

RESTAURANT RECOMMENDATION SYSTEM

Submitted in partial fulfillment of the requirements for the
award of Bachelor of Engineering Degree in

Computer Science and Engineering

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March 2021



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BONAFIDE CERTIFICATE

This is to certify that this Professional Training Report is the bonafide work of **KOVURU VENKATA PADMASUSHMASAI(Reg.No:37110378)TALLURI.SIVA PAVANI (Reg. No. 37110767)** who have done the project as a team who carried out the project entitled “**RESTAURANT RECOMMENDATION SYSTEM**” under my supervision from November 2020 to March 2021.

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ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my sincere thanks to **Dr.T.SASIKALA M.E.,Ph.D., Dean, School of Computing and Dr.L.LakshmananM.E.,and Ph.D., Dr. S.VIGNESHWARI, M.E., Ph.D., Head of the Department, Dept. of Computer Science and Engineering** for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Ms. INDIRA K. M.E.,(Ph.D)** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my projectwork.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of **Computer Science and Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT

Recommender Systems or Recommendation Systems are simple algorithms that aim to provide the most relevant and accurate items (products, movies, events) to the user (customers, visitors, app users) by filtering useful stuff from a huge pool of information base. Recommendation engines discover data patterns in the data set by learning consumers choices and produces the outcomes that co-relates to their needs and interests. Our project is to develop similar recommendation system related to restaurants.

Our aim is to build a restaurant recommendation system that provides personalized restaurant recommendations to users. Since different people have different food preferences and dietary restrictions, we perform careful feature selection to take advantage of the information reflected in a user's reviews. we have generated recommendations not just for an individual user, but also for a group of users. Our project is developed using the Latent Factor Collaborative Filtering Optimization. The main important purpose of this project is to help the users to visit and enjoy their favorite food in the best restaurants.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

A Recommendation System is an information filtering system that seeks to predict the rating a user would give for the item (in this case a restaurant). We can break down the large matrix of ratings from users and items into two smaller matrixes of user-feature and item-feature. Recommender Systems or Recommendation Systems are simple algorithms that aim to provide the most relevant and accurate items (products, movies, events, articles, food, restaurants) to the user (customers, visitors, app users, readers) by filtering useful stuff from a huge pool of information base. Recommendation engines discover data patterns in the data set by learning consumers' choices and produces the outcomes that co-relates to their needs and interests.

Our project is to develop similar recommendation system related to restaurants. Restaurant Recommendation System is a recommender system for restaurants based on user preferences. When user or customer requests for a specific type of restaurant, the system automatically recommends the restaurants that meet their requirements. Our aim is to build a restaurant recommendation system that provides personalized restaurant recommendations to users. Since different people have different food preferences and dietary restrictions, we perform careful feature selection to take advantage of the information reflected in a user's reviews. Furthermore, since dining is frequently a communal activity, we generated recommendations not just for an individual user, but also for a group of users. This system needs to consider the information of all individuals in a group and recommend restaurants that satisfiesthe group of users according to some criterion.

Although reviews provide valuable recommendations about restaurants, reading reviews for businesses can be time consuming. People go through several pages of recommendations published on Yelp just wanting to find a right restaurant, which has most potential to satisfy their personal appetite or their own food preference. Above that, when people visit a new place, move or travel, users have to go through the same search procedure again. This can be tedious and sometime annoying.

Food is not just a necessity of life. The food we eat represents our culture, tradition, and values. The norms and values of a place can be significantly related to varieties of food available there. Eventually, the highest rated hotel is being recommended to the user by the restaurant recommended system. Our application takes the food preference and ratings into consideration to recommend food the users. The application uses item based collaborative filtering and user-based collaborative filtering method to recommend the food to the users. The application takes user ratings for different food items and stores it into the database. The application then recommends food items to the users on the basis of their ratings. In this project, we developed a web app which recommend the restaurant based on the choice of your interest. This is used for the users to predict the suitable and best restaurant as per their tastes. The content based filtering and collaborative based filtering makes the recommendation more efficient so that each user can use this application for their easy prediction of restaurant.

1.2 PURPOSE OF THE PROJECT

The main important purpose of the restaurant recommendation system is to help the users to visit and enjoy their favorite food in the best restaurants. For example, In the case of picking a restaurant to have lunch or dinner when you are traveling to other countries or cities, commonly you will ask your friend that lives in that country or city what is the best restaurant in town. The problem is you don't have any friends that lived in that town. Your personal recommendations can be generated by an artificial friend: the recommender system. This is the underlying purpose of the system to help the users in picking the best restaurants.

While many existing recommender systems mainly target individuals, there is a remarkable increase of recommender systems which generate suggestions for groups. Some early systems were developed in a variety of domains, such as, group web page recommendation (Lieberman et al. 1999), tour packages for groups of tourists (Ardissono et al. 2003), music tracks and playlists for large groups of many listeners (Crossen et al. 2002), movies and TV programs for friends and family (O'Connor et al. 2001; Yu et al. 2006). Group scenarios are especially popular in the food domain in which a group of family members, friends or colleagues wants to make a party or simply have a meal together. However, the complexity significantly increases when food recommender systems need to take

into account the preferences of all group members and strategies for achieving the consensus within group members.

From the survey, we have inferred that they have developed a recommended system just to search for food. However, the complexity significantly increases when food recommender systems need to take into account the preferences of all group members and strategies for achieving the consensus within group members.

1.3 EXISTING SYSTEM

While many existing recommender systems mainly target individuals, there is a remarkable increase of recommender systems which generate suggestions for groups. Some early systems were developed in a variety of domains, such as, group web page recommendation (Lieberman et al. 1999), tour packages for groups of tourists (Ardissono et al. 2003), music tracks and playlists for large groups of many listeners (Crossen et al. 2002), movies and TV programs for friends and family (O'Connor et al. 2001; Yu et al. 2006). Group scenarios are especially popular in the food domain in which a group of family members, friends or colleagues wants to make a party or simply have a meal together. However, the complexity significantly increases when food recommender systems need to take into account the preferences of all group members and strategies for achieving the consensus within group members.

From the survey, we have inferred that they have developed a recommended system just to search for food. However, the complexity significantly increases when food recommender systems need to take into account the preferences of all group members and strategies for achieving the consensus within group members. Many Restaurants stores and maintain their day to day transactions manually. But some of them are having automation system which is helping them to store the data. But such restaurants are storing the information about the orders and the customer information. They don't have facility to store the information of feedbacks and favourite orders of customers over some period of time. Restaurants are having standalone applications so at one time, they have the facility of many screens or many operations which is happening at one time. So they are storing them and then at last, the restaurant managers will able to see the data of last day.

1.4 PROPOSED SYSTEM

We are proposing a system, which uses streamlit to develop a small web app. Our main aim is to build a restaurant recommendation system that provides personalized restaurant recommendations to users. Since different people have different food preferences and dietary restrictions, we perform careful feature selection to take advantage of the information reflected in a user's reviews. we develop a restaurant recommendation system using the Latent Factor Collaborative Filtering Optimization. This system recommends restaurants for users or group of users based on their preferences such as beautiful ambience, good food, tasteful desserts and so.

Our system provides personalized restaurant recommendations to users. The recommendation for new user is done by considering the user's location by tracking his location through gps, and by the ratings we got from Zomato's API. The restaurant which is nearby to the user, whose ratings are high will be recommended. For the old user we will consider his behaviour while using the application along with his location and restaurant popularity.

1.5 PROGRAMMING LANGUAGES

Python is the best programming language suited for Machine Learning. According to studies and surveys, Python is the fifth most important language as well as the most popular language for machine learning and data science. It is because of the following strengths that Python has –

- Easy to learn and understand – The syntax of Python is simpler; hence it is relatively easy, even for beginners also, to learn and understand the language.
- Multi-purpose language – Python is a multi-purpose programming language because it supports structured programming, object-oriented programming as well as functional programming.
- Support of open source community – As being open source programming language, Python is supported by a very large developer community. Due to this, the bugs are easily fixed by the Python community. This characteristic makes Python very robust and adaptive.

CHAPTER 2

LITERATURE SURVEY

- A personalized recommender system victimization machine learning based mostly sentiment analysis over social information (2016). during this paper, proposes such a social framework and it provides the user with faster and additional relevant information, so avoiding moot information and providing abundant required personalization.
- Analysis of classification models supported cookery prediction exploitation machine learning (2017). The correlation between numerous recipes and their ingredient sets were investigated with the assistance of common classification techniques. The tests were conducted on the dataset compiled from numerous sources additionally the} accuracy of classifiers want to predict the cuisines were also and compared.
- A hybrid recommendation system considering visual info for predicting favorite restaurants (2017). during this paper, particularly investigate the influence of visual info, i.e., photos taken by customers and placed on blogs, on predicting favorite restaurants for any given user. It offers the visual info effectively aids favorite eating place prediction.
- Machine learning primarily based food direction recommendation system (2018). In this, they use similarity techniques of user primarily based approach and introduce fastened size neighborhood and threshold-based neighborhood to identical. The performance for the Allrecipe knowledge set is found to be higher than the simulated dataset since there ar additional range of interactions between users and things.
- Recommendation system supported item and user similarity on restaurants directory on-line (2018). It merges the item similarity and user similarity options to come up with recommendations. analysis shows that the advice system supported item similarity yields higher F1-measure price once examination to user similarity.
- Comparing filtering techniques in restaurant recommendation system (2018). This paper aims to predict restaurants. It results have shown that hybrid

filtering outperforms content-based filtering using regression model and collaborative filtering using cluster-based technique.

- Recipe Recommendation System Mistreatment Machine Learning Models (2019). they need used 2 machine learning models-vector house model and Word2Vec model to seek out prime ingredient pairs from completely different cuisines and to counsel alternate ingredients. the main focus is on the Indian culinary art. Indian culinary art is incredibly Brobdingnagian and various and therefore it's tough to seek out patterns and generate pairs.
- Sentiment analysis of eating house reviews mistreatment machine learning techniques (2019). This paper chiefly focuses on the implementation of varied classification algorithms and their performance analysis. The simulation results showed that SVM classifier resulted within the highest accuracy of ninety-four.56% for the given dataset.
- Restaurant Recommendation System for User Preference and Services supported Rating and Amenities (2019). the present paper proposes a machine learning algorithm to resolve the difficulty of customized eating house choice. The results reveal that the advised approach yields high accuracy.
- Restaurant Recommendation System Victimization Machine Learning (2020). during this paper, consistent with the characteristics of eating house recommender systems. It proposes a machine learning algorithm to resolve the problems of customized eating house choice relying upon yelp information.

CHAPTER 3

AIM AND SCOPE OF THE PROJECT

3.1 AIM OF PROJECT

The primary aim of this proposed system i.e. "Restaurant recommendation system" is used to suggest people on the basis of their interests. It shows the ratings to the restaurants so that people can also choose according to those.

3.1.1 OBJECTIVES

The problem is you don't have any friends that lived in that town. Your personal recommendations can be generated by an artificial friend: the recommender system. While many existing recommender systems mainly target individuals, there is a remarkable increase of recommender systems which generate suggestions for groups.

However, the complexity significantly increases when food recommender systems need to take into account the preferences of all group members and strategies for achieving the consensus within group members.

3.2 SCOPE

Restaurant Recommendation Systems has a wide scope in the future. At present, there are few food delivery applications which take help of the restaurant recommendation systems. There is a necessary scope in increasing the efficiency of the system. The scope of the application is as that: The restaurants and hotels within the valley will be listed in the application.

The application is targeting everyone who wishes to go to a restaurant to eat. The application takes the food preference and ratings into consideration to recommend food the users. The application uses item based collaborative filtering and user-based collaborative filtering method to recommend the food to the users. The restaurant recommendation system can provide users with accurate and effective restaurant information based on user's profile information and preference. This type of recommendations can save a lot of time and we can easily choose the restaurants.

CHAPTER 4

EXPERIMENTAL AND MATERIALS AND METHODS; ALGORITHMS USED

4.1 SOFTWARE ENVIRONMENT:

The software requirements are the specification of the system. It should include both a definition and a specification of requirements. It is a set of what the system should do rather than how it should do it. The software requirements provide a basis for creating the software requirements specification. It is useful in estimating cost, planning team activities, performing tasks and tracking the teams and tracking the team's progress throughout the development activity.

Operating system: Windows 10.

Used: Python, Jupyter Notebook and Anaconda Prompt.

4.2 HARDWARE ENVIRONMENT:

The hardware requirements may serve as the basis for a contract for the implementation of the system and should therefore be a complete and consistent specification of the whole system. They are used by software engineers as the starting point for the system design. It shows what the systems do and not how it should be implemented.

Hardware: Intel i5 Core

RAM: 8GB

4.3 MODULE DESCRIPTION

Recommender Systems or Recommendation Systems are simple algorithms that aim to provide the most relevant and accurate items (products, movies, events, articles) to the user (customers, visitors, app users, readers) by filtering useful stuff from a huge pool of information base. Recommendation engines discover data patterns in the data set by learning consumers' choices and produces the outcomes that co-relates to their needs and interests. Unlike offline stores, online stores have no sales people, they have huge number of products on their websites and users on other hand have

limited time and patience to navigate to the items that they are looking for. Recommendation systems solve these kinds of problems by exploiting the user preferences and prioritize the items based on all other users' past behaviour.

Recommendation engines discover data patterns in the data set by learning consumers' choices and produces the outcomes that co-relates to their needs and interests.

There are two types of Recommendation Systems. They are:

- 1) Content-Based Filtering
- 2) Collaborative Filtering

1. Content-Based Filtering: -

Content-based filtering refers to such methods that provide recommendations by comparing representations of content describing an item to representations of content that interest the user pairs. This system recommends based on comparison between the descriptors of the items and a user profile.

2) Collaborative Filtering: -

Unlike content-based filtering, this system doesn't require description of the data hence it recommends without knowing anything about the products. Collaborative filtering is the type of recommendation algorithm that bases its predictions and recommendations on the rating or behavior of other users in the system. The fundamental idea of collaborative filtering is to find other users in the community that share opinions.

There are two popular approaches of collaborative filtering:

A. User-based approach Food Recommendation System uses the user ratings of other users with similar preferences to recommend a food item to a certain user. User-based recommendation algorithms firstly identify the k most similar users to the active user in which each user is treated as a vector and the similarities between the active user and other users are computed.

B. Item-based approach Though user- based approach is useful, it suffers from the scalability problem as the user base grows. Searching from the

neighbours of a user becomes time-consuming. To extend collaborative filtering to the large user base, a more scalable version of collaborative filtering, the i.e. item based approach was introduced. The overall structure of this approach seems to be similar to that of content based approach to recommendation and personalization, but item similarity is deduced from user preference patterns rather than extracted from the item data.

Matrix factorization: -

It is a class of collaborative filtering algorithms used in recommender systems. Matrix factorization algorithms work by decomposing the user-item interaction matrix into the product of two lower dimensionality rectangular matrices.

A Recommendation System is an information filtering system that seeks to predict the rating a user would give for the item (in this case a restaurant). We can break down the large matrix of ratings from users and items into two smaller matrixes of user-feature and item-feature.

We have two matrixes (user-features, business-features) that we can multiply to predict the ratings that a user gives to a restaurant. Later, we need to update the values in the features of our two matrixes according to the Error.

To optimize the predictions, we need to calculate the error using the function below.

$$\min_{P,Q} \sum_{(i,x) \in R} (r_{xi} - q_i \cdot p_x^T)^2$$

Given P is the users-features matrix and Q is the business-features matrix. If we subtract the real ratings (r) with the predicted ratings (P.Q) and we square it, we get the LSE(Least Square Error).

To avoid overfitting we have to add regularization to our LSE formula and it will become the formula written below.

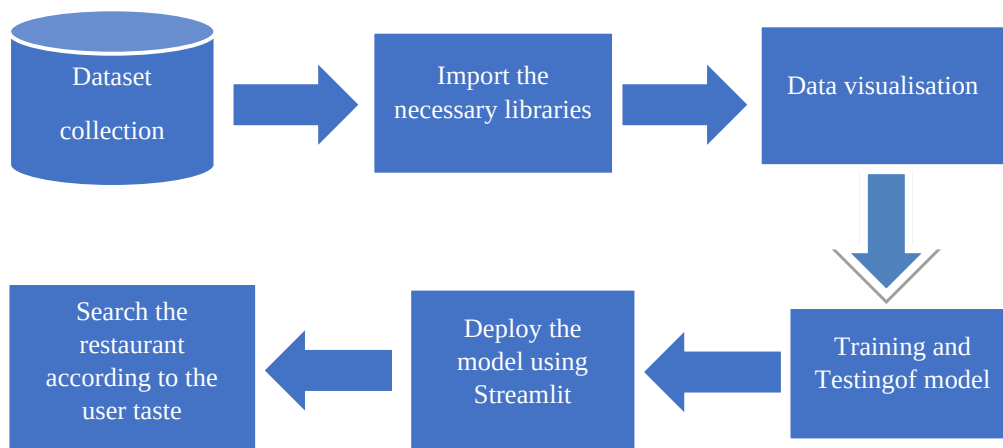
$$\min_{P,Q} \underbrace{\sum_{(i,x) \in R} (r_{xi} - q_i \cdot p_x^T)^2}_{\text{"error"}} + \lambda \underbrace{\left[\sum_x \|p_x\|^2 + \sum_i \|q_i\|^2 \right]}_{\text{"length"}}$$

We apply the equation to minimize the error using Gradient Decent to update the values of each feature in matrix P and matrix Q.

4.4 LIBRARIES

- Sklearn- Scikit Learn additionally called sklearn could be a free code machine learning library for python programming. It options varied classification, clustering, regression machine learning algorithms. during this it's used for mercantilism machine learning models, get accuracy, get confusion matrix.
- Pandas- Pandas could be a quick, powerful, versatile and easy to use, engineered on prime of the Python programming language. It is open source used for knowledge analysis and manipulation tool. In this, it's accustomed scan the dataset.
- Matplotlib- Matplotlib could be a plotting library for the Python programing language and its numerical mathematical extension NumPy. In this, it's used for knowledge visualization.
- NumPy- Numpy could be a python library used for working with arrays. additionally has functions for domain of algebra, fourier rework, and matrices. Numpy stands for Numerical Python. In this it's accustomed amendment 2-dimensional array into contiguous plante array.
- Streamlit is associate degree ASCII text file Python library that produces it Straight forward to make and share lovely, custom internet apps for machine learning and information science. in only a number of minutes you'll be able to build and deploy powerful information apps. The best issue concerning Streamlit is it does not need any data of internet development.
- Seaborn could be a library for creating applied mathematics graphics in Python. it's designed on prime of matplotlib and closely integrated with pandas knowledge structures. It aims to form visual image a central a part of exploring and understanding knowledge.

4.5 SYSTEM ARCHITECTURE



4.6 ALGORITHMS

Matrix factorization algorithms work by decomposing the original matrix into two matrices one is the upper triangle (U), and the other is the lower triangle (L).

Algorithm:

Step 1: Take the input matrix as U and an empty diagonal matrix as L

Step 2: n be length of matrix U

Step 3: for col in range (1, n):

a. for row in range (2, n):

a-1. if row > col

$$mul = U[[row, col]] / U[[col, col]]$$

$$L[row, col] = mul$$

$$U[row, :] = U[row, :] - mul * U[col, :]$$

Return U

4.7 METHODOLOGY

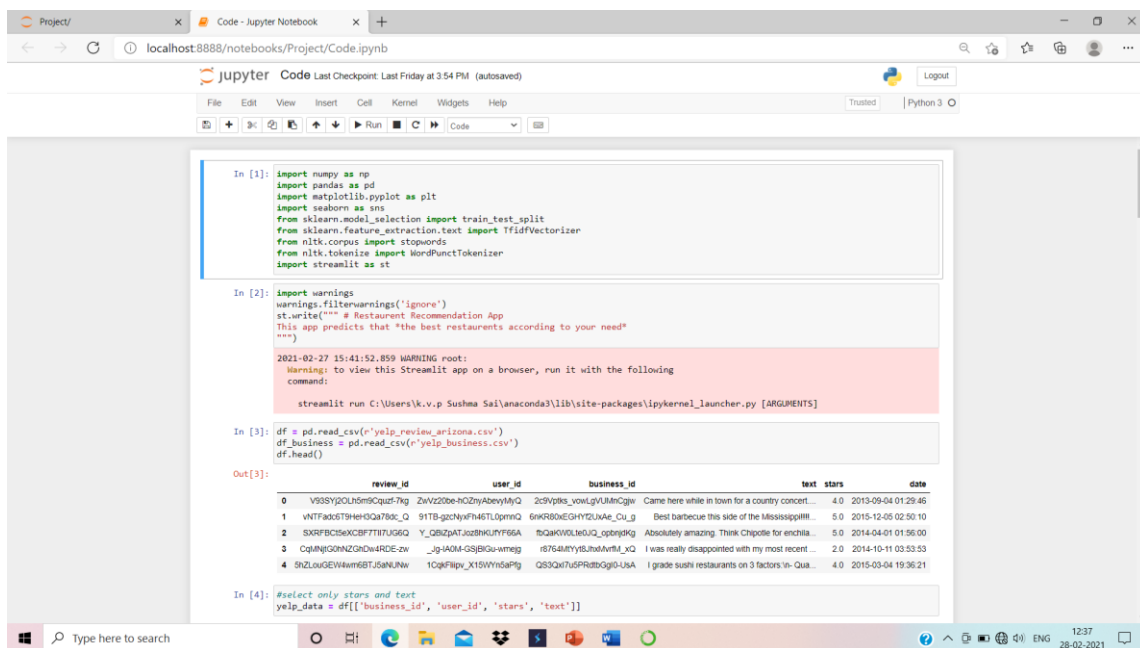
Project contain three components:

1. Dataset assortment
 2. Train and check the model.
 3. Deploy the model mistreatment streamlit.
- ✓ **Dataset assortment:** - we tend to had collected dataset from kaggle notebooks. The dataset contains userid, review, ratings. It contains 192609 rows.
 - ✓ **Train and test method:** - we had used a machine algorithm to train the model and after training, we had tested the model.
 - ✓ **Deploy the model using streamlit:** - In this we have created a web application to search the restaurant according to customers tastes and also it shows some recommendations according to the reviews and rating.

CHAPTER – 5

RESULTS AND DISCUSSION

Our web application is used to find the restaurants based on user's taste. It can be accessed by anyone from anyplace if they have network. we perform careful feature selection to take advantage of the information reflected in a user's rating.



The screenshot shows a Jupyter Notebook running in a web browser at localhost:8888. The notebook has three cells. The first cell imports various libraries: numpy, pandas, matplotlib, sklearn, nltk, and streamlit. The second cell contains a warning message about Streamlit and a command to run the application. The third cell reads data from CSV files and displays the first five rows of the resulting DataFrame.

```
In [1]: import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import TfidfVectorizer
from nltk.corpus import stopwords
from nltk.tokenize import WordPunctTokenizer
import streamlit as st

In [2]: import warnings
warnings.filterwarnings('ignore')
st.write(""" # Restaurant Recommendation App
This app predicts that "the best restaurants according to your need"
""")

2021-02-27 15:41:52.859 WARNING root:
Warning: to view this Streamlit app on a browser, run it with the following
command:
streamlit run C:\Users\k.v.p.Sushma Sai\anaconda3\lib\site-packages\ipykernel_launcher.py [ARGUMENTS]

In [3]: df = pd.read_csv(r'yelp_review_arizona.csv')
df_business = pd.read_csv(r'yelp_business.csv')
df.head()
```

	review_id	user_id	business_id	text	stars	date
0	Y9S5Y2OLH5m9Qzot-7kg	ZwVz20be-HQZnAbeVnMyQ	2c9Vp8s_vovLgVUMrCgW	Came here while in town for a country concert...	4.0	2013-09-04 01:29:46
1	VNTFAdo5T9HeH0Ga70dc_Q	91TB-gzCzNxFH6TL0pmnQ	6wR80wEGHY2UAAe_Cu_g	Best barbecue this side of the Mississippi!!!!	5.0	2015-12-05 02:50:10
2	SXRFBC56XCBFT7tUJG6Q	Y_QBzPATJcz8KJNYF66A	tbQhK0VL6u0Q_cpbq9Kq	Absolutely amazing. Think Chipotle for enchila...	5.0	2014-04-01 01:56:00
3	CqJNGGONZGHDw4RDE-zw	_Jg-IA0M-GS8IGu-wmeJg	r8764MYy8JhoAvrtL_xQ	I was really disappointed with my most recent ...	2.0	2014-10-11 03:53:53
4	5hZLxUGEVWw6BTJ5ANJNW	1CqF8lpy_X15WYn5aPfg	Q53Qm7u5PRbtGg0-UkA	I grade sushi restaurants on 3 factors: ve-Qua...	4.0	2015-03-04 19:36:21

```
In [4]: #select only stars and text
yelp_data = df[['business_id', 'user_id', 'stars', 'text']]
```

Fig 5.1 – Import the necessary libraries

First, we have to install the libraries using command prompt. For installing, we have to type pip install required library in command prompt. After installing import the required libraries in Jupyter notebook and we have used sklearn it is used to build machine learning models and it has lot of efficient tools for machine learning and statistical modeling. We have removed stop words using NLTK in python.

```
In [26]: #dynamic input
st.write("your search please!")
words = st.text_input("Enter text")
test_df= pd.DataFrame([words], columns=['text'])
test_df['text'] = test_df['text'].apply(text_process)
test_vectors = userid_vectorizer.transform(test_df['text'])
test_v_df = pd.DataFrame(test_vectors.toarray(), index=test_df.index, columns=userid_vectorizer.get_feature_names())
predictItemRating=pd.DataFrame(np.dot(test_v_df.loc[0],Q.T),index=Q.index,columns=['Rating'])
topRecommendations=pd.DataFrame.sort_values(predictItemRating,['Rating'],ascending=[0])[:7]
for i in topRecommendations.index:
    st.write(df_business[df_business['business_id']==i]['name'].iloc[0])
    st.write(df_business[df_business['business_id']==i]['categories'].iloc[0])
    st.write(str(df_business[df_business['business_id']==i]['stars'].iloc[0]) + ' ' +str(df_business[df_business['business_id']==i]
    st.write('')
```

Fig 5.2 - Main program

We have used recommendation algorithm in machine learning for best results. By using streamlit, it easy to create and share beautiful, custom web apps. In just a few minutes you can build and deploy data apps.

```
C:\windows\system32\cmd.exe - streamlit run code.py
Microsoft Windows [Version 10.0.19041.804]
(c) 2020 Microsoft Corporation. All rights reserved.

(base) C:\Users\k.v.p Sushma Sai>cd downloads
(base) C:\Users\k.v.p Sushma Sai\Downloads>streamlit run code.py

You can now view your Streamlit app in your browser.

Local URL: http://localhost:8501
Network URL: http://192.168.43.75:8501

[nltk_data] Downloading package stopwords to C:\Users\k.v.p Sushma
[nltk_data]   Sai\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
2021-02-27 15:49:30.580 NumExpr defaulting to 8 threads.
```

Fig 5.3 – Run the command

After saving the code, open the Anaconda prompt and set the path first i.e., where the code file is saved. After setting the path, use this command to see the output Streamlit run filename.py, it automatically takes into the browser.

Restarent Recommendation App

This app predicts that *the best restaurants according to your need*

your search please!

Enter text

Press Enter to apply

Fig 5.4 – Web app

After running the command, above is the picture how the output looks like. You can search whatever the restaurant according to your taste.

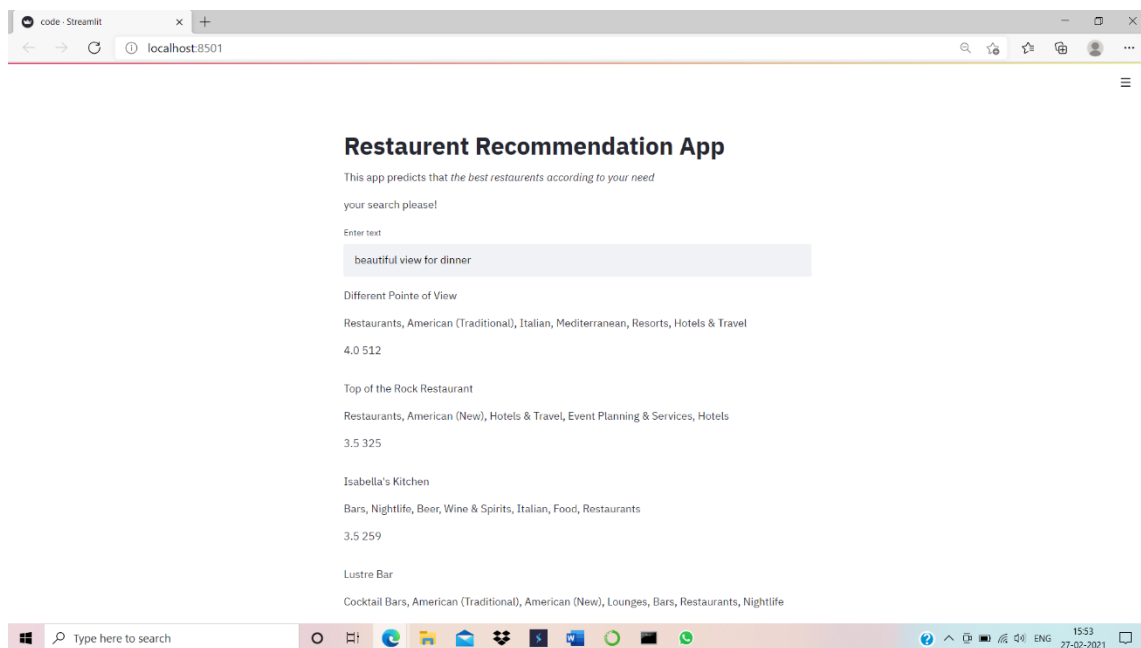


Fig 5.5 – Output

It will recommend some restaurants with rating and you can choose whatever restaurant you want.

CHAPTER – 6

CONCLUSION

In this project, we developed a web app which recommend the restaurant based on the choice of your interest. This is used for the users to predict the suitable and best restaurant as per their tastes. The content based filtering and collaborative based filtering makes the recommendation more efficient so that each user can use this application for their easy prediction of restaurant.

The project Restaurant Recommendation System was successfully completed by using latent factor collaborative filtering or matrix factorization. In this project, we developed a model that could recommend the restaurant based on the choice of interest.

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[10] Yelp, www.yelp.com/academicdataset, Yelp academic dataset.

APPENDIX

A. PLAGAIRISM REPORT

Sentence

Restaurant Recommended Web Application Using Machine Learning 1K.v.p Sushma Sai, 2T. Siva Pavani, 3K. Indira 1,2UG Student, Professor, Dept. of IT, Sathyabama Institute of Science and Technology, Chennai. 1kvpsushmasai@gmail.com, 2tallurisiva2000@gmail.com, 3indira.it@sathyabama.ac.in Abstract- Recommender Systems or Recommendation Systems are straightforward algorithms that aim to produce the foremost relevant and correct things (products, movies, events) to the user (customers, visitors, app users) by filtering helpful stuff from an enormous pool of knowledge base. Recommendation engines discover knowledge patterns within the knowledge set by learning shoppers' selections and produces the outcomes that co-relates to their wants and interests. Our project is to develop similar recommendation system associated with restaurants. Our aim is to create a edifice recommendation system that gives customized edifice recommendations to users and also developed a web app. Since totally different completely different} folks have different food preferences and dietary restrictions, we have a tendency to perform careful feature choice to require advantage of the knowledge mirrored in an exceedingly user's reviews. we've got generated recommendations not only for a private user, however conjointly for a bunch of users. Our project is developed mistreatment the Latent issue cooperative Filtering improvement. the most vital purpose of this project is to assist the users to go to and luxuriate in their favorite food within the best restaurants. Keywords: Recommendation, Users, Customer reviews. 1.INTRODUCTION Restaurant Recommendation System could be a recommender system for restaurants supported user preferences. once user or client requests for a particular kind of restaurant, the system mechanically recommends the restaurants that meet their necessities. The main necessary purpose of the building recommendation system is to assist the users to go to and revel in their favorite food within the best restaurants. For instance, within the case of choosing a building to possess lunch or dinner after you area unit traveling to different countries or cities, ordinarily you'll raise your friend that lives therein country or town what's the most effective building in city. The problem is you don't have any friends that lived there in city. Your personal recommendations may be generated by a man-made friend: the recommender system, this can be the underlying purpose of the system to assist the users in choosing the most effective restaurants. While several existing recommender systems principally target people, there's a stimulating increase of recommender systems that generate suggestions for teams. Some early systems were developed in an exceedingly type of domains, such as, cluster online page recommendation (Lieberman et al. 1999), tour packages for teams of tourists (Ardissono et al. 2003), music tracks and playlists for big teams of the many listeners (Crossen et al. 2002), movies and television programs for friends and family (O'Connor et al. 2001; Yu et al. 2006). cluster eventualities ar particularly standard within the food domain within which a gaggle of relations, friends or colleagues needs to form a celebration or just have a meal along. However, the complexness considerably will increase once food recommender systems have to be compelled to take under consideration the preferences of all cluster members and methods for achieving the accord at intervals cluster members. Our aim is to make a restaurant recommendation system that has personalised restaurant recommendations to users. Since totally {different completely different} folks have different food preferences and dietary restrictions, we tend to perform careful feature choice to require advantage of the data mirrored during a user's reviews. Furthermore, since eating is usually a communal activity, we tend to generated recommendations not only for a personal user, however additionally for a gaggle of users. this technique has to contemplate the data of all people during a cluster and suggest restaurants that satisfies the cluster of users consistent with some criterion. 2.LITERATURE SURVEY > A personalized recommender system victimization machine learning based mostly sentiment analysis over social information (2016). during this paper, proposes such a social framework and it provides the user with faster and additional relevant information, so avoiding moot information and providing abundant required personalization. > Analysis of classification models supported cookery prediction exploitation machine learning (2017). The correlation between numerous recipes and their ingredient sets were investigated with the assistance of common classification techniques. The tests were conducted on the dataset compiled from numerous sources additionally the} accuracy of classifiers want to predict the cuisines were also and compared. > A hybrid recommendation system considering visual info for predicting favorite restaurants (2017). during this paper, particularly investigate the influence of visual info, i.e., photos taken by customers and placed on blogs, on predicting favorite restaurants for any given user. It offers the visual info effectively aids favorite eating place prediction. > Machine learning primarily based food direction recommendation system (2018). In this, they use similarity techniques of user primarily based approach and introduce fastened size neighborhood and threshold-based neighborhood to identical. The performance for the Allrecipe knowledge set is found to be higher than the simulated dataset since there ar additional range of interactions between users and things. > Recommendation system supported item and user similarity on restaurants directory on-line (2018). It merges the item similarity and user similarity options to come up with recommendations. analysis shows that the advice system

Nation (Smart TechCon), 1485-1490, 2017. [3 Wei-Ta Chu et al. "A hybrid recommendation system considering visual info for predicting favorite restaurants" World Wide Web 20 (6), 1313-1331, 2017. [4 MB Vivek et al, "Machine learning primarily based food direction recommendation system" Proceedings of international conference on cognition and recognition, 11-19, 2018. [5 Nanthaphat Koetphrom et al, "Comparing filtering techniques in restaurant recommendation system" 2nd International Conference on Engineering Innovation (ICEI), 46-51, 2018. [6 Suyash Maheshwari et al, "Recipe Recommendation System Mistreatment Machine Learning Models" International Research Journal of Engineering and Technology (IRJET) 6 (9), 366-369, 2019. [7 Akshay Krishna et al, "Sentiment analysis of eating house reviews mistreatment machine learning techniques" Emerging Research in Electronics, Computer Science and Technology, 687-696, 2019. [8 Mr. N Varatharajan et al, "Restaurant Recommendation System Victimization Machine Learning" International Educational Applied Research Journal 4 (3), 1-4, 2020. [9 Rahul Katarya; Om Prakash Verma International Conference on Green Computing and Internet of Things (ICGCIoT) "Restaurant recommender system based on psychographic and demographic factors in mobile environment". [10 Yelp, www.yelp.com/academicdataset, Yelp academic dataset.

Report Title:	Restaurant recommendation system
Report Link: (Use this link to send report to anyone)	https://www.check-plagiarism.com/plag-report/23540eda1528f364a1e3c46000434f6a422821615959055
Report Generated Date:	17 March, 2021
Total Words:	2126
Total Characters:	14666
Keywords/Total Words Ratio:	83.04%
Excluded URL:	No
Unique:	91%
Matched:	9%

Sentence wise detail:

Keywords Density		
One Word	2 Words	3 Words
tion 8.42%	machine learning 1.53%	restaurant recommendation system 0.61%
recommend 3.52%	recommendation system 1.45%	perform careful feature 0.31%
system 3.06%	recommender system 0.92%	victimization machine learning 0.31%
user 2.83%	restaurant recommendation 0.77%	machine learning models 0.31%
recommendation 2.37%	dataset 0.77%	system victimization machine 0.31%

Plagiarism Report

By check-plagiarism.com

B. JOURNAL PAPER

Restaurant Recommended Web Application Using Machine Learning

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Abstract- Recommender Systems or Recommendation Systems are straightforward algorithms that aim to produce the foremost relevant and correct things (products, movies, events) to the user (customers, visitors, app users) by filtering helpful stuff from an enormous pool of knowledge base. Recommendation engines discover knowledge patterns within the knowledge set by learning shoppers' selections and produces the outcomes that co-relates to their wants and interests. Our project is to develop similar recommendation system associated with restaurants. Our aim is to create a edifice recommendation system that gives customized edifice recommendations to users and also developed a web app. Since totally different completely different} folks have different food preferences and dietary restrictions, we have a tendency to perform careful feature choice to require advantage of the knowledge mirrored in an exceedingly user's reviews. we've got generated recommendations not only for a private user, however conjointly for a bunch of users. Our project is developed mistreatment the Latent issue cooperative Filtering improvement. the most vital purpose of this project is to assist the users to go to and luxuriate in their favorite food within the best restaurants.

Keywords: Recommendation, Users, Customer reviews.

1.INTRODUCTION

Restaurant Recommendation System could be a recommender system for restaurants supported user preferences. once user or client requests for a particular kind of restaurant, the system mechanically recommends the restaurants that meet their necessities.

The main necessary purpose of the building recommendation system is to assist the users to go to and revel in their favorite food within the best restaurants. For instance, within the case of choosing a building to possess lunch or dinner a fter you area unit traveling to different countries or cities, ordinarily you'll raise your friend that lives therein country or town what's the most effective building in city.

The problem is you don't have any friends that lived there in city. Your personal recommendations may be generated by a man-made friend: the recommender system, this can be the underlying

purpose of the system to assist the users in choosing the most effective restaurants.

While several existing recommender systems principally target people, there's a stimulating increase of recommender systems that generate suggestions for teams. Some early systems were developed in an exceedingly type of domains, such as, cluster online page recommendation (Lieberman et al. 1999), tour packages for teams of tourists (Ardissono et al. 2003), music tracks and playlists for big teams of the many listeners (Crossen et al. 2002), movies and television programs for friends and family (O'Connor et al. 2001; Yu et al. 2006). cluster eventualities ar particularly standard within the food domain within which a gaggle of relations, friends or colleagues needs to form a celebration or just have a meal along. However, the complexness considerably will increase once food recommender systems have to be compelled to take under consideration the preferences of all cluster members and methods for achieving the accord at intervals cluster members.

Our aim is to make a restaurant recommendation system that has personalised restaurant recommendations to users. Since totally {different completely different} folks have different food preferences and dietary restrictions, we tend to perform careful feature choice to require advantage of the data mirrored during a user's reviews.

Furthermore, since eating is usually a communal activity, we tend to generated recommendations not only for a personal user, however additionally for a gaggle of users. this technique has to contemplate the data of all people during a cluster and suggest restaurants that satisfies the cluster of users consistent with some criterion.

2.LITERATURE SURVEY

- A personalized recommender system victimization machine learning based mostly sentiment analysis over social information (2016). during this paper, proposes such a social framework and it provides the user with faster and additional relevant information, so avoiding moot information and providing abundant required personalization.
- Analysis of classification models supported cookery prediction exploitation machine learning (2017). The correlation between numerous recipes and their ingredient sets were investigated with the assistance of common classification techniques. The tests were conducted on the dataset compiled from numerous sources additionally the accuracy of classifiers want to predict the cuisines were also and compared.
- A hybrid recommendation system considering visual info for predicting favorite restaurants (2017). during this paper, particularly investigate the influence of visual info, i.e., photos taken by customers and placed on blogs, on predicting favorite restaurants for any given user. It offers the visual info effectively aids favorite eating place prediction.
- Machine learning primarily based food direction recommendation system (2018). In this, they use similarity techniques of user primarily based approach and introduce fastened size neighborhood and threshold-based neighborhood to identical. The performance for the Allrecipe knowledge set is found to be higher than the simulated dataset since there are additional range of interactions between users and things.
- Recommendation system supported item and user similarity on restaurants directory on-line (2018). It merges the item similarity and user similarity options to come up with recommendations. analysis shows that the advice system supported item similarity yields higher F1-measure price once examination to user similarity.
- Comparing filtering techniques in restaurant recommendation system (2018). This paper aims to predict restaurants. It results have shown that hybrid filtering outperforms content-based filtering using regression model and collaborative filtering using cluster-based technique.
- Recipe Recommendation System Mistreatment Machine Learning Models (2019). they need used 2 machine learning models-vector house model and Word2Vec model to seek out prime ingredient pairs from completely different cuisines and to counsel alternate ingredients. the main

focus is on the Indian culinary art. Indian culinary art is incredibly Brobdingnagian and various and therefore it's tough to seek out patterns and generate pairs.

- Sentiment analysis of eating house reviews mistreatment machine learning techniques (2019). This paper chiefly focuses on the implementation of varied classification algorithms and their performance analysis. The simulation results showed that SVM classifier resulted within the highest accuracy of ninety-four.56% for the given dataset.
- Restaurant Recommendation System for User Preference and Services supported Rating and Amenities (2019). the present paper proposes a machine learning algorithm to resolve the difficulty of customized eating house choice. The results reveal that the advised approach yields high accuracy.
- Restaurant Recommendation System Victimization Machine Learning (2020). during this paper, consistent with the characteristics of eating house recommender systems. It proposes a machine learning algorithm to resolve the problems of customized eating house choice relying upon yelp information.

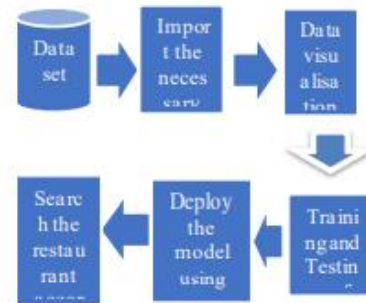
2.1 EXISTING SYSTEM

From the on top of literature survey, we've inferred that they need developed a counselled system simply to look for food. However, the quality considerably will increase once food recommender systems got to take into consideration the preferences of all cluster members and methods for achieving the accord among cluster members.

2.2 PROPOSED SYSTEM

We are proposing a system, which uses streamlit to develop a small web app. Our main aim is to build a restaurant recommendation system that provides personalized restaurant recommendations to users. Since different people have different food preferences and dietary restrictions, we perform careful feature selection to take advantage of the information reflected in a user's reviews.

3. SYSTEM ARCHITECTURE



4. METHODOLOGY

- ✓ Sklearn- Scikit Learn additionally called sklearn could be a free code machine learning library for python programming. It offers varied classification, clustering, regression machine learning algorithms. during this it's used for mercantile machine learning models, get accuracy, get confusion matrix.
- ✓ Pandas- Pandas could be a quick, powerful, versatile and easy to use, engineered on prime of the Python programming language. It is open source used for knowledge analysis and manipulation tool. In this, it's accustomed scan the dataset.
- ✓ Matplotlib- Matplotlib could be a plotting library for the Python programming language.

and its numerical mathematical extension NumPy. In this, it's used for knowledge visualization.

- ✓ NumPy- Numpy could be a python library used for working with arrays. It additionally has functions for domain of algebra, fourier rework, and matrices. Numpy stands for Numerical Python. In this it's accustomed amendment 2-dimensional array into contiguous planate array.
- ✓ Streamlit is a associate degree ASCII text file Python library that produces it straightforward to make and share lovely, custom internet apps for machine learning and information science. in only a number of minutes you'll be able to build and deploy powerful information apps. The best issue concerning Streamlit is it does not need any data of internet development.
- ✓ Seaborn could be a library for creating applied mathematics graphics in Python. it's designed on prime of matplotlib and closely integrated with pandas knowledge structures. It aims to form visual image a central a part of exploring and understanding knowledge.

MATRIX FACTORIZATION

Matrix factoring could be a category of cooperative filtering algorithms employed in recommender systems. Matrix factoring algorithms work by moldering the user-item interaction matrix into the merchandise of 2 lower spatiality rectangular matrices.

we've got 2 matrixes (user-features, business-features) that we are able to multiply to predict the ratings that a user offers to a building. Later, we want to update the values within the options of our 2 matrixes consistent with the Error.

To optimize the predictions, we want to calculate the error mistreatment the operate below.

$$\min_{P,Q} \sum_{(i,x) \in R} (r_{xi} - q_i \cdot p_x^T)^2$$

Given P is that the users-features matrix and letter of the alphabet is that the business-features matrix. If we tend to deduct the important ratings (r) with the expected ratings (P.Q) and that we sq. it, we tend to get the LSE(Least sq. Error).

To avoid overfitting, we've got to feature regularization to our LSE formula and it'll become the formula written below.

$$\min_{P,Q} \underbrace{\sum_{(i,x) \in R} (r_{xi} - q_i \cdot p_x^T)^2}_{\text{"error"}} + \lambda \left[\underbrace{\sum_x \|p_x\|^2}_{\text{"length"}} + \sum_i \|q_i\|^2 \right]$$

We apply the equation to reduce the error mistreatment Gradient good to update the values of every feature in matrix P and matrix letter of the alphabet.

Project contain three components:

1. Data set assortment
 2. Train and check the model.
 3. Deploy the model mistreatment streamlit.
- ✓ **Dataset assortment:** - we tend to had collected dataset from kaggle notebooks. The dataset contains userid, review, ratings. It contains 192609 rows.
 - ✓ **Train and test method:** - we had used a machine algorithm to train the model and a fter training, we had tested the model.

- ✓ **Deploy the model using streamlit:** - In this we have created a web application to search the restaurant according to customers tastes and also it shows some recommendations according to the reviews and rating.

5.RESULTS

Our web application is used to find the restaurants based on user's taste. It can be accessed by anyone from anyplace if they have network. we perform careful feature selection to take advantage of the information reflected in a user's rating.



Fig 1 Anaconda prompt



Fig 2 Web Application



Fig 3 Output

6. CONCLUSION

In this project, we developed a web app which recommend the restaurant based on the choice of your interest. This is used for the users to predict the suitable and best restaurant as per their tastes. The content based filtering and collaborative based filtering makes the recommendation more efficient so that the each user can use this application for their easy prediction of restaurant.

REFERENCES

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- [10] Yelp, www.yelp.com/academicdataset, Yelp academic dataset.

C. SOURCE CODE

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import TfidfVectorizer
from nltk.corpus import stopwords
from nltk.tokenize import WordPunctTokenizer
import streamlit as st

import warnings
warnings.filterwarnings('ignore')
st.write(""" # Restaurent Recommendation App
This app predicts that *the best restaurents according to your
need*
""")

df = pd.read_csv(r'yelp_review_arizona.csv')
df_business = pd.read_csv(r'yelp_business.csv')
df.Head()

#select only stars and text
yelp_data = df[['business_id', 'user_id', 'stars', 'text']]

import nltk
nltk.download('stopwords')

import string
from nltk.corpus import stopwords
stop = []
for word in stopwords.words('english'):
    s = [char for char in word if char not in string.punctuation]
```

```

stop.Append("".Join(s))

def text_process(mess):
    """
    Takes in a string of text, then performs the following:
    1. Remove all punctuation
    2. Remove all stopwords
    3. Returns a list of the cleaned text
    """

    #check characters to see if they are in punctuation
    nopunc = [char for char in mess if char not in string.Punctuation]

    #Join the characters again to form the string.
    nopunc = "".join(nopunc)

    #Now just remove any stopwords
    return " ".join([word for word in nopunc.split() if word.lower()
not in stop])
yelp_data['text'] = yelp_data['text'].apply(text_process)

vld_size=0.15

X_train, X_valid, y_train, y_valid = train_test_split(yelp_data['text'],
df['business_id'], test_size = vld_size)

userid_df = yelp_data[['user_id','text']]

business_df = yelp_data[['business_id','text']]

userid_df = userid_df.groupby('user_id').agg({'text': ' '.join})

business_df = business_df.groupby('business_id').agg({'text': ' '.join})

from sklearn.feature_extraction.text import TfidfVectorizer

```

```
userid_vectorizer=TfidfVectorizer(tokenizer=WordPunctTokenizer().tokenize,
max_features=5000)
```

```
userid_vectors = userid_vectorizer.fit_transform(userid_df['text'])
```

```
businessid_vectorizer=TfidfVectorizer(tokenizer=
WordPunctTokenizer().tokenize, max_features=5000)
```

```
businessid_vectors= businessid_vectorizer.fit_transform(business_df['text'])
```

```
userid_rating_matrix      =      pd.pivot_table(yelp_data,      values='stars',
index=['user_id'], columns=['business_id'])
```

```
P=pd.DataFrame(userid_vectors.toarray(),      index=userid_df.index,
columns=userid_vectorizer.get_feature_names())
```

```
Q=pd.DataFrame(businessid_vectors.toarray(),      index=business_df.index,
columns=businessid_vectorizer.get_feature_names())
```

```
def matrix_factorization(R, P, Q, steps=25, gamma=0.001,lamda=0.02):
```

```
    for step in range(steps):
```

```
        for i in R.index:
```

```
            for j in R.columns:
```

```
                if R.loc[i,j]>0:
```

```
                    eij=R.loc[i,j]-np.dot(P.loc[i],Q.loc[j])
```

```
                    P.loc[i]=P.loc[i]+gamma*(eij*Q.loc[j]-lamda*P.loc[i])
```

```
                    Q.loc[j]=Q.loc[j]+gamma*(eij*P.loc[i]-lamda*Q.loc[j])
```

```
                    e=0
```

```
            for i in R.index:
```

```
                for j in R.columns:
```

```
                    if R.loc[i,j]>0:
```

```
                        e=      e      +      pow(R.loc[i,j]-
```

```
np.dot(P.loc[i],Q.loc[j]),2)+lamda*(pow(np.linalg.norm(P.l
```

```
oc[i]),2)+pow(np.linalg.norm(Q.loc[j]),2))
```

```

        if e<0.001:
            break

    return P,Q

Q.iloc[0].sort_values(ascending=False).head(10)

# Store P, Q and vectorizer in pickle file
import pickle
output = open('yelp_recommendation_model_8.pkl', 'wb')
pickle.dump(P,output)
pickle.dump(Q,output)
pickle.dump(userid_vectorizer,output)
output.close()

#dynamic input
st.write("your search please!")
words = st.text_input("Enter text")
test_df= pd.DataFrame([words], columns=['text'])
test_df['text'] = test_df['text'].apply(text_process)
test_vectors = userid_vectorizer.transform(test_df['text'])
test_v_df = pd.DataFrame(test_vectors.toarray(),
index=test_df.index,
columns=userid_vectorizer.get_feature_names())
predictItemRating=pd.DataFrame(np.dot(test_v_df.loc[0],
Q.T),index=Q.index,columns=['Rating'])
topRecommendations=pd.DataFrame.sort_values(predict
ItemRating,['Rating'],ascending=[0]):7]
for i in topRecommendations.index:
st.write(df_business[df_business['business_id']==i]['name
'].iloc[0])
st.write(df_business[df_business['business_id']==i]['categ
ories'].iloc[0])

```

```
st.write(str(df_business[df_business['business_id']==i]['stars'].iloc[0])+  
'+str(df_business[df_business['business_id']==i]['review_count'].iloc[0]))  
st.write("")
```