# Real Estate Recommendation using Hybrid Recommendation Algorithms

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*Abstract----* **Increased digitalization has influenced real estate sector dramatically. Internet has enabled us to search, rent and buy property online. But there is hard to find the suitable property to purchase as purchasing property include lot of factor like finance, location, accessibility , etc. User purchase preferences, their likes and dislikes are a very tricky task even for humans. Many website are available for real estate but they just have standard filter feature to filter out the available property they cannot understand the full user requirement. The main help of our system to recommend suitable home to user based on user financial condition, sentiment, family, locality etc. Your system uses the sentiment analysis and considers the various factor of the property and recommend most suitable property match. First our system takes the user input which includes user details, financial condition, etc. The system also performs the sentiment analysis using various algorithms like fast Text. After the sentiment analysis user classification is done and lastly personalized recommendation is done. The input to system is the user data and the output of the system is the best home recommendation to user based on user preference. Your system also include to home price predication which will help user to buy home. Ultimate aim of the system is to recommend the best possible home to the user which perfectly matches the various requirement of the user. Currently the content based recommendation and collaborative recommendation are used in recommendation system. We are using the hybrid recommendation algorithm which combines the content based recommendation and collaborative filtering. First we are going to apply the collaborative filtering and the output of collaborative filtering will be taken as input to content based recommendation model. Hybrid recommendation algorithm will increase the accuracy of recommendation system.**

*Keywords—* **Data Science, Deep Learning, DBMS, Machine Learning, Recommender System**

## I. INTRODUCTION

Internet have enable us to search and buy property online one can buy, sell or even rent property online but when we want to buy the house to live it can be hard to find the house of the internet which fulfill all our requirement. The available real estate system only has the filter which just filters out the property but they don't fully understand the user so they are unable to find the perfect house which fulfill. Home recommendation is the recommendation system which is built to predict the best suitable home for the user. The system obtains the information of the user and also does the sentiment analysis of the user thus fully understand the requirement of the user. The system is also undertaking the financial condition of the user and thus suggests the best home best n financial condition. The true purpose of the system is to find the best home possible as the buying home is one biggest decision in the life and there are many direct and indirect factor involved behind

The system also has the feature of the price prediction which predict the future price of the home and thus help the user to finding out which home is best for investment purpose and some of the user want home for living and

some of them want home for the investment purpose thus our system price prediction feature will help those user.In the current era, there is tremendous growth in online real estate market. As most of the people are preferring online methods rather than traditional methods. We are going to develop Hybrid Algorithm which is combination of Content-Based Filtering and Collaborative Filtering for recommending best available property to user. The Hybrid Algorithm will increase the accuracy of the recommendation system and will also overcome the drawbacks of Content-Based Filtering and Collaborative Filtering. Increased digitalization has influenced real estate sector dramatically. Internet has enabled us to search, rent and buy property online. But there is hard to find the suitable property to purchase as purchasing property include lot of factor like finance, location, accessibility , etc.
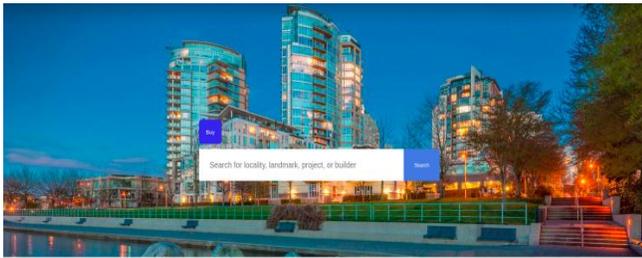
Explore Buy / Sell / Find Property in India

## II. TYPES

### 1. Collaborative Filtering:

Collaborative methods for recommender systems are methods that are based solely on the past interactions recorded between users and items in order to produce new recommendations. The main idea that rules collaborative methods is that these past user-item interactions are sufficient to detect similar users and/or similar items and make predictions based on these estimated proximities. An example of Collaborative Filtering is KNN algorithm.

### 2. Content-based Filtering:

A content based recommender works with data that the user provides, either explicitly like rating or implicitly like clicking on a link. Based on that data, a user profile is generated, which is then used to make suggestions to the user.

A content-based recommendation system tries to recommend items to users based on their profile. The user's profile revolves around that user's preferences and tastes. Example of Content-based Filtering is Matrix factorization.
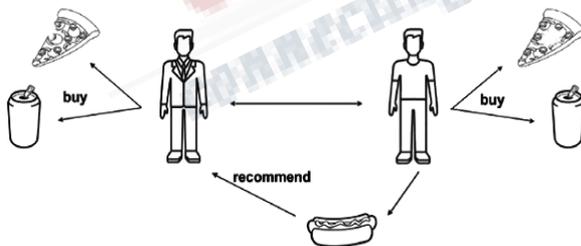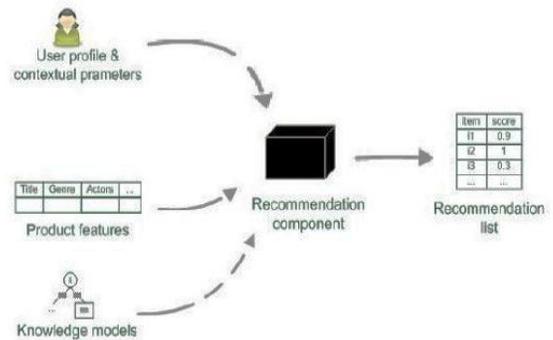


**Fig. II.A: Collaborative Filtering**



Knowledge-based: *Tell me what fits based on my needs*

**Fig. II.B: Content-based Filtering**

## III. METHODOLOGY

Algorithm ():

```python
import pandas as pd
import numpy as np
from sklearn.feature_extraction.text import
CountVectorizer
from sklearn.metrics.pairwise import cosine_similarity

def get_address_from_index(INDEX):
return df[df.INDEX == INDEX]["ADDRESS"].values[0]

def get_neighbour_from_index(INDEX):
return df[df.INDEX ==
INDEX]["NEIGHBORHOOD"].values[0]

def get_index_from_address(ADDRESS):
return df[df.ADDRESS ==
ADDRESS]["INDEX"].values[0]
##Step 1: Read CSV File
df = pd.read_csv("Book1.csv")
#print (df.columns)

##Step 2: Select Features
features = ['ADDRESS','NEIGHBORHOOD']

##Step 3: Create a column in DF which combines all
selected features
def combine_features(row):
return row['ADDRESS'] +" "+row['NEIGHBORHOOD']
df["combine_features"] =
df.apply(combine_features,axis=1)
#print(df["combine_features"])
```

##Step 4: Create count matrix from this new combined column
ccv = CountVectorizer()
Xi = ccv.fit_transform(df["combine_features"])

##Step 5: Compute the Cosine Similarity based on the count_matrix
cosine_sim = cosine_similarity(Xi)
#print(cosine_sim)
#print (cosine_sim)
movie_user_likes = "153 AVENUE B"

## Step 6: Get index of this movie from its title
movie_index =
get_index_from_address(movie_user_likes)
similar_movies =
list(enumerate(cosine_sim[movie_index]))

## Step 7: Get a list of similar movies in descending order of similarity score
sorted_similar_movies = sorted(similar_movies,
key=lambda x:x[1], reverse = True)

## Step 8: Print titles of first 50 properties
i = 0
for movie in sorted_similar_movies:
king = get_address_from_index(movie[0])
print (king)
i = i+1
if i>100:
break;

**Hybrid Recommendation Model:**
1. Collect requirements from users and convert them into property search parameters.
2. Display user parameter properties.
3. Gets a rating of the display property from the user.
4. The most highly rated property is used as input to the collaborative filtering algorithm.
5. Collaborative filtering algorithms provide user profiles that are similar to current user requirements. Recommended properties for similar users are entered into the content-based filtering algorithm.
6. The output of the content-based filtering algorithm is the final output. The final output is a user-recommended property.
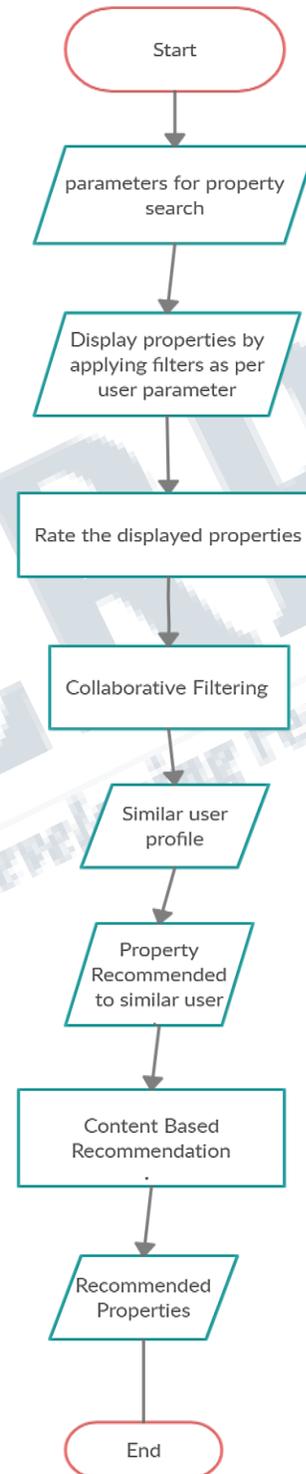


**Fig. II.C: Hybrid recommendation algorithm**

## IV.    IV. IMPLEMENTATION

many machine learning techniques, a recommender system makes prediction based on users' historical behaviors. Specifically, it's to predict user preference for a set of items based on past experience. To build a recommender system, the most two popular approaches are Content-based and Collaborative Filtering.

[1]     Collaborative methods for recommender systems are methods that are based solely on the past interactions recorded between users and items in order to produce new recommendations. The main idea that rules collaborative methods is that these past user-item interactions are sufficient to detect similar users and/or similar items and make predictions based on these estimated proximities. Examples of Collaborative Filtering KNN algorithm.

[2]     A content based recommender works with data that the user provides, either explicitly like rating or implicitly like clicking on a link. Based on that data, a user profile is generated, which is then used to make suggestions to the user. A Content-based recommendation system tries to recommend items to users based on their profile. The user's profile revolves around that user's preferences and tastes. Example of Content-based Filtering is Matrix factorization.

[3]     To build a system that can automatically recommend items to users based on the preferences of other users, the first step is to find similar users or items. The second step is to predict the ratings of the items that are not yet rated by a user.

## V.    FEATURE SCOPE

We are planning to add various features like price predication of the property. It will help user to make decision correctly to buy property or not. It will be also help user who are buying property for investment purpose as they can have an idea of future price of their property.

## VI.    CONCLUSION

By implementing this project drawback of existing system such as cold start has to overcome. Due to use of hybrid recommendation algorithm the accuracy will increase accuracy than existing technologies and which will predict more precise result. Our system recommend a suitable property to user based on various user parameters such as user financial condition, family, locality etc.

## VII.    LITERATURE SURVEY

In [1] named "Reviewer Credibility and Sentiment Analysis Based User Profile Modeling for Online Product Recommendation"IEEE ACCESS 19/01/2020. Proposed by authors named Shigang Hu, Akshi Kumar, Fadi Al Turjman, Shivam Gupta, Simran Seth. Product recommender systems find applications within e-commerce (Amazon, Flipkart, and Big-basket) and media service (Amazon-Prime, Netflix) domains. Various techniques for product recommendations like exploiting ratings for quantifying user-user and user-product adherence [content based and collaborative filtering], sentiment-analysis based recommendations, context-aware recommendations, user-preference and trust oriented recommendations have been reported. Literature is well equipped with primary and secondary studies on state-of-the-art techniques for recommender systems.

In [2] named "Web Information Recommendation Evaluation Model Based on Multifactor Decision Making" IEEE International Conference 12/08/2019. Proposed by authors named Shu nan Ma. Recommender systems aim to provide users with personalized services and overcome the information overload problems. The mainly used recommendation techniques are collaborative filtering and content-based recommendation.

In [3] named "User Rating Classification via Deep Belief Network Learning and Sentiment Analysis" IEEE Transactions 31/05/2019.Proposed by authors named Rung-Ching Chen Hendr. Many researchers have explored sentiment analysis. Sentiment analysis is artificial intelligence research of user opinions behavior and emotions through text mining. Sentiment analysis is not only applicable to product reviews but may also be applied to other domains such as stock markets, news articles and travel and tourism According to sentiment analysis may be considered a classification process. Many algorithms have been developed to enhance the capability of sentiment analysis. Sentiment classification is the most common task in sentiment analysis. Its main goal is to detect the sentiments within a document, a sentence, or an aspect. This task can be divided into three steps: polarity detection (label the sentiment of the text as positive, negative, or neutral), aspect selection/extraction (obtain the features), and classification (apply machine learning or lexical approaches to classify the text).

In [4] named "Community Education Course Recommendation Based on Intelligent Recommendation Algorithm" IEEE Springer Conference31/07/2019.Proposed by author Wenjun Liu rs.Personalized recommendation technology is gradually applied to the community teaching resource network. It provide susers with personalized services, which not

onlyimproves learning efficiency and user experience, but also discovers and mines potential points of interest for users, so that learning resources can be fully utilized, and the relevance of users and resources is increased. Personalized recommendation technology mainly provides resource recommendation services to users through the correlation between users, between items, and between users and objects. Similar users have similar hobbies or learning needs. Therefore, by recording the behavior information of each user, when the target user needs to recommend, according to the information of the target user, the user who is similar to the user is found, and the learning resources that are of interest to the user with higher similarity are recommended to the target.

In [5] named "Customer Reviews Analysis with Deep Neural Networks for E-Commerce Recommender Systems" IEEE Access26/08/2019.Proposed by author Babak Maleki shoji, Nassie Htabriz. Dealing with text as unstructured data is challenging. Natural Language Processing (NLP) is a branch of computer science and artificial intelligence (AI) concerned with processing and analyzing natural language data. Deep learning for NLP is one of the approaches that are improving the capability of the computer to understand human language. There are a few studies that try to incorporate customer written reviews in generating recommendations.

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