



**PUNE INSTITUTE OF COMPUTER TECHNOLOGY, PUNE - 411043**

**Department of Computer Engineering**  
**S.No.-27, Pune Satara Road, Dhankawadi, Pune-411043**

**Project Based Learning-II (AY 2021-22)**

**Batch-G2          Sem-II**

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Sign:

Date:

Title of project

**“DVSAM: Restaurant Recommender System”**



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**CERTIFICATE**

This is to certify that the work incorporated in the report entitled “**DVSAM: Restaurant Recommender System**” is carried out by Mr. Siddhesh Sarang Pande (Roll No-21260), who is part of a group of students for Project under the subject **Project Based Learning** during A.Y. **2021-22**.

Such material has not been submitted to any other University/ Institute for any financial support. The literature related to the problem investigated has been appropriately cited and duly acknowledged wherever facilities and suggestions have been availed of.

**Date: 12/05/2022**

**Name & Sign of Project Guide**

**Place: PUNE**

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**Prof. Rutuja Kulkarni**

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**Name & Sign of PBL Coordinator**

**Name & Sign of Head of Department**



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Finally, I would also like to thank my parents and friends who helped me a lot in finalizing this project within the limited time frame.

**Place: Pune**

**Name of Student (In capital) & Sign**

**SIDDHESH SARANG PANDE**



# **DVSAM: Restaurant Recommender System**

## **Introduction:**

Recommendation systems are a subclass of information filtering systems that seek to predict the "rating" or "preference" a user would give to an item. Several fields like entertainment, music and social media are currently exploiting the potential of machine learning recommender systems that help grow their respective businesses. Some commonly recognized forms of recommender systems are playlist generators, product recommenders for online stores as well as online dating. Recommenders for exploring research articles, collaborators and financial services have also been developed.

Recommender Systems are broadly classified into two types:

### **1. Collaborative Filtering:**

This method is purely based on the past interactions between customers and targeted products. The historical data is stored and scraped from the internet to explore the likings as well as disliking of different users.

This method lacks in considering present trends and culture as it solely depends on historical data and nothing else. However, it can recommend more personal recommendations as it analyses a customer's individual preferences.

### **2. Content-based Filtering:**

This method of recommendation generation employs additional information about the customer as well as the product. For better predictions and analysis, the algorithm takes into consideration information like date of birth, sex, region, linguistic preference, marital status, etc.

## **Motivation:**

Food is the basic requirement for any individual across all ages. It represents values, traditions, and culture of various segments of the population. However, the working class of people who move out of their hometowns find it difficult to track their own culture as well as explore other traditions and customs.

A restaurant recommender system helps users to satisfy their culinary needs and explore new cuisines and restaurants. It also helps restaurants to gain fame and grow as individual businesses. This type of recommender systems can also help individuals who travel a lot find restaurants and diners according to their tastes and preferences.

This project uses a dataset scraped and compiled by the popular food delivery system Zomato reviewing and crowd-sourcing platform Yelp and exploits data generated by millions of users living in and near the city of Pune.



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## Objective:

The objective of this project is to provide quality restaurant recommendations for individuals across ages, culture, locality, and economic status. To measure the quality of recommendations we have used data from students in PICT to rate the recommendations from our model.

It is also proposed to help restaurants gain recognition via our website and uncover hidden gems in and around Pune. In our society, there are people who like to explore restaurants and diners and post their likings on social media platforms like Yelp. Our algorithms can scrape the data from these platforms and process it to form our own database to provide quality results for the users. In turn, restaurants also gain followers via social media influencers.

## Scope of Project and Intended Audience:

Our project exploits crowd-sourced data to generate recommendations. It is therefore limited to areas in and near the city of Pune. The project can be used by residents of Pune as well as visitors of Pune to get quality recommendations from our website.



## **Overall Description**

### **Functional Requirements:**

The following are the functional requirements for accessing our website:

- 1) For computers or laptops:
  - a) Internet connectivity.
  - b) Web browser like Google Chrome, Microsoft Edge, etc.
  - c) Intel i3 8<sup>th</sup> Gen Processor.
  - d) 4GB RAM.
- 2) For mobile devices:
  - a) Internet connectivity.
  - b) Web browser.
- 3) For hosting website:
  - a) Heroku application and account.
  - b) Heroku command line interface
  - c) Local Git Repository.
  - d) Python libraries of Django for Back-end
  - e) HTML, CSS and Bootstrap for Front-end.

### **Non-Functional Requirements:**

The following are the non-functional requirements we have met while creating this project:

- 1) Security: Django offers tokens to make sure that data cannot be tampered with while sending it to and from the backend and frontend sections of the web application.
- 2) Speed: We have used optimized Sci-Kit Learn and Pandas libraries and used concepts of OOP to improve the reaction speed of our web application.
- 3) Portability: Our web application has been created considering individuals accessing the website from numerous devices and has responsive features to improve user experience.

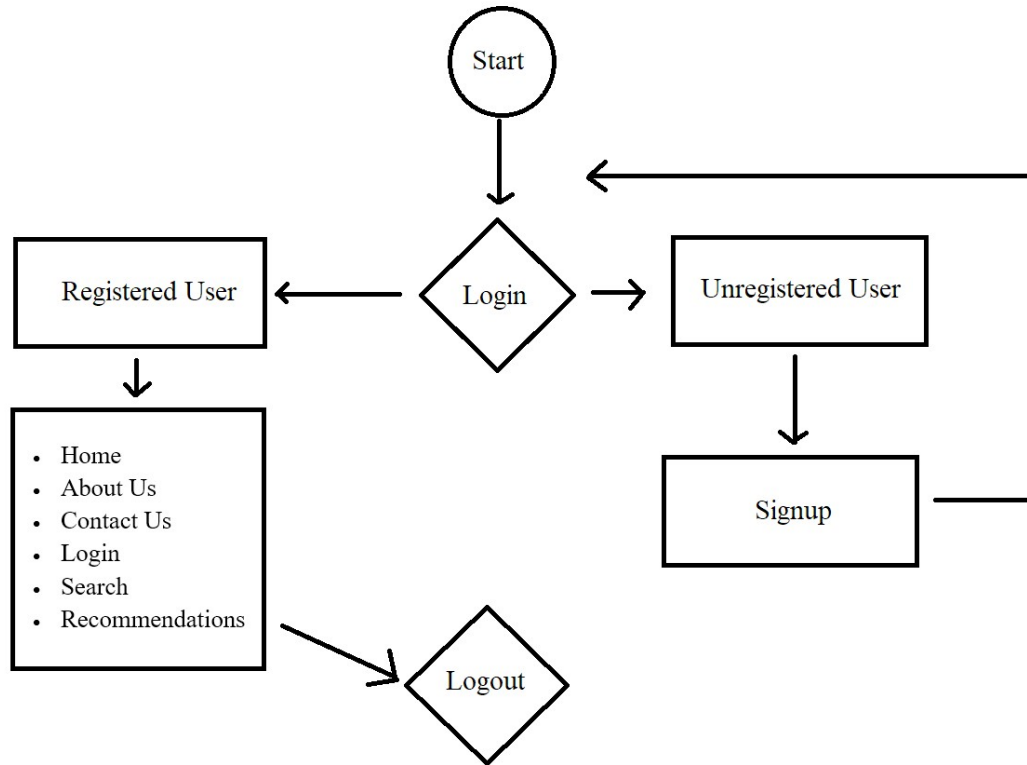
### **Operating Environment:**

We have used the following tech-stack for our project:

- 1) Back-end: Django
- 2) Front-end: HTML, CSS, Bootstrap
- 3) Machine Learning: Python, Pandas, Sci-Kit Learn
- 4) Database: SQLite (in-built)
- 5) Intel i7 10<sup>th</sup> Gen Processor
- 6) Windows 10 Operating System.



## Flowchart:



## Implementation Details:

### 1) Cleaning:

Before implementing any machine learning algorithm, the data gathered by Zomato had to be cleaned in order to explore it.

	Restaurant_Name	Web_Link	Locality	Sponsored	Ratings_out_of_5	Number of votes	Phone_number	Cuisines	Charges_for_two
0	AB's - Absolute Barbecues	<a href="https://www.zomato.com/pune/abs-absolute-barbe-">https://www.zomato.com/pune/abs-absolute-barbe-</a>	Hinjawadi	Casual Dining	4.9	7029 votes	+91 9373112211	Continental, North Indian, Chinese	₹1,400
1	Cafe Co2 Resto Lounge	<a href="https://www.zomato.com/pune/cafe.co2-resto-lou-">https://www.zomato.com/pune/cafe.co2-resto-lou-</a>	Rhugaon	Lounge, Casual Dining	4.6	2578 votes	060 46971866	North Indian, Chinese, Continental, Kebab, Sika	₹1,500
2	Paasha - JW Marriott Pune	<a href="https://www.zomato.com/pune/paasha-jw-marriott-">https://www.zomato.com/pune/paasha-jw-marriott-</a>	Senapati Bapat Road	Fine Dining	4.6	3291 votes	060 46971309	North Indian, Kebab, Biryani	₹2,500
3	I Amsterdam	<a href="https://www.zomato.com/pune/i-amsterdam-hinjawadi">https://www.zomato.com/pune/i-amsterdam-hinjawadi</a>	Hinjawadi	Casual Dining, Bar	4.3	430 votes	+91 8669698090 +91 8669697090	Asian, European, Modern Indian, Italian	₹1,400
4	FC Road Social	<a href="https://www.zomato.com/pune/fc-road-social-shi-">https://www.zomato.com/pune/fc-road-social-shi-</a>	Shivaji Nagar	Bar, Casual Dining	4.5	2138 votes	+91 9172378889 020 29805112	North Indian, Chinese, Biryani, American, Cont...	₹1,500

Fig 1.1: Uncleaned Zomato Data



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During cleaning, the pseudo-numeric values were converted to numeric values and unrelated columns were dropped.

	Restaurant_Name	Web_Link	Locality	Ratings_out_of_5	Cuisines	Charges_for_two
0	AB's - Absolute Barbecues	<a href="https://www.zomato.com/pune/abs-absolute-barbe...">https://www.zomato.com/pune/abs-absolute-barbe...</a>	Hinjawadi	4.9	Continental, North Indian, Chinese	1400.0
1	Cafe Co2 Resto Lounge	<a href="https://www.zomato.com/pune/cafe-co2-resto-lou...">https://www.zomato.com/pune/cafe-co2-resto-lou...</a>	Bhugaon	4.6	North Indian, Chinese, Continental, Kebab, Sea...	1500.0
2	Paasha - JW Marriott Pune	<a href="https://www.zomato.com/pune/paasha-jw-marriott...">https://www.zomato.com/pune/paasha-jw-marriott...</a>	Senapati Bapat Road	4.6	North Indian, Kebab, Biryani	2500.0
3	I Amsterdam	<a href="https://www.zomato.com/pune/i-amsterdam-hinjawadi">https://www.zomato.com/pune/i-amsterdam-hinjawadi</a>	Hinjawadi	4.3	Asian, European, Modern Indian, Italian	1400.0
4	FC Road Social	<a href="https://www.zomato.com/pune/fc-road-social-shi...">https://www.zomato.com/pune/fc-road-social-shi...</a>	Shivaji Nagar	4.5	North Indian, Chinese, Biryani, American, Cont...	1500.0
...	...	...	...	...	...	...
12184	Nil Food Point	<a href="https://www.zomato.com/pune/nil-food-point-hin...">https://www.zomato.com/pune/nil-food-point-hin...</a>	Hinjawadi	0.0	Chinese	0.0
12185	Flirty Momo	<a href="https://www.zomato.com/pune/flirty-momo-kharadi">https://www.zomato.com/pune/flirty-momo-kharadi</a>	Kharadi	0.0	Mongolian, Pizza, Chinese, Beverages	0.0
12186	Hunger Treat	<a href="https://www.zomato.com/pune/hunger-treat-katraj">https://www.zomato.com/pune/hunger-treat-katraj</a>	Katraj	0.0	South Indian, Fast Food, Chinese	300.0
12187	Bungalow 424	<a href="https://www.zomato.com/pune/bungalow-424-kothrud">https://www.zomato.com/pune/bungalow-424-kothrud</a>	Kothrud	0.0	North Indian, Fast Food, Continental	1200.0
12188	Desi Shakes By KB	<a href="https://www.zomato.com/pune/desi-shakes-by-kb-...">https://www.zomato.com/pune/desi-shakes-by-kb-...</a>	Bavdhan	0.0	Beverages	200.0

Fig 1.2: Cleaned data

### 2) Creating user profile to restaurant relation data:

To implement collaborative filtering, a relational dataset is required which maps users to their rated restaurants. This data was collected via google forms from 500 students of PICT. The students filled the restaurant names from the list of restaurants in the Zomato dataset and assigned ratings as per their choice.

	user_id	rest_name	rating
0	0	Southern Spice	3
1	0	Cafe Little Eggs	4
2	0	Indori Sarafa	3
3	0	Hotel Aamantran	4
4	0	Hotel Satkar	2
...	...	...	...
18918	500	The Hunger Point	0
18919	500	Woods Villa Family Restaurant	4
18920	500	Thali Junction Lonavala	3
18921	500	Cafe iSuite	1
18922	500	Hotel Trishna	0

18923 rows × 3 columns

Fig 2.1: Mapped data





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#### 3) Pivoting dataset to generate matrix:

The data set was pivoted to generate a matrix of restaurant name to restaurant name to implement cosine similarity model.

rest_name	#PFC-Pocket Friendly Cafe	#Selfieccino	#TAG Cafe	#TFT	.Cafe Farm House	1 Lounge and Restaurant	1 More Biryani	100 Rupis.com Burgers & More	100° Resto Lounge	103- Shanghai Express	...	Zucchini Bell	Zumo Bar	Zuni's Express	che-GUEVARA CHEESE	eat HEALTHY
user_id																
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
496	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
497	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
498	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
499	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0
500	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0

501 rows × 8634 columns

Fig 3.1: Mapping of restaurant users to all the restaurants (Pivot Table)

#### 4) Standardizing Data:

The pivot table was standardized in order to eliminate harsh ratings, non-rated restaurants and un-visited restaurants in the table.

rest_name	#PFC-Pocket Friendly Cafe	#Selfieccino	#TAG Cafe	#TFT	.Cafe Farm House	1 Lounge and Restaurant	1 More Biryani	100 Rupis.com Burgers & More	100° Resto Lounge	103- Shanghai Express	...	Zucchini Bell	Zumo Bar	Zuni's Express	ch GUEVARA CHEESE
user_id															
0	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
1	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
2	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
3	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
4	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
496	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
497	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
498	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
499	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996
500	-0.003194	-0.001996	-0.001996	0.0	0.0	-0.003327	-0.00479	-0.001996	-0.001996	-0.003593	...	-0.004657	-0.001996	-0.001996	-0.001996

501 rows × 8634 columns

Fig 4.1: Standardized form of user-to-restaurant mapping.



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#### 5) Creating Similarity Table:

The pivot table was used to create a similarity table using cosine similarity module of Sci-Kit Learn library. Using this we received a 2-D array which contained similarity between restaurants on the basis of the users (students) who rated them.

rest_name	#PFC-Pocket Friendly Cafe	#Selfieccino	#TAG Cafe	#TFT	.Cafe Farm House	1 Lounge and Restaurant	1 More Biryani	100 Rupis.com Burgers & More	100° Resto Lounge	103-Shanghai Express	...	Zucchini Bell	Zumo Bar	Zuni's Express
rest_name														
#PFC-Pocket Friendly Cafe	1.000000	-0.002746	-0.002746	0.0	0.0	-0.003812	-0.004870	-0.002746	-0.002746	-0.003864	...	-0.004417	-0.002746	-0.002746
#Selfieccino	-0.002746	1.000000	-0.002000	0.0	0.0	-0.002776	-0.003546	-0.002000	-0.002000	-0.002814	...	-0.003217	-0.002000	-0.002000
#TAG Cafe	-0.002746	-0.002000	1.000000	0.0	0.0	-0.002776	-0.003546	-0.002000	-0.002000	-0.002814	...	-0.003217	-0.002000	-0.002000
#TFT	0.000000	0.000000	0.000000	0.0	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000
.Cafe Farm House	0.000000	0.000000	0.000000	0.0	0.0	0.000000	0.000000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
eat.fit	-0.003849	-0.002803	-0.002803	0.0	0.0	-0.003890	0.469254	-0.002803	-0.002803	-0.003943	...	-0.004508	-0.002803	-0.002803
foods@99.in	-0.002746	-0.002000	-0.002000	0.0	0.0	-0.002776	-0.003546	-0.002000	-0.002000	-0.002814	...	-0.003217	-0.002000	-0.002000
ibaco	-0.002746	-0.002000	-0.002000	0.0	0.0	-0.002776	-0.003546	-0.002000	-0.002000	-0.002814	...	-0.003217	-0.002000	-0.002000
चमMuch Misal & Pav Bhaji House	-0.003688	-0.002685	-0.002685	0.0	0.0	-0.003727	-0.004761	-0.002685	-0.002685	-0.003778	...	0.304825	-0.002685	-0.002685
सोBar	-0.004492	-0.003271	-0.003271	0.0	0.0	-0.004541	-0.005801	-0.003271	-0.003271	-0.004603	...	-0.005262	-0.003271	-0.003271

8634 rows × 8634 columns

Fig 5.1: Similarity Table

#### 6) Getting similar restaurants:

To get similar restaurants, similarity scores of the given restaurant were calculated based on its user rating. Sorting the restaurants in the descending order, the top 10 restaurants were considered as the best recommendations. On doing this for all the restaurants that a particular user has rated, the compiled list of recommendations is sorted again to give overall recommendations.

```
x.get_restaurant({'Rai Mess And Litti Chokha': 3})
```

	Restaurant_Name	Web_Link	Locality	Ratings_out_of_5	Cuisines	Charges_for_two
6942	Sai Snacks - Sai Loni Dosa	<a href="https://www.zomato.com/pune/sai-snacks-sai-lon...">https://www.zomato.com/pune/sai-snacks-sai-lon...</a>	Shivaji Nagar	0.0	South Indian	200.0
10164	Ratnamala Restaurant	<a href="https://www.zomato.com/pune/ratnamala-restaura...">https://www.zomato.com/pune/ratnamala-restaura...</a>	Narhe	0.0	Maharashtrian, North Indian	400.0
4598	Asian Harbour - Vivanta Pune	<a href="https://www.zomato.com/pune/asian-harbour-viva...">https://www.zomato.com/pune/asian-harbour-viva...</a>	Hinjawadi	4.0	Asian	1800.0
2719	Cafe Bistro	<a href="https://www.zomato.com/pune/cafe-bistro-satara...">https://www.zomato.com/pune/cafe-bistro-satara...</a>	Satara Road	3.9	Cafe	500.0
8861	FoodXD	<a href="https://www.zomato.com/foodxd">https://www.zomato.com/foodxd</a>	SB Road - Aundh	3.5	North Indian, Fast Food	0.0
5804	Hotel Dhangarwada	<a href="https://www.zomato.com/pune/hotel-dhangarwada-...">https://www.zomato.com/pune/hotel-dhangarwada-...</a>	Hadapsar	0.0	Maharashtrian, North Indian, Chinese	500.0
4139	Dream Kitchen	<a href="https://www.zomato.com/pune/dream-kitchen-1-ha...">https://www.zomato.com/pune/dream-kitchen-1-ha...</a>	Hadapsar	0.0	Maharashtrian, South Indian, North Indian	0.0
11851	Cafe Taiba	<a href="https://www.zomato.com/pune/cafe-taiba-camp-area">https://www.zomato.com/pune/cafe-taiba-camp-area</a>	Camp Area	3.3	North Indian, Mughlai, Hyderabadi, Chinese	450.0
4010	Shivprasad Restaurant	<a href="https://www.zomato.com/pune/shivprasad-restaur...">https://www.zomato.com/pune/shivprasad-restaur...</a>	Bavdhan	3.5	North Indian, Chinese	500.0
11949	Shivam Tandoori Special	<a href="https://www.zomato.com/pune/shivam-tandoori-sp...">https://www.zomato.com/pune/shivam-tandoori-sp...</a>	Pimple Saudagar	3.5	Chinese, North Indian, Kebab	300.0

Fig 6.1: Compiled list of similar restaurants for Rai Mess and Litti Chokha.

```
x.get_restaurant({"eat HEALTHY": 3, 'eat.fit': 4})
```

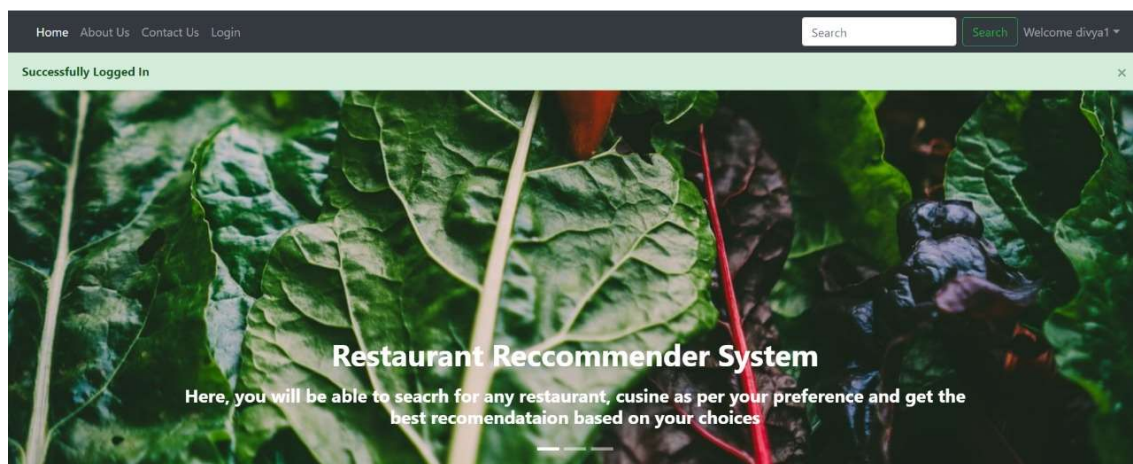
	Restaurant_Name	Web_Link	Locality	Ratings_out_of_5	Cuisines	Charges_for_two
7685	Seven Spices	https://www.zomato.com/pune/seven-spices-chand...	Chandan Nagar	0.0	Chinese, Fast Food, Juices	300.0
11078	Manmohan Panipuri	https://www.zomato.com/pune/manmohan-panipuri-...	Shukrawar Peth	3.2	Street Food	200.0
977	MRP	https://www.zomato.com/pune/mrp-kalyani-nagar	Kalyani Nagar	4.1	Continental, Italian, Chinese, North Indian	1400.0
1232	Hyderabadi Royal Biryani	https://www.zomato.com/pune/hyderabadi-royal-b...	Kharadi	3.5	Biryani, North Indian	500.0
10619	Foodies Nest	https://www.zomato.com/pune/foodies-nest-pimpl...	Pimple Saudagar	0.0	Fast Food	0.0
9673	Foodcast	https://www.zomato.com/pune/foodcast-kharadi	Kharadi	0.0	Chinese, Fast Food	0.0
2383	Chulangan Restaurant	https://www.zomato.com/pune/chulangan-restaura...	Kharadi	3.4	North Indian, Maharashtrian	650.0
3543	Aunty's Kitchen	https://www.zomato.com/pune/auntys-kitchen-dha...	Dhankawadi	3.4	North Indian	200.0
7635	Hotel Mayur Misal House	https://www.zomato.com/pune/hotel-mayur-misal-...	Pimple Gurav	0.0	Street Food	100.0
12152	Good Food Corner	https://www.zomato.com/pune/good-food-corner-k...	Karve Nagar	0.0	Fast Food	0.0

Fig 6.4: Compiled list of similar restaurants for multiple restaurants.

#### 7) Displaying data on webpages:

The data from machine learning model was used in Django back-end framework to show the data in graphical format on the users' screen.

- Django User model stores data in the form of 10 variables to store the restaurant names and ratings of the last five restaurants the user has rated.
- This data is sent to the machine learning model in the form of dictionaries.
- The data is retrieved in the form of Django data frame which is passed to the front-end via *json records* encoded as a context dictionary.
- Django also allowed the use of python statements in HTML pages to loop and print all the data in the json record on a HTML page.
- The HTML pages were designed using CSS code and Bootstrap framework.



Featuring!

Fig 7.1: Home page of Website




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**Department of Computer Engineering**

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Home About Us Contact Us Login

## Login



Sign into your account

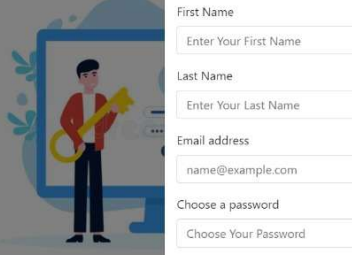
[Forgot Password](#)

Don't have an Account ?

Fig 7.2: Login page for Users.

Home About Us Contact Us Login

## Login



SignUp Here

Username

First Name

Last Name

Email address

Choose a password

Confirm Password

Fig 7.3: Sign Up page for Users.



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## **Conclusion**

The objective of this study was to recommend quality recommendations to users by using their history and ratings by using a web-based interface.

The collaborative filtering approach to recommendation systems also ensures that user privacy is maintained as similar users are recommended restaurants that they might like based on crowd-sourced models. The only data used by the recommender system being the rating that the users have given to the restaurants. Unlike content-based filtering, the complex logic to assign weights to different features of a particular restaurant is abstracted in collaborative filtering and therefore makes it more efficient for application and prediction of restaurants.

The future of this project has a lot of potential to be a successful platform to search for restaurants. The restaurants recommended will have better quality if more data can be obtained by making the system learn from real-time data. To implement such a system would be a Herculean task but worth the time and money spent on it.