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Digitalized Recommendation Engine for Supermarket Customers Using Frequency of Purchase

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ABSTRACT: A recommender system that considers frequency is proposed in the paper that would eliminate all the hazels of remembering the shopping list. It also eliminates the book keeping process which is followed by the customer until today. The system is intelligent to suggest a list based on previous purchases. .To make shopping easy and help the shopkeeper to predict the trend of purchases made by the customer.

KEYWORDS: Recommender system; Frequency based recommendation; Clustering algorithms; Android UI: Supermarket recommender system

I. INTRODUCTION

Analysing customer needs is one of the bizarre tasks in the business world today. Hence proposing a scientific method to analyse what a customer is likely to buy plays a crucial role in attracting existing and new customers. The project aims at doing this with the help of a recommender system that will analyse customer needs and suggest the best possible shopping list.

Recommender systems have always been in existence since the business has begun. It is very important to understand customer needs to sell any products efficiently and effectively. In the olden days, in the business arena physical records were maintained to predict the future cross-selling and up-selling.

As computer era emerged, the need to automate the logging of customer details came to fore. This gave opportunity to use the logged data for predicting the behaviour of the customer. This was the very idea behind the emergence of recommender systems. Initially recommender systems considered very few parameters to analyze, but with the emergence of e-commerce websites that had a myriad of customers and products keeping track of user traits became increasingly difficult. So the need for a better recommender system which considers more parameters evolved.

II. RELATED WORK

Recommendation systems have become essential with the advent of big data analytics and machine learning in modern computing. Different types of recommendation mechanisms such as user based recommendation systems and item-based recommendation systems have been explored with time and again in the modern era. Several researches have proposed several clustering approaches for recommendation systems that use clustering algorithms such as simple k-means, DBScan, GMM and much more. Several areas of implementations for myriad of these algorithms have been worked on such as online recommender systems, news recommender systems, book recommender systems, hotel recommender systems and so on. However such previous works lack in providing an offline implementation for supermarket environment and does not consider the user's behaviour of repetition in such an environment, by which user tends to purchase the same products again and again with alarming regularity.

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III. PROPOSED ALGORITHM

We propose a new system to recommend products which authenticates users requesting the recommendations and provides them with recommended results. The system is set in a supermarket environment. It uses the purchase history of the user and the user's behaviour of repetition during purchases in a supermarket. The user's behaviour of repetition can be characterized by his/her or tendency to purchase the same item in regular time periods. We use the product purchase history of the user to provide recommendations using the following algorithm.

A. *Design Considerations:*

- The system must be fast and elegant.
- The system must use the server's resource as efficiently as possible.
- Accommodations to larger datasets.

B. ***T****ypes of modules in the system:*

- Registration: When users come into supermarket for the first time they are registered in to the system as normal users. The system's database maybe backed up into cloud in real time for redundancy.
- Updating purchase history: The purchase details of the product that include product details, user details, date of purchase, amount are stored in the database whenever a purchase is made by an user.
- Recommender Engine: The recommender engine uses the proposed algorithm to provide recommendations to the user whenever an user inputs the user id and requests the recommendations.

C. *Description of the Proposed Algorithm:*

Aim of the proposed algorithm is to utilize user's purchase history and provide recommendations to the user based on the product purchases made previously by the user. The proposed algorithm consists of three main steps.

Step 1: Calculate the Difference in number of days between current date and last purchase date

This difference is calculated for each product for the particular user and is used to compare with mean value of purchase for each product.

Step 2: Calculate the mean days of purchase

To calculate the mean days of purchase the difference in number of days between purchases of each product by that user is calculated first. The mean value of these differences is calculated for each product using means function.

Step 3: Determine product to be recommended

If the mean value calculated in Step 2 is within the range specified from the Difference calculated in step 1 then the product is checked as recommended.

IV. PSEUDO CODE

Step 1: Registration of the user in the supermarket database
Step 2: Add purchase details to the database whenever new purchase occurs
Step 3: Request user id if the user wants recommendation
Step 4: Calcualte the difference in number of days between purchase of each product by that user.
Step 5: Calculate the mean days of purchase from the above value.
Step 6: Check the below condition for each product to be recommended.

```
if (mean value lies between specified range)
        Check the item as recommended
Else
    Do not recommend the item
End
```

Step 7: Display all the recommended items in the UI
Step 8: End

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V. IMPLEMENTATION OF SOFTWARE

The approach taken towards implementation of this Recommender system comprised of various parts and being integrated to produce the final output or the product of expectation. This involves Recommender Engine and the Android platform on which it is depicted through the help of Shiny Application that is an package for R language. The following section briefly describes each of those components.

A. *Recommender Engine:*

The recommender engine is built in R language. It's main functions are

1. To Authenticate the user
2. To provide recommendations to the server when requested.

B. *Android System:*

To make the application available to everyone and used on a larger scale we have deployed it on ANDROID. Logic of the algorithm is implemented in the backend, finally, the application needs to interact with the user whenever required. To make it portable of the application, application is targeted to the android interface.

Current android application uses Navigation Drawer to provide choices for the user to navigate between the different options. The inbuilt SQLite database is used for every database write and read operations. Current dataset which is present in R-studio, needs to be integrated with the android system to display the recommended data back to the user which actually helps him in further transactions.

C. *Shiny application:*

The Shiny application provides means to deploy the r code on a webserver without having to implement different layers of implementation to handle R over Apache. This makes it available to deploy the application on an offline system making the system completely usable without internet. The Shiny application also provides reactive interaction features that make it much more unique and elegant.

VI. RESULTS

The methodology explained in sections III and IV was tested over the ta-feng dataset. The ta-feng dataset is the largest open source dataset available for supermarkets and consists of purchase details of a super market in china spread over 4 months. The dataset when passed over the recommender system proposed provided satisfactory results for every user. Some outliers for users who purchase objects single time were detected and were discarded since their impact on overall performance of the recommender system was negligible. The product recommendations are as shown in Fig 1 when implemented in Shiny environment. The results also proved that as the number of purchases of a product by the particular user increases the accuracy of its recommendation increases as shown in the Fig 2.

	Product Subclass	Product id	Amount you purchased last time
1	510304	2.240055e+12	1
2	100509	4.710085e+12	1
3	110401	2.053541e+07	1
4	500203	4.710104e+12	1
5	100503	4.710947e+12	1
6	100505	4.710154e+12	1
7	110217	4.712162e+12	1
8	110505	4.711258e+12	1
9	100505	4.713776e+12	1
11	130315	4.714981e+12	2
12	530406	4.710303e+12	1
13	500201	4.710036e+12	1

Fig.1. Recommended Product List

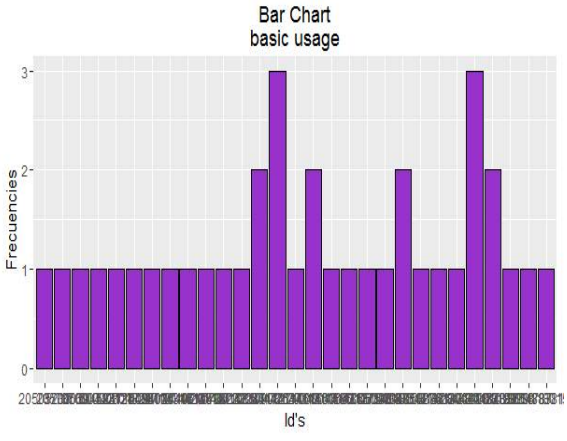

Fig.2. Bar graph representation of product count

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VII. CONCLUSION AND FUTURE WORK

The results documented in the previous section shows that the developed prediction model using domain knowledge and machine learning keeps a track of the purchases. The model however consists of pure technical analysis and is favorable for short term of some predetermined time. Irrespective of the volume of data, the system recommends the user of their required type. Using the clustering algorithm, all the data of their respective types are grouped under single domain and thus it becomes easy to recommend over the single group rather than individual items.

For the purpose of future enhancements, Run the algorithms on a distributed system, like Hadoop to parallelize the computation, decrease the runtime and leverage distributed memory to run the complete MSD. This increases its efficiency as we include Hadoop computation ability.

Combine different methods and learn the weightage for each method according to the dataset. So, this gives priority to the data of user. Automatically generate relevant features will allow user to expose to the new upcoming discounts or sales or such advance features. Develop more recommendation algorithms based on different data (e.g. the how the user is feeling, social recommendation, etc.)

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BIOGRAPHY

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