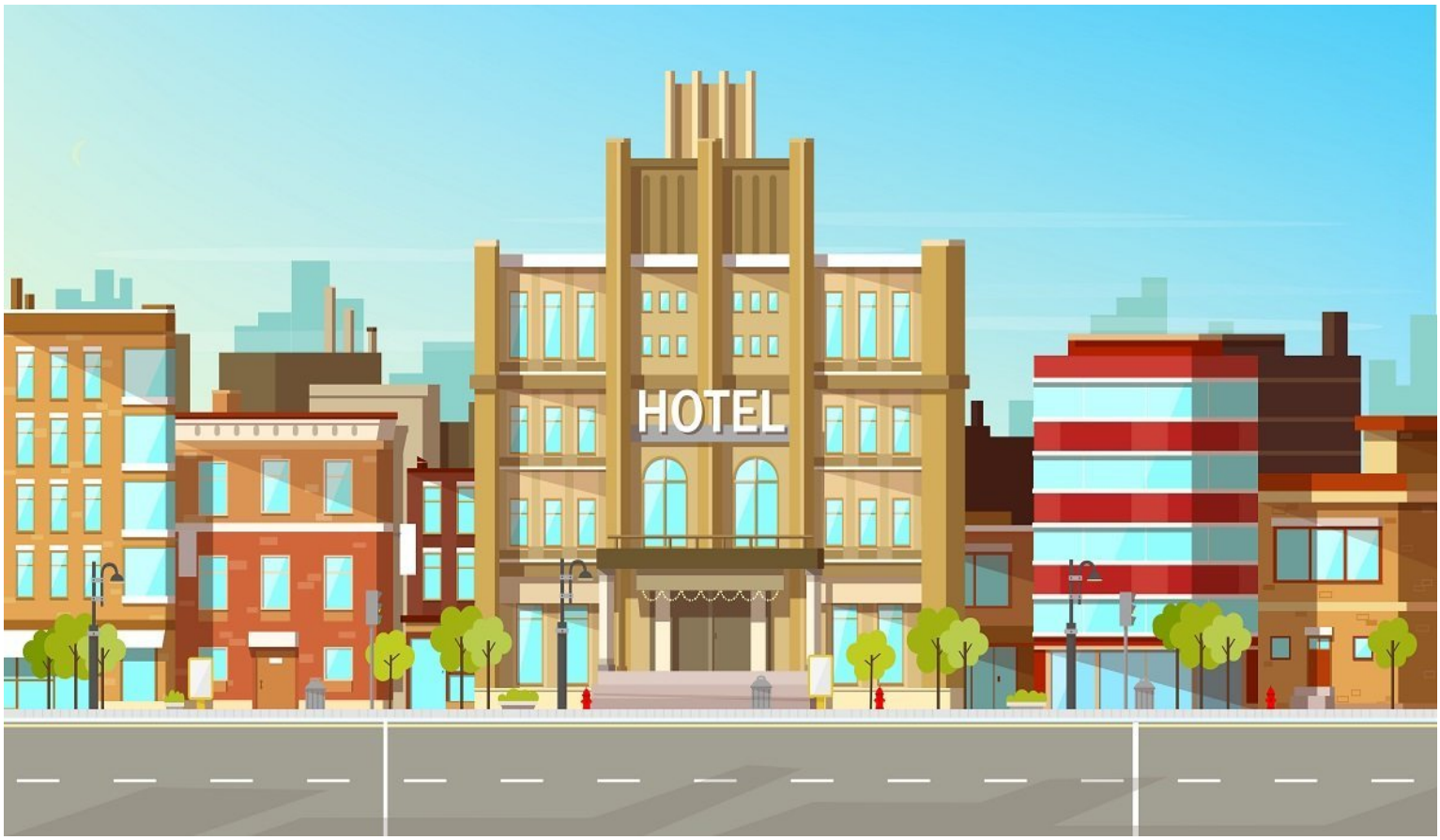
Hotel Recommendation System

by Deepu singh



M.TECH
IN DATA AND COMPUTATION SCIENCE

Submitted by
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–
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॥ त्वं ज्ञानमयो विज्ञानमयोऽसि ॥

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Introduction

- Why Recommendation System Required: In today's data-driven world, it would be nearly impossible to follow the traditional heuristic approach to recommend millions of users an item that they would actually like and prefer.
  Hence, a Recommendation System solves our problem where it incorporates user's input, historical interaction, and sometimes even user's demographics to build an intelligent model to provide recommendations.

- Objective: In this report I will cover all the steps that are required to build a Hotel Recommendation System for the problem statement mentioned below. We will do an end-to-end implementation from data understanding and data pre-processing, and the logic used along with their codes.

- Problem Statement:

  Build a recommendation system providing hotel recommendations to users for a particular city they have searched for based on higher ratings.

DATA COLLECTION AND PREPARATION

- Data Analysis:
  I took two datasets according to my need which was hotel_details.csv and hotel_room_attributes.csv. In below snap you can see the columns and structure of Data

- hotel_details dataset:

[2]:

	id	hotelid	hotelname	address	city	country	zipcode	propertytype	starrating	latitude	longitude	Source	url	curr
0	46406	1771651	Mediteran Bungalow Galeb	Vukovarska 7	Omis	Croatia	21310.0	Holiday parks	4	43.440124	16.682505	2	https://www.booking.com/hotel/hr/bungalow-luxu...	EUR
1	46407	177167	Hotel Polonia	Plac Teatralny 5	Torun	Poland	NaN	Hotels	3	53.012329	18.603800	5	https://www.agoda.com/en-gb/hotel-polonia/hote...	EUR
2	46408	1771675	Rifugio Sass Bece	Belvedere del Pordoi,1	Canazei	Italy	38032.0	Hotels	3	46.477920	11.813350	2	http://www.booking.com/hotel/it/rifugio-sass-b...	EUR
3	46409	177168	Madalena Hotel	Mykonos	Mykonos	Greece	84600.0	Hotels	3	37.452316	25.329849	5	https://www.agoda.com/en-gb/madalena-hotel/hot...	EUR
4	46410	1771718	Pension Morenfeld	Mair im Korn Strasse 2	Lagundo	Italy	39022.0	Hotels	3	46.682780	11.131736	2	http://www.booking.com/hotel/it/pension-morenf...	EUR

- hotel_details_columns:

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 108048 entries, 0 to 108047
Data columns (total 14 columns):
 #   Column        Non-Null Count   Dtype
---  ------        --------------   -----
 0   id            108048 non-null  int64
 1   hotelid       108048 non-null  int64
 2   hotelname     108048 non-null  object
 3   address       102955 non-null  object
 4   city          108048 non-null  object
 5   country       108048 non-null  object
 6   zipcode       83486 non-null   float64
 7   propertytype  108048 non-null  object
 8   starrating    108048 non-null  int64
 9   latitude      108048 non-null  float64
 10  longitude     108048 non-null  float64
 11  Source        108048 non-null  int64
 12  url           107937 non-null  object
 13  curr          108048 non-null  object
dtypes: float64(3), int64(4), object(7)
memory usage: 11.5+ MB
```

- hotel_room_attributes datasets:

[3]:

	id	hotelcode	roomamenities	roomtype	ratedescription
0	50677497	634876	Air conditioning: ;Alarm clock: ;Carpeting: ;C...	Double Room	Room size: 15 m²/161 ft², Shower, 1 king bed
1	50672149	8328096	Air conditioning: ;Closet: ;Fireplace: ;Free W...	Vacation Home	Shower, Kitchenette, 2 bedrooms, 1 double bed ...
2	50643430	8323442	Air conditioning: ;Closet: ;Dishwasher: ;Firep...	Vacation Home	Shower, Kitchenette, 2 bedrooms, 1 double bed ...
3	50650317	7975	Air conditioning: ;Clothes rack: ;Coffee/tea m...	Standard Triple Room	Room size: 20 m²/215 ft², Shower, 3 single beds
4	50650318	7975	Air conditioning: ;Clothes rack: ;Coffee/tea m...	Standard Triple Room	Room size: 20 m²/215 ft², Shower, 3 single beds

- hotel_room_attributes columns:

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 165873 entries, 0 to 165872
Data columns (total 5 columns):
 #   Column           Non-Null Count   Dtype 
---  ------           --------------   ----- 
 0   id               165873 non-null  int64 
 1   hotelcode        165873 non-null  int64 
 2   roomamenities    161054 non-null  object
 3   roomtype         165873 non-null  object
 4   ratedescription  161054 non-null  object
dtypes: int64(2), object(3)
memory usage: 6.3+ MB
```

- Data Cleaning:

  For data cleaning first i have to decide what columns i need and after taking the selected columns i have to check if there is any null values or not if there is null values there could be multiple way to handel it. In my case i removed null values as it was present in address column so it become obvious to remove those rows because there is no sense to recommend hotel without address.(In below snap you can see that address column has null values)

[16]:
```
hotel_details.isnull().sum()
```

[16]:
```
hotelid          0
hotelname        0
address       5093
city             0
country          0
starrating       0
dtype: int64
```

- ## Column selection:
  After cleaning all the datasets actually i merged both the datasets and selected the column which was needed. In below snap you can see what columns i choosen.

Merging the dataframes

```
[27]: hotel_data=room_attributes_updated.merge(hotel_details_updated,on="hotelid")
      hotel_data.shape
```

```
[27]: (8669, 10)
```

```
[28]: hotel_data.head()
```

[28]:

	id	hotelid	roomamenities	roomtype	ratedescription	hotelname	address	city	country	starrating
0	50677497	634876	Air conditioning: ;Alarm clock: ;Carpeting: ;C...	Double Room	Room size: 15 m²/161 ft², Shower, 1 king bed	The Old Cider House	25 Castle Street	Nether Stowey	United Kingdom	4
1	50650317	7975	Air conditioning: ;Clothes rack: ;Coffee/tea m...	Standard Triple Room	Room size: 20 m²/215 ft², Shower, 3 single beds	Apollo Hotel London	64-66 Queensborough Terrace	London	United Kingdom	2
2	50678356	59961	Air conditioning: ;Closet: ;Daily housekeeping...	Single Room	Room size: 18 m²/194 ft², City view, Shower an...	Hotel Rivoli	Albert-Rosshaupter-Str. 18	Munich	Germany	3
3	50688956	6825	Air conditioning: ;Alarm clock: ;Bathrobes: ;C...	Comfort Single Room	Room size: 14 m²/151 ft², City view, Non-smoki...	Timhotel Tour Eiffel	11 rue Juge	Paris	France	3
4	50696476	1198059	Air conditioning: ;Closet: ;Coffee/tea maker: ...	Deluxe, Guest room, 1 Double	Room size: 25 m²/269 ft², City view, 2 single ...	AC Hotel Manchester Salford Quays	17-19 Trafford Road, Salford Quays	Manchester	United Kingdom	4

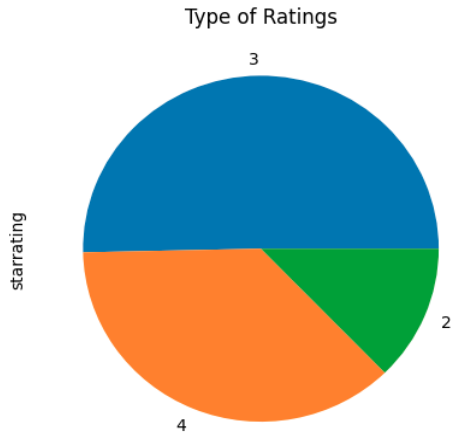
Data Visualization

Before Applying my logic i wanted to see my data attributes like which types of ratings are there how many countries are there and how many cities are there in a particular country according to my dataset. So that visualization graph you will see in below snaps.

- ## Types of Ratings:

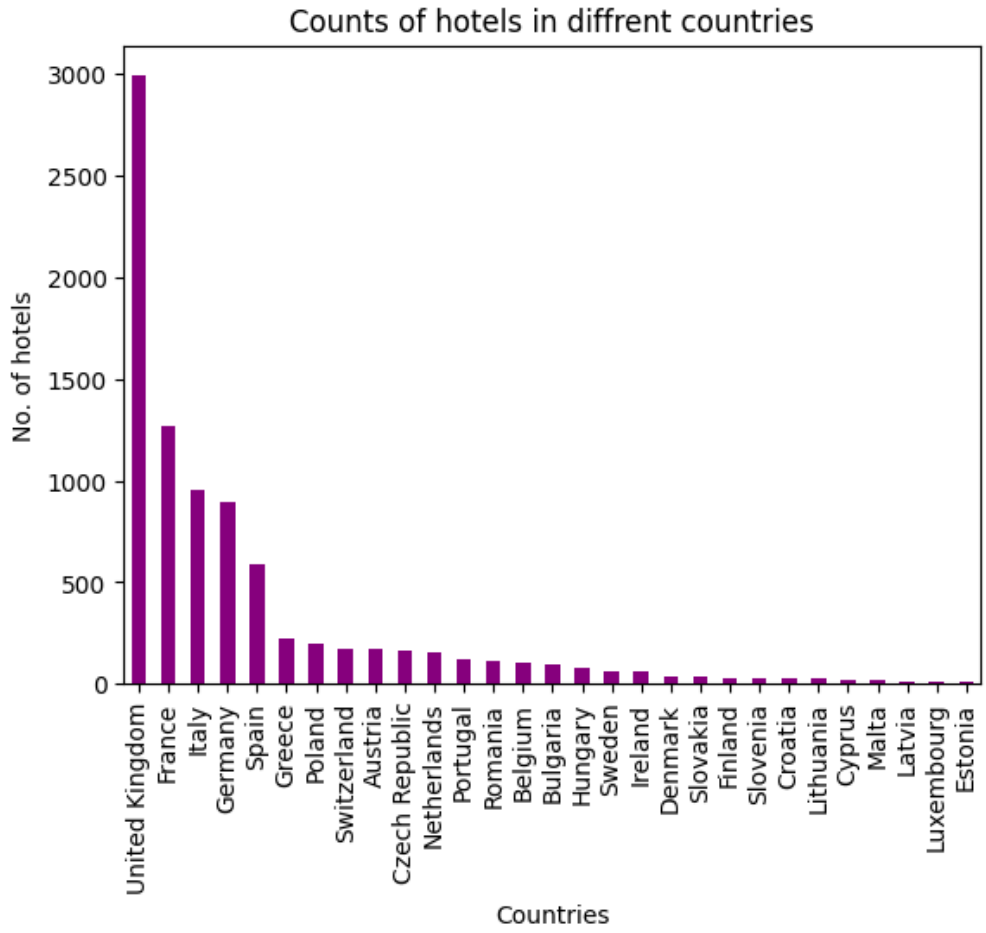
```
[29]: plt.title("Type of Ratings")
      hotel_data["starrating"].value_counts().plot(kind="pie")
```

```
[29]: <AxesSubplot: title={'center': 'Type of Ratings'}, ylabel='starrating'>
```

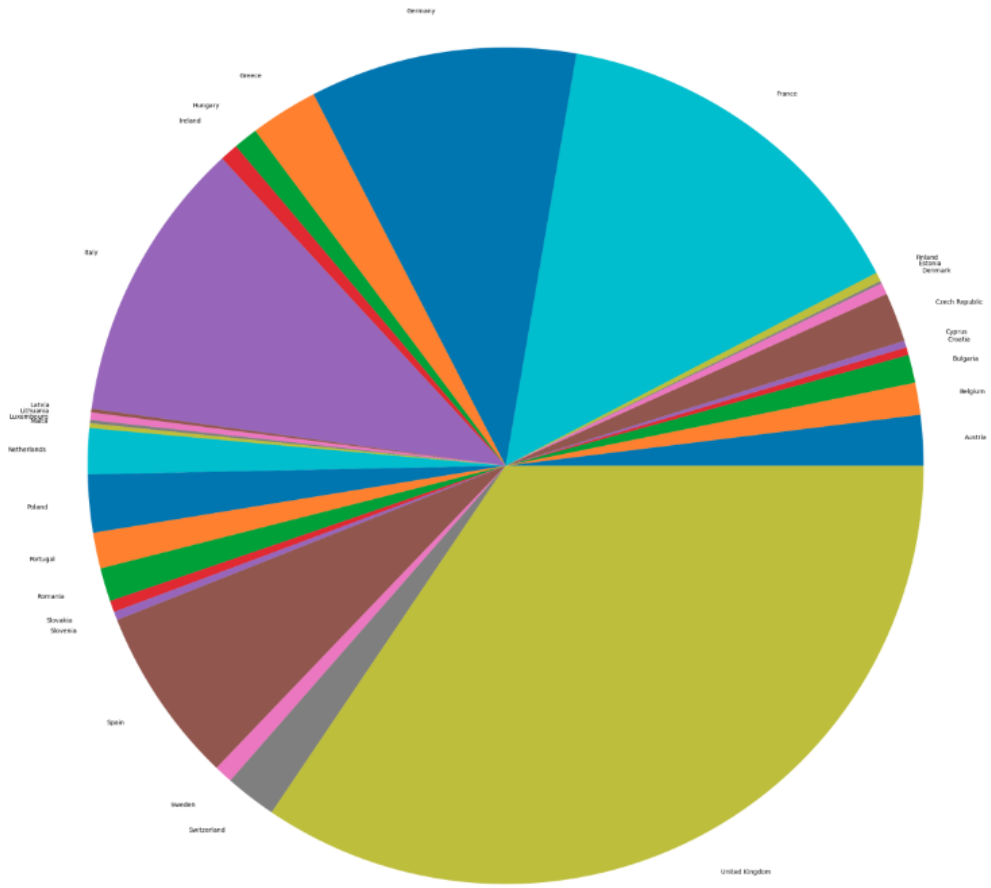


- Total Hotels in diffrent coutries:

```
[30]: Text(0, 0.5, 'No. of hotels')
```



- Total Counts of cities under a particular country:



[31]:
```
hotel_data.groupby("country",as_index=False)["city"].count()
```

[31]:

	country	city
0	Austria	169
1	Belgium	107
2	Bulgaria	94
3	Croatia	26
4	Cyprus	23
5	Czech Republic	165
6	Denmark	39
7	Estonia	8
8	Finland	31
9	France	1270
10	Germany	894
11	Greece	227
12	Hungary	82
13	Ireland	61
14	Italy	950
15	Latvia	12
16	Lithuania	25
17	Luxembourg	11
18	Malta	16
19	Netherlands	153
20	Poland	194
21	Portugal	120
22	Romania	112
23	Slovakia	38
24	Slovenia	29
25	Spain	592
26	Sweden	62
27	Switzerland	172
28	United Kingdom	2987

- Recommendation:

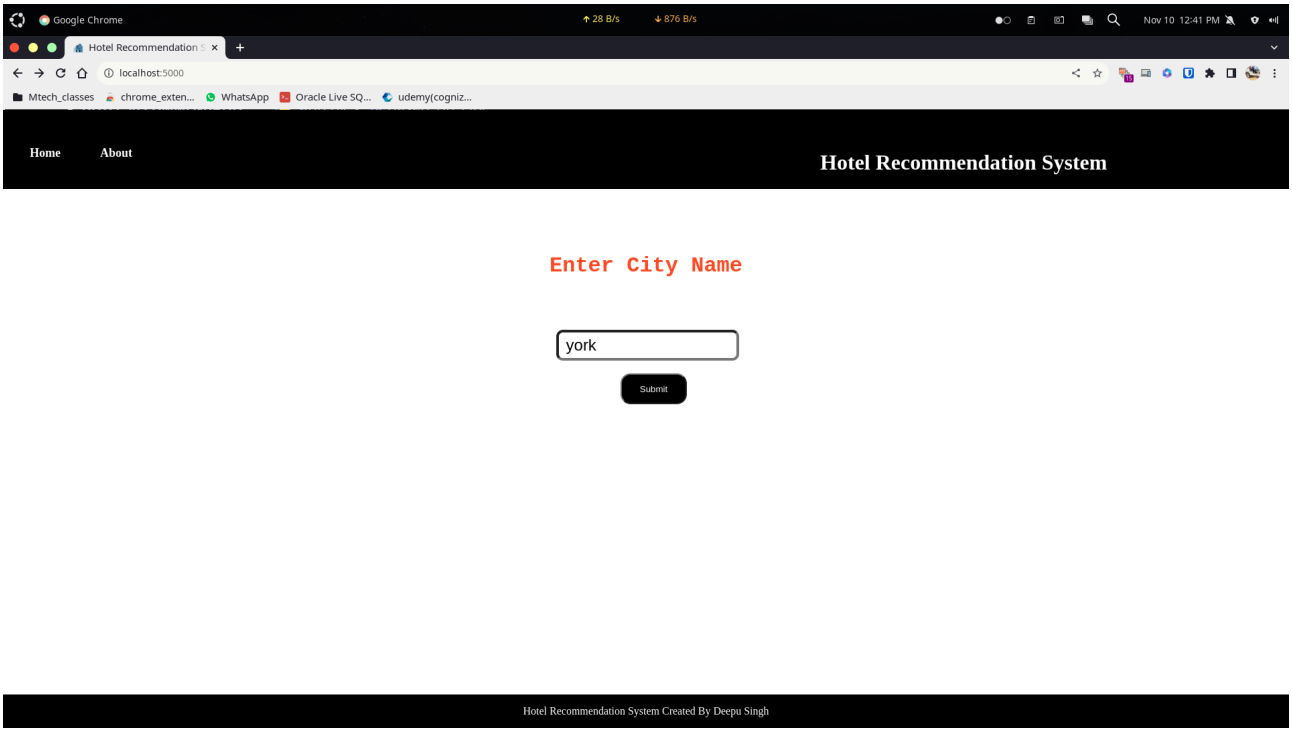
As this recommendation was based on city and ratings so both were present in my datasets. So first i converted all the cities in lower case in my dataset and again the input which i was getting from user as a city name that city name also i converted in lowercase . After that i searched same city name in my dataset if it is present then return all the hotels in descending order based on star-ratings. So that user will get the highest rating hotel first. For your reference the below snap has the function which is recommending the hotel based on city.

```
def based_on_city(city):
    hotel_data=pd.read_csv('/media/deepu/HardDisk/iitj/Hotel_Recommendation_system/datasets/hotel_data.csv')
    hotel_data['city']=hotel_data['city'].str.lower()
    matched_city=hotel_data[hotel_data['city']==city.lower()]
    matched_city=matched_city.sort_values(by='starrating',ascending=False)
    if matched_city.empty==False:
        data=matched_city.iloc[:,[5,3,2,6,7,8,4,9]]
        count=data.shape[0]
        return data.to_html(index=False),count
    else:
        return "",0
        print("No Hotel Found!")
```

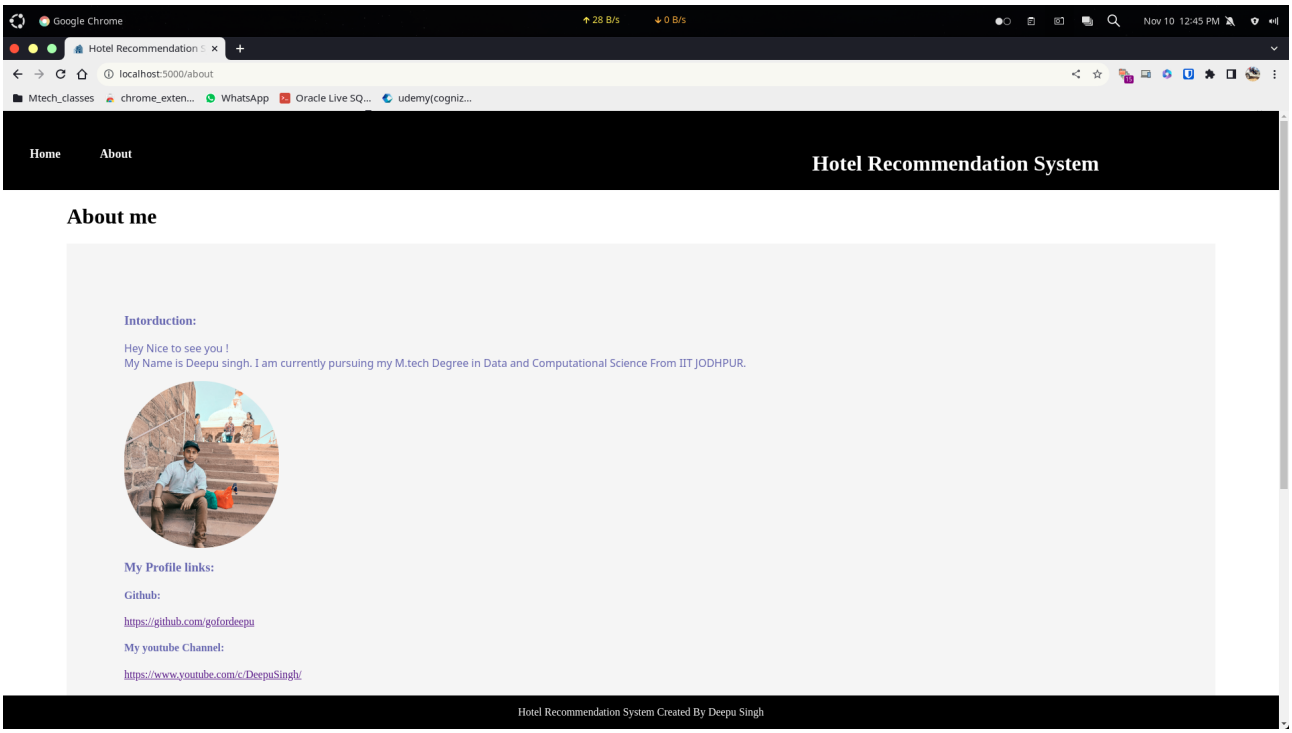
Same function i am using in the UI part of my project. After cleaning the dataset from jupyter lab actually i exported that dataset so that it will be used in my UI part. And after that the same function i am calling . The function is taking input as a city name and returning hotels based on ratings.

- User Interface:
  The user Interface i made using HTML, CSS and the backened i made using Python Flask framework. So in below snap you can see how the UI looks and works.

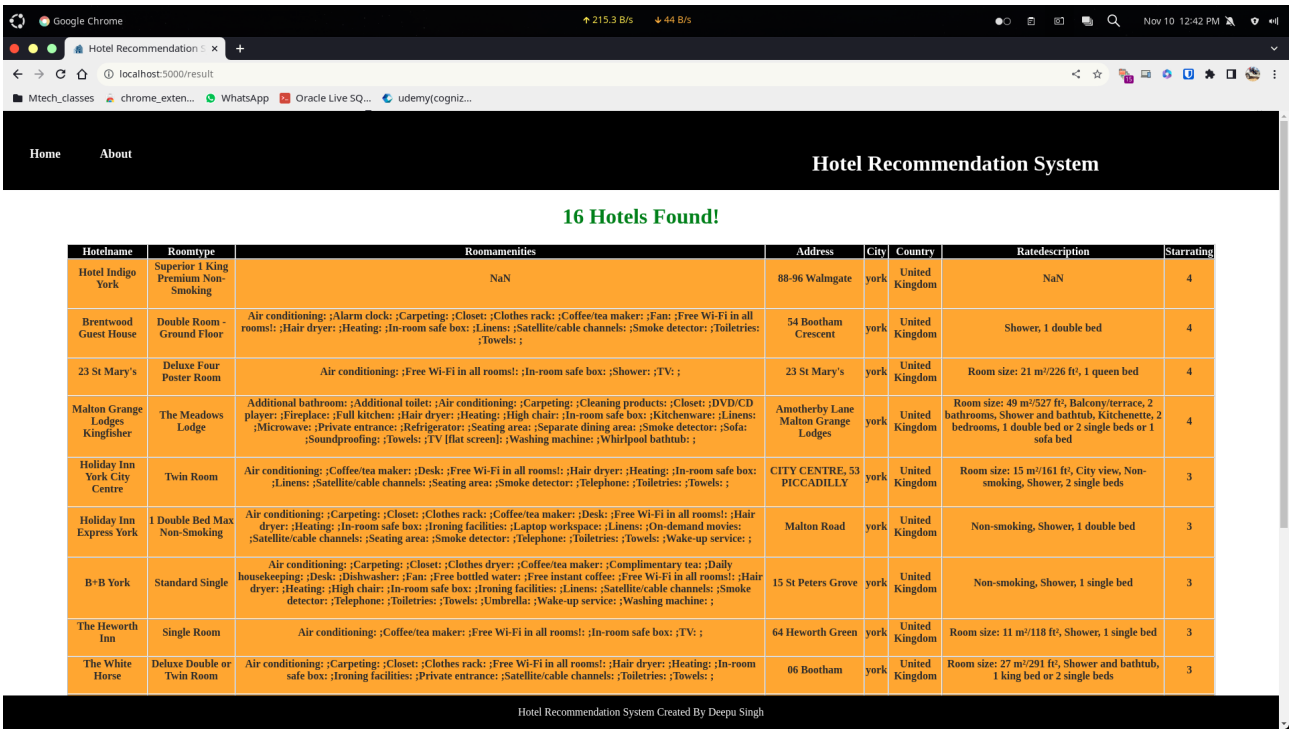
- Home Page



- About Page

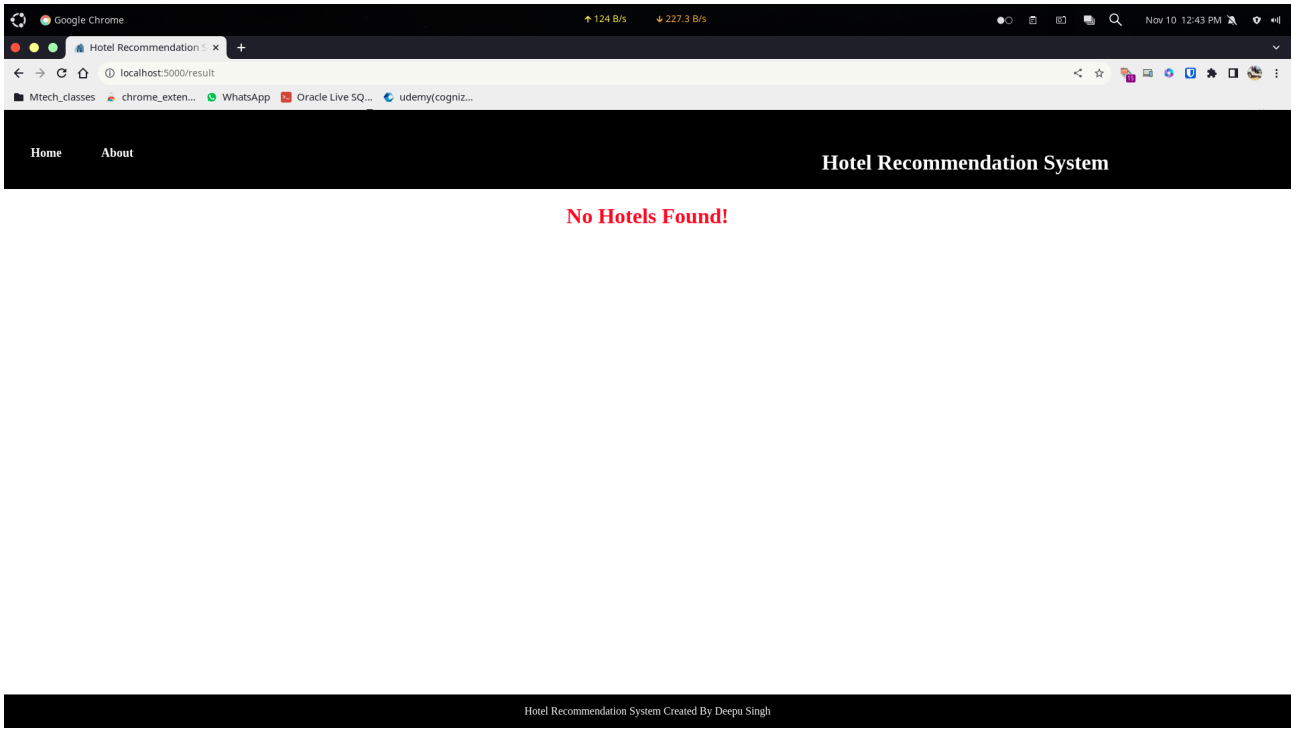


- Hotels Found:



Hotelname	Roomtype	Roomamenities	Address	City	Country	Ratedescription	Starrating
Hotel Indigo York	Superior 1 King Premium Non-Smoking	NaN	88-96 Walmgate	york	United Kingdom	NaN	4
Brentwood Guest House	Double Room - Ground Floor	Air conditioning: ;Alarm clock: ;Carpeting: ;Closet: ;Clothes rack: ;Coffee/tea maker: ;Fan: ;Free Wi-Fi in all rooms!: ;Hair dryer: ;Heating: ;In-room safe box: ;Linens: ;Satellite/cable channels: ;Smoke detector: ;Toiletries: ;Towels: ;	54 Bootham Crescent	york	United Kingdom	Shower, 1 double bed	4
23 St Mary's	Deluxe Four Poster Room	Air conditioning: ;Free Wi-Fi in all rooms!: ;In-room safe box: ;Shower: ;TV: ;	23 St Mary's	york	United Kingdom	Room size: 21 m²/226 ft², 1 queen bed	4
Malton Grange Lodges Kingfisher	The Meadows Lodge	Additional bathroom: ;Additional toilet: ;Air conditioning: ;Carpeting: ;Cleaning products: ;Closet: ;DVD/CD player: ;Fireplace: ;Full kitchen: ;Hair dryer: ;Heating: ;High chair: ;In-room safe box: ;Kitchenware: ;Linens: ;Microwave: ;Private entrance: ;Refrigerator: ;Seating area: ;Separate dining area: ;Smoke detector: ;Sofa: ;Soundproofing: ;Towels: ;TV [flat screen]: ;Washing machine: ;Whirlpool bathtub: ;	Amotherby Lane Malton Grange Lodges	york	United Kingdom	Room size: 49 m²/527 ft², Balcony/terrace, 2 bathrooms, Shower and bathtub, Kitchenette, 2 bedrooms, 1 double bed or 2 single beds or 1 sofa bed	4
Holiday Inn York City Centre	Twin Room	Air conditioning: ;Coffee/tea maker: ;Desk: ;Free Wi-Fi in all rooms!: ;Hair dryer: ;Heating: ;In-room safe box: ;Linens: ;Satellite/cable channels: ;Seating area: ;Smoke detector: ;Telephone: ;Toiletries: ;Towels: ;	CITY CENTRE, 53 PICCADILLY	york	United Kingdom	Room size: 15 m²/161 ft², City view, Non-smoking, Shower, 2 single beds	3
Holiday Inn Express York	1 Double Bed Max Non-Smoking	Air conditioning: ;Carpeting: ;Closet: ;Clothes rack: ;Coffee/tea maker: ;Desk: ;Free Wi-Fi in all rooms!: ;Hair dryer: ;Heating: ;In-room safe box: ;Ironing facilities: ;Laptop workspace: ;Linens: ;On-demand movies: ;Satellite/cable channels: ;Seating area: ;Smoke detector: ;Telephone: ;Toiletries: ;Towels: ;Wake-up service: ;	Malton Road	york	United Kingdom	Non-smoking, Shower, 1 double bed	3
B+B York	Standard Single	Air conditioning: ;Carpeting: ;Closet: ;Clothes dryer: ;Coffee/tea maker: ;Complimentary tea: ;Daily housekeeping: ;Desk: ;Dishwasher: ;Fan: ;Free bottled water: ;Free instant coffee: ;Free Wi-Fi in all rooms!: ;Hair dryer: ;Heating: ;High chair: ;In-room safe box: ;Ironing facilities: ;Linens: ;Satellite/cable channels: ;Smoke detector: ;Telephone: ;Toiletries: ;Towels: ;Umbrella: ;Wake-up service: ;Washing machine: ;	15 St Peters Grove	york	United Kingdom	Non-smoking, Shower, 1 single bed	3
The Heworth Inn	Single Room	Air conditioning: ;Coffee/tea maker: ;Free Wi-Fi in all rooms!: ;In-room safe box: ;TV: ;	64 Heworth Green	york	United Kingdom	Room size: 11 m²/118 ft², Shower, 1 single bed	3
The White Horse	Deluxe Double or Twin Room	Air conditioning: ;Carpeting: ;Closet: ;Clothes rack: ;Free Wi-Fi in all rooms!: ;Hair dryer: ;Heating: ;In-room safe box: ;Ironing facilities: ;Private entrance: ;Satellite/cable channels: ;Toiletries: ;Towels: ;	06 Bootham	york	United Kingdom	Room size: 27 m²/291 ft², Shower and bathtub, 1 king bed or 2 single beds	3

- Hotels Not Found:



- References:

- Data source: https://www.kaggle.com/code/haryantohidayat2/hotel-recommender/data

- Technology Used:

  - Programming language: Python
  - Libraries: Pandas, Matplotlib, Numpy, Flask
  - Version control system : Git
  - Ui Design : Html,Css ,Javascript