using T**erm frequncy – Inverse Doc Frequency (TF-IDF)** - returns the probabilty that from given category user will buy next item.

$$f_{ij} \rightarrow frequency\ of\ term$$

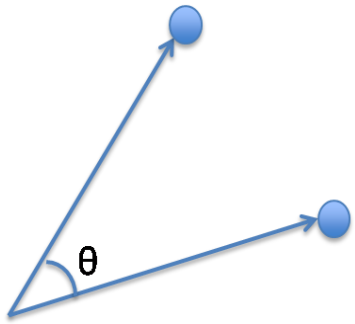
$$TF = \frac{f_{ij}}{\sum f_{ij}}$$

$$\sum f_{ij} \rightarrow sum\ of\ f_{ij}\ element\ for\ one\ categor$$



Collaborative Filtering Recommendation Systm (CF) As we had seen from introduction, CF calculates prediction using previous purchases of given user. Then he compares his list of bought items with items of other users. The algorithm behinde matching user items is simple forumula for finding the cosine of two given vector (see image below). Firstly all items from all other users all laoded from database put inside vecto. Then dot product between two users is calculated. After that the product of length of those vector is calculated. By dividing dot product with length product, we get cosine of the angel Between those vectors. The bigger the cosine the smaller the angle which means that those two vectors are more simular. So we will choose the vector with maximum cosine value, and after subtracting the items original user had bought , will return the all items which original user hadn't bought , but might be intrested.

$$sim(A,B) = \cos(\theta) = \frac{A \cdot B}{\|A\|\|B\|}$$



Sl. 3 – Finding the angle between two vrectors

III. Conclusion

Recommendation System is very often used for predicting user desired content based on user previus actions. People use them to find books, music, news, smart phones and vacation trips. Nearly every product, service or type of information has recommenders to help people select from among the myriad alternatives the few they would most appreciate.

Content-based recommendation systems recommend an item to a user based upon a description of the item and a profile of the user's interest. While a user a profile may be entered by user, it is commonly learned from feeback the user provides on items. A variety of learning algorithms have been adapted to learning user profiles, and the choice of learning algorithm depends upon the represntation of content.

Collaborative Filtering does the item prediction using items from other user and gives us the list of predicited items. Of course this approach isn't always the best, because people behaviour isn't so easily predicted. But it's advantages lies in simplicity of algorithm and his efficinecy.

IV. References

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