

Personalized Product Recommendation System Using Content based and Collaborative approach

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Abstract: In an age of information overload, the importance of personalized recommendation system for online products and services is rapidly growing. Such systems allows buyers to find what they want without wasting their time and also enables sellers to provide buyers what they are expecting to purchase, thereby furnishing benefits to both parties. Mundanely, people take errant walks in large scale shopping complexes and during that period they mostly face problems such as missing benefactor deals on customer's side as well as reduction in sells on vendor's side. Apparent solutions to these problems emphasize on providing recommendation based on large set of data; while proposed system is able to execute on small set of data and generating optimal and precise recommendation to the customer with in contrast to Netflix and YouTube etc. System emphasize on amalgamated version of content based approach as well as collaborative filtering approach for the recommendation engine. Vital problems such as scarcity, cold star, scalability and provides accurate solution executing on small set of data.

Keyword: Android, Content Based, Collaborative, Data Set, Hybrid, JavaScript, Recommendation Engine etc.

I. INTRODUCTION

This is the 21st century, Era of computer development and data manipulation. This is where information in digital form has become an undivided part of human knowledge processing. From social networking to putting steps on moon computer are become inevitable to make progress and in taking decisions.

Online shopping has become new trend of human lifestyle. So while shopping it is always better have some suggestion, advice and most importantly masterly experience in buying. In the real world we take our friends and families to the shopping with us to take better decisions to buy and to enhance our option and eliminate tunnel visioning while roaming around shopping complex.

So the four housemen in digital marketing and online shopping like Amazon, Netflix, You tube, Google has come to know that providing better options of product to buy for customer has become backbone of competition in digital world.

For this purposes this vendors started to use technology called as recommender engines. The key reason why many people seem to care about recommender systems is money. For companies such as Amazon, Netflix, and Spotting, recommender systems drive significant engagement and revenue. But this is the more cynical view of things. The reason these companies (and others) see increased revenue is because they deliver actual value to their customers – recommender systems provide a scalable way of personalizing content for users in scenarios with many items.

But all of these recommendation systems are used to buy online products while we will be designing the engine to make recommendations on products which they can buy from store surrounding them in shopping complexes or mall. The reason behind this is that by visiting the shop based on our product recommendation customers can actually get a chance to see and touch and feel the products as well as their originality.

Uniqueness of this system is that now a day algorithms used to develop recommendation engines follow single approaches while we will be implementing hybrid approach to tackle disadvantages of both the approaches. This will give upper hand to the system while working moderately small amount of data as well as out of the box structure of our system.

II. LITERATURE SURVEY

Recommendation system is an emerging field in now a days trending computer science. Lot of research and experiments are conducting right now to make recommendation engines more accurate than or at least as precise as possible.

There is system called Unified Collaborative and Content-Based Web Service Recommendation which provides a Unique Algorithms for Web Service Recommendation. It Combines two major approaches: Collaborative and Content-based and finds an unique algorithm overcoming the drawbacks of both algorithm. A project called as Unifying User based and Item based Collaborative Filtering Approaches by Similarity Fusion which reformulates the memory-based collaborative filtering problem in a generative probabilistic framework, treating individual user-item ratings as predictors of missing ratings.

Systems like Matrix Factorization Techniques for Recommender Systems to design the recommender system which rely on different sets of input data which are placed in a matrix, representing the individual interest. It shows an approach to implement recommender systems using matrix factorization.

Amazon uses a recommendation engine which to suggest various algorithms which basically aggregate items from similar customers, it suggest the items which are not yet bought or rated by users. Netflix uses its own one of kind award winning recommendation engine which combines 105 algorithms and generate recommendations. Approaches like Item-Based Collaborative Filtering. Recommendation Algorithm is used to produce high quality recommendations and perform much recommendation per second for millions of users and achieve high coverage in the face of data scarcity.

There is a survey conducted on Collaborative Filtering Based Recommender Systems for Mobile Internet Applications which focuses on taking full advantages of this ubiquitous mobile internet data from rapid development and applications for recommender systems.

There are some supplementary systems needed to work with recommendation engine like collective intelligence and decision support system along with ex-pert systems which are equipped with Mechanism that supports adaptive and collective intelligence while avoiding limitations of conventional recommendation systems.

III. IMPLEMENTATION

We have divided our whole recommendation system in three parts- User, Vendor and Server. On the Users' side we have implemented an android app which will help user to interact with system. Vendor's side we have provided one website using JavaScript, CSS and Java technology which enables vendor to add products to centralized database. Server's side holds an access to centralized database and is responsible for generating the recommendation on users' app.

Diagram:

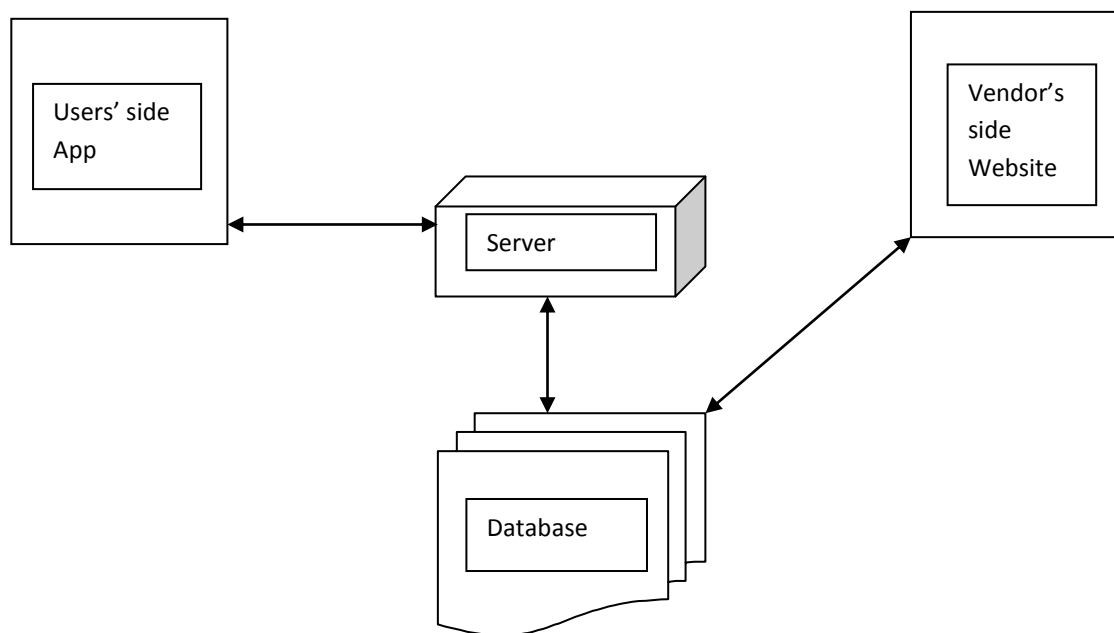


Fig 1. Flow among the System

Users' Side App: This app is developed for Android OS using the IDE Android studio which is provided by Google itself amalgamating with Java technology. The main function of this app is to provide the user an interface to access all the products in the shopping complexes which are sold by different vendors. There are two options provided for the naïve users as Login and Register. With Register option user can register by providing all the required data and with Login option user can Login in App. A roadmap of shopping complex is also provided in App. The naïve users who access for the first time are provided the default recommendations which are result of content based algorithm for recommendation which recommends the user with top selling products in the shopping complex. On the other hand for the old users are provided the recommendations which are result off the collaborative algorithm for recommendation. Our system combines the both content based and collaborative approach for recommendation resulting in Hybrid approach for recommendation. Whenever user purchases any product it is added in purchased products list in the user app.

Vendor's side website: This website is been developed by using many technologies like JavaScript, CSS, JSP, HTML5 for the front end of website and SQL for database related functions in website. The main function of the website is provide an access to the vendors which privileges them to add the products in their account with all necessary information regarding the products like Product ID, Name, Cost, Offer etc. Purchase receipt is generated after the purchase done by the user and sent it to app of user. Vendor has to add all the products to his account which is authorized by the admin account. Here the admin account acts as a verifier of all the vendors who are responsible for adding the products to their respective account. HTML5 and CSS are used for enhancing the GUI and JSP, JavaScript are used for handling execution functionalities. SQL is used along with JSP which generates the queries to store the data regarding the products in database. And this stored data is used from database by the server to generate recommendation.

Server: This is the crucial part of the Recommendation engine which holds the main function of generating the recommendation for the user. For the naïve users the basic recommendations are displayed which can be result of content based algorithm. Example for the basic recommendation can be whenever a new person enters into shopping complex he is recommended the top selling product in the shopping complex. For recommending products to the existing users their purchase history is one of the important factors. There are some other factors that are responsible for recommendation and those are:

1. Number of star ratings
2. Positive and Negative tone of reviews
3. Various features of products (e.g. Battery life, RAM, screen resolution with respect to mobile phones) discussed in reviews
4. Helpfulness factor of reviews
5. Authenticity of reviews
6. Number and age of reviews

whenever we consider such parameters for recommendations then it is known as Collaborative approach aka Behavioral approach. Example for the collaborative approach can be, assume a user has entered in shopping complex and he is searching for Shoes, then the user is recommended the shoes which have high rating (number of stars), Reviews are good, high purchase count, similar users as well as products in stock.

Mathematical Model:

Let S be the System

Where, $S = I, O, F$, Success, Failure

Where I is Input Set of Data

$I = I_1, I_2, I_3, I_4$

Where,

I1) User MAC Address

I2) User Name

I3) Mobile Number

I4) User Data (Bought Products)

O is Set of Outputs.

O = O1, O2, O3 to On.

Where, O1 to On is Recommendation Results.

F is Set of Functions

F = F1, F2, F3, F4.

F1) Recommendation Engine

F2) Security and Authentication

F3) Result Optimization & Generation

F4) History & User Data

Success= Appropriate Recommendations

Failure=System Failure, Irrelevant Recommendation, Technical Issues etc.

Mathematical Model for Recommendation System:

Where, S = I, O, F, Success, Failure

Where I is Input Set of Data

I = I1, I2, I3

Where,

I1) User Information

I2) Previous Purchases

I3) Visited Objects O is Set of Outputs:

O = O1

Where O1 is Recommendation Result

F is Set of Functions

F = F1, F2, F3

F1) Demodulate

F2) Pattern Matching

F3) Pool of Results

Success= Appropriate Recommendations

Failure= System Failure Irrelevant Recommendation, Technical Issues etc.

The relationship between the user, vendor and server can be depicted with below Venn Diagram-

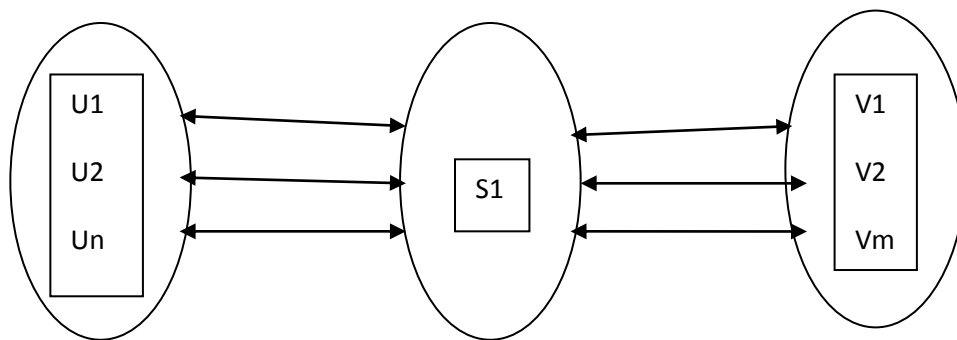


Fig 2. Venn diagram depicting relation between 'n' Users, 'm' Vendors and one Server.

IV. CONCLUSION

Recommendation algorithm creates a personalized shopping experience for each customer by providing an effective form of targeted marketing. Our system provides middle ground for both content-based and collaborative filtering by eliminating their limitations. Changes in user's data affect recommendation immediately to make it more precise and efficient. Considering above advantages our system has enhanced recommendations considering all the parameters as discussed in paper.

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