Virtual assistant based recommendation system

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ABSTRACT

In the current commercial application, the e-commerce applications give the only recommendation of the particular tastes only when one is interested in a particular item. The recommendation is also very much related to the item the user is interested in. Though this system works well it lacks the personalized experience that the user can get when purchasing an item through an offline vendor. This can be achieved by aggregating the recommendation engine within a virtual assistant. In our proposed system the user will be getting the online e-commerce experience with a personalized buying assistance that one gets while buying through an offline vendor.

Keywords— Recommendation, Virtual assistant, Book recommendation, E-commerce, Collaborative filtering, Content based filtering, Cosine similarity, Linear regression

1. INTRODUCTION

In today's world there are millions of choices for every object we need to buy online and books are no exception, hence customers need certain tools for selecting books that are worth their time. Major e-commerce, book publishing and book magazine’s use recommendation as their tool. This recommendation can also be provided by a vendor at a local store who has quite some amount of expertise in that field along with providing personal service. This can be achieved in the online commerce also by using a virtual assistant within which a recommendation system is also integrated. Today the number of choices is massive and people need some instruments to find and choose the best that suits them. For that one of such tools is called recommendation system. Another one such tool that filters out the best choice for them is a virtual assistant that tells as to why one should choose. Recommender systems support users in a personalised way for the identification of products based on the history of the user that can be useful or interesting in the large space of possible product. Recommender engine helps to access relevant information quickly without searching the web manually. A recommender system is an information filtering technology, commonly used on e-commerce Web sites to present information on items and products that are likely to be of interest to the reader. So far, several approaches have been developed in both the research and business fields. But none has yet implemented the combination of both the recommendation engine and the virtual assistant. Content-based make method recommendations by analysing the description of the items that have been rated by the user and the description of items to be recommended. Collaborative filtering systems, which suggest items to a particular user based on a database of all user ratings. When asked for a recommendation for the current user, it identifies users similar to her (her neighbours) and it is suggested her the items the neighbours have like in the past. But the problem with this is it gives a cold start and not much useful when the level of an object is very granular and niche such as a book recommendation. Thus the required level of accuracy can be reached with content-based filtering without the problem of cold starts. The virtual assistant system also has the feature of interacting with the user, which facilitates user and show its artificial intelligence. Also, it has functionalities like defining words, auto correction the search hands-free voice control. The virtual assistant provides a personal like service that gives and explains the reason to pick a choice.

2. LITERATURE SURVEY

In 2009 Mr Zheng proposed a web service recommender system, constructed on a CF-based approach, for selecting and recommending web services to users. This paper used content-based filtering to create a recommendation system. A service recommendation system is meant to provide users with recommendations of services, including those on the web, in the cloud, or such services as people might require on a daily basis.

In 2011 a Survey conducted by Sandholm & Ung on Social Media, Recommendation System showed that recommendation
system actually worked as a good marketing strategy that
indeed proves to be profitable and also improved customer
service. A social media recommendation system recommends
media in social networks or internet like online news, Twitter
pages, online videos, etc. To users, which was extensively used
in online content advertisement could also be used for
recommended buying. A social media recommendation system
for online web content is built on a CF-based method which
considers geographical influences on ratings and the features of
the book itself and compares with the similar parameters of
another book on the recommendation.

In 2016 Punam Bedi and Ravish Sharma published a paper
called Trust based Ant Recommender System (TARS) which
produces valuable recommendations by incorporating a notion
of dynamic trust between users and selecting a small and best
neighbourhood based on a biological metaphor of ant colonies.
New users can highly benefit from pheromone updating
strategy known from ant algorithms as positive feedback in the
form of aggregated dynamic trust pheromone defines “popularity”
of a user as recommended over a period of time.

The current e-commerce websites have a large range of
products, this makes it difficult for creating the virtual assistant
models that can learn from the virtual assistant that can suggest
the users with the items or filter down the possibilities that the
user might be interested. This is possible when the range of
products that the virtual assistant has to consider is very niche.
Thus the book recommendation platform is the best to start
with creating preference suggesting bot’s that can narrow down
the possibilities for the user, so they can have a fast and easy
choice making process while buying the articles.

Nowadays, the changing trends in technology and rapid
development on the internet has affected almost every aspect of
life. People depend on the internet for various things, online
shopping is one of them. Purchasing books on the internet from
the huge collection of the book is very difficult to work for
various academician and students. From the huge number of
books, it is really difficult to choose a particular textbook. So,
the recommendation system technique plays a very important
role and helps the user to get books according to their need and
interest.

3. EXISTING SYSTEM
There are several recommendation websites already in
existence for various domains. The methodology adopted for
giving recommendations from these sites may vary but have
still had a lot in common. Item-based collaborative filtering and
User-based collaborative filtering are the two commonly
adopted techniques. In Item-based recommendations, the
similarity between items is taken into account and then
predictions are made. Whereas in the latter, users with similar
taste are found and on the basis of their ratings, predictions are
made.

Different algorithms like Cosine Similarity Measure, Pearson
Correlation Similarity Measure are used for the same. Book
recommendation websites have flourished over the web over
the past decade. Huddersfield Book Recommender system,
Book Psychic, Whatsheadreadnext.com, Library Thing,
Goodreads.com and Bookexplorer.com are some of the popular
ones.

Content-based recommendations are also provided by some of
the mentioned systems. But none of them combines the regular
content-based recommendation system with a virtual assistant
that progressively provides a system that can be an online
system providing the personal service equivalent to that of an
offline retail vendor’s personal service.

The reason why the big league companies such as Amazon,
eBay etc. are not yet able to accomplish the task of training a
virtual assistant that acts as a personal recommender of the
products is the sheer range and variety of products. This can be
accomplished in a very nice environment such as a book rental
platform since the range of products within which the bot has to
learn is less and comparatively easy.

4. PROPOSED SYSTEM
In the proposed system the recommendation engine is built
within a virtual assistant. The virtual assistant is built within an
android application. The virtual assistant is built using the NLP
models for the recommendation. The primary focus is to
provide real-time responsiveness of the book recommendation
system that assists the user in the searching process. This
system also provides a platform for an online library with a
recommender engine that enhances the users'ability to obtain
personalised recommendations of books of his taste.

4.1 Android application
The design of the android application is such that it creates the
feels of a virtual library. The users can browse through books
manually can use the help of a virtual assistant. The Virtual
Assistant helps the users in finding books related to the users'
tastes and also generates recommendations similar to a given
book. The in-app intelligent AI assistant can be used to
completely surf the platform at ease and also place purchase
orders by interacting with the bot.

The Virtual Assistant based Book Recommender System is built
upon the Android platform using Native Android Framework
for Java, Dialogflow for Natural Language Processing, Node. Is
at the server side back-end and Google Firebase NoSQL
database.

4.2 Virtual assistant
The core of the whole system is a virtual assistant that can, to a
certain degree, understand the questions typed by the users in
the natural language form, the language form can include
manually typed, chats or user voice that is recognised and then
translated into text that the virtual assistant can understand.

The Virtual Assistant generates personalised recommendations
for a given user based on the users past purchase history, which
is, of course, a result of the recommendation engine. The
Virtual Assistant is capable enough to notify the users about
new releases in the market that might lead to potential sales.
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Fig. 1: Flow chart of virtual Assistant

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users that he/she might potentially be interested in which might lead to more sales as a result of targeted advertising based on Machine Learning backed inferences from the user's data.

Dialog flow is an API that is used to power assistants in any platforms. Dialog Flow is extensively used by Apple's Siri, Google assistant, Microsoft Cortona, etc. It uses NLP techniques to create a virtual assistant. It is powered by Google’s machine learning techniques such as speech – to – text, etc. The flow chart of the dialog flow is given in figure 1.

4.3 Recommendation System

Recommendation System is a subclass of information filtering system. It is primarily used to understand the user's preferences and taste and they use this information to generate recommendations so that it can be used commercially to improve customer satisfaction and user-friendliness. In this context, the book recommendation can be given through two concepts, content-based filtering and collaborative filtering.

In content-based filtering and collaborative filtering both the techniques can be implemented using the cosine – similarity algorithm and linear regression algorithms can be used to predict the books that a person might like.

Cosine similarity is a metric used to measure how similar the documents are irrespective of their size. Mathematically, it measures the cosine of the angle between two vectors projected in a multi-dimensional space. The cosine similarity is advantageous because even if the two similar documents are far apart by the Euclidean distance (due to the size of the document), chances are they may still be oriented closer together. The smaller the angle, the higher the cosine similarity.

In this approach, similarities between pair of items are computed using the cosine similarity metric. The rating for target item \(i\) for the active user \(a\) can be predicted by using a simple weighted average as:

\[
P_{a,i} = \frac{\sum_{j \in K} \frac{r_{a,j}}{w_{i,j}}}{\sum_{j \in K} |w_{i,j}|}
\]

Where \(K\) is the neighborhood of most similar items rated by the active user \(a\), and \(w_{ij}\) is the similarity between items \(i\) and \(j\). For predicting what books a person might like we can use linear regression that predicts the similarity between two or more books based

\[\hat{r}_{ui} - \bar{r}_u = a + b(r_{ui} - \bar{r}_v)\]

on the parameters obtained from cosine similarity. The traditional prediction formula, we can find that

\[\hat{r}_{ui} - \bar{r}_u = \frac{\sum_{v \in I} |\text{sim}(u,v)| (r_{ui} - \bar{r}_v)}{\sum_{v \in I} |\text{sim}(u,v)|}\]

Behind this aggregation, there is a valid assumption that the relationship between them a special linear correlation,

\[f(x) = x\]

Where \(x\) denotes Person correlation coefficient represents the degree of linear correlation between two book records, it reflects as to how similar those two books are. Thus we use a general weighted linear regression formula here.

\[r_{ui} - \bar{r}_v \text{ and } f(x) \text{ represents } \hat{r}_{ui} - \bar{r}_u.\]

Linear regression is most basically used to adjust the book records of missing book record values like rating, rank within the genre etc. This can also be used to adjust the values so as to recommend books with the highest accuracy as possible.

5. RESULT

As Shani and Gunawardana say [11], experiments on recommendation systems are divided into the three categories: a) offline experiments: when user behaviour is simulated i.e. the process of system making predictions and recommendations and the user corrects them or uses these re recommendation is simulated, b) user studies: analyze the quantitative and qualitative measurements and observe the be behaviour of a group of subjects that will interact with the systems c) online evaluation: the system is used by real users son real tasks and then analyzed. But the user base for this project is less compared to that of industry giants thus we opted for an online survey. Through this survey, we selected a group of people and asked them to find a book that they had already read and they had also liked the book, the genre and various other parameters of the book. They they were asked to rate based on how fast and easily all the books that were recommended to them. The same people were also asked to do the same on different websites. The results were as shown below.

Note: the following graphs are based on a survey conducted with a few random groups of people with varying age group.
The important point to note here is that the user-friendliness of the application is significantly better than that of other websites due to the use of virtual assistants in every aspect of the application.

6. CONCLUSION
The innovative idea of combining virtual assistant and recommendation system. This integration of a Recommendation Engine within a virtual assistant improves the recommendation due to the fact that the virtual assistant can recognise the conversation and the conversation can be fed to the recommendation engine to recognise the tastes and preferences of the user.

7. REFERENCES