Travel.io

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Problem Statement

Everyone has different tastes in the colours of walls, types of beds, ceilings or even showers or even in the ambience of the hotel. Numerous hotels offer comparable amenities while considering the customer's needs, and they try to show their finest services that are essentially the same. However, specific work is needed to tailor the room to the customer.

Aim

To filter you out of the hotels according to amenities in the hotel, your budget, reviews or ratings, nearby amenities and go to places, then show you some pictures of the room and hotel allowing you to choose hotels depending upon your perception and tastes. Afterwards, the system ranks the hotels filtered according to the images you selected.

Motivation

We believe that by incorporating visual information and personal preferences of users, we can create a more refined and personalized hotel recommendation system. Our motivation is to provide users with a unique and customized experience in choosing hotels that align with their preferences, leading to more satisfying travel experiences.

Literature Survey

With the aim of providing recommendations to customers, Collaborative Filtering has been investigated across a variety of industries, including social media (Jiang et al., 2020), restaurants (Liu et al., 2013), and travel (Zheng, Burke, & Mobasher, 2012). The evaluation approaches used include Pearson Correlation Coefficient, Spearman Rank Correlation Coefficient, Cosine Similarity, and Mean-Square Difference in order to identify similar items or users (Pappas & Popescu-Belis, 2015). In the hospitality sector, collaborative filtering is a well-liked method for creating recommendation systems, notably for hotel recommendations.

Overall, the use of image similarity in hotel recommendation systems shows promising results in improving recommendation accuracy and user satisfaction. Research on collaborative filtering-based hotel recommendation systems shows that this method is beneficial for providing individualised recommendations in the hospitality sector. Research in this area will likely benefit from deep learning techniques, hybrid recommendation systems, and matrix factorisation, as they are all intriguing directions for this field's future study. However, there are still challenges to be addressed, such as the high computational cost of image processing and the need for large amounts of image data.

Literature Reviews

[1] Within this paper, the context-aware hotel recommendation (CAPH) approach is considered to recommend hotels based on their features and the type of traveller who will be using them. The system's accuracy is obtained and compared to the traditional user and item-based collaborative filtering models.

[2]This paper takes traditional user-based collaborative filtering and decomposes it into three context-sensitive components, and proposes a hybrid contextual approach. It can be seen that choosing an appropriate relaxation of the contextual constraints for each component of an algorithm outperforms the strict application of the context.

[3]This paper proposes a hybrid recommendation model based on deep emotion analysis and multi-source view fusion. This model creates individualised recommendations using user-post interaction evaluations, implicit feedback, and auxiliary data. The DMHR algorithm proposed within this paper performs significantly better at score prediction and suggestion.

[4]This paper proposed a hotel recommendation system that combines collaborative filtering and the RankBoost algorithm. The system's ability to accurately recommend hotels to users was tested using reviews of hotels. The article shows the usefulness of merging various recommendation algorithms and the possibility of personalised recommendation systems in the hotel sector.

Literature Reviews

[5]This paper introduced VADER (Valence Aware Dictionary for sEntiment Reasoning), a rule-based sentiment analysis model that analyses social media material using a sentiment lexicon with over 9,000 lexical elements. Researchers and practitioners of natural language processing (NLP) find VADER a popular tool for sentiment analysis across various fields and domains. Multiple models like NB, ME, SVM-C and SVM-R were used

[6]This research used VADER to analyse sentiment in restaurant reviews. According to the study, VADER had an accuracy rate of over 85% when categorising reviews as good, negative, or neutral. The study demonstrates how VADER can be used to analyse the sentiment of consumer feedback

[7]This paper used TensorFlow 2.0 to create a model for image similarity detection. The model, built on a convolutional neural network, detected similar photos with high accuracy. In particular, applications where picture similarity detection is crucial, are highlighted in the research as examples of where deep learning techniques might be used for computer vision tasks.

[8]This research suggests a subject model and sentiment analysis-based visual recommendation system for peer-to-peer accommodation. To offer comparable accommodations, the study blends textual information from internet evaluations with visual elements taken from photographs. The study highlights the value of combining several recommendation techniques and the potential of visual characteristics in the lodging sector.

Workflow

- Choosing parameters like price, location, some amenities etc.
- Filtering dataset on the basis of parameters
- Ranking the dataset and then showing the best results on top.
- Select some photos of rooms.
- Running similar image detection model on the dataset.
- Select some more photos which are most relevant to earlier choices.
- Repeating this until user is satisfied with photos selection.
- End process if user wants to end or dataset came to end.

Raw DataSet Extraction

- Extracted data using web scraping
- Beautiful soup4 and selenium was used for scraping data from web.
- Took around 6-8 hours to scrape the data for each city.
- We scraped 3 cities i.e [Delhi , Goa , Bangalore]

Sample Output for raw data extraction

{'Location': '16th cross Rangaswamy Layout, Chowdeshwari Amma Temple, Kormangala, Bangalore, India, 560030', 'overall_rating': '7.9', 'Name': 'The Raj Residency', 'reviews': [{'Review_Rating': '7.2', 'Review_Heading': 'Staff is awesome.”', 'Review_Body': "Location for going with uber or ola cab is great becuz the price of cab from this location is best I've found. Otherwise the location for walking distance its not very good."}, {'Review_Rating': '7.2', 'Review_Heading': 'Good for Budget Options”', 'Review_Body': 'Not so clean and neat but ok for budget'}, {'Review_Rating': '5.6', 'Review_Heading': 'Worth for the money. ”', 'Review_Body': 'Need to maintain more cleanliness... '}], 'price': '797', 'img_link': 'https://pix8.agoda.net/hotelImages/33906104/0/a9803a2422e189e5ab37808a08a90853.jpg?ce=0&s=1024x768', 'room_size': '200m²', 'amenities': ['Outdoor view', 'Balcony/terrace', 'Bathtub', 'Free Wi-Fi', 'Free Wi-Fi in all rooms!', 'Telephone', 'TV', 'BBQ facilities', 'Seating area', 'Washing machine'], 'city': 'Bangalore', 'link': 'https://agoda.com/en-gb/raj-residency-h21978829/hotel/bangalore-in.html?finalPriceView=1&isShowMobileAppPrice=false&cid=1844104&numberOfBedrooms=&familyMode=false&adults=2&children=0&rooms=1&maxRooms=0&checkIn=2023-03-18&isCalendarCallout=false&childAges=&numberOfGuest=0&missingChildAges=false&travellerType=1&showReviewSubmissionEntry=false&currencyCode=INR&isFreeOccSearch=false&isCityHaveAsq=false&los=1&searchrequestid=ce50a25e-9b0a-4a21-8024-02d485d62919'}

Data Preprocessing

- Data in form of dictionary in a dictionary
- Sorting and arranging it in dataframe with each column for each feature
- Merging the synonym amenities keywords
- Assigning score 0 and 1 to amenities for further processing
- Deleting duplicates (if any)
- Calculated frequency of each amenities
- Selected 25 amenities with significant impact
- 13 with high frequency and 12 with average frequency

Sample Output (preprocessed data)

{'Location': '16th cross Rangaswamy Layout, Chowdeshwari Amma Temple, Kormangala, Bangalore, India, 560030', 'overall_rating': '7.9', 'Name': 'The Raj Residency', 'reviews': [{'Review_Rating': '7.2', 'Review_Heading': 'Staff is awesome.”', 'Review_Body': "Location for going with uber or ola cab is great becuz the price of cab from this location is best I've found. Otherwise the location for walking distance its not very good."}, {'Review_Rating': '7.2', 'Review_Heading': 'Good for Budget Options”', 'Review_Body': 'Not so clean and neat but ok for budget'}, {'Review_Rating': '5.6', 'Review_Heading': 'Worth for the money. ”', 'Review_Body': 'Need to maintain more cleanliness... '}], 'price': '797', 'img_link': 'https://pix8.agoda.net/hotelImages/33906104/0/a9803a2422e189e5ab37808a08a90853.jpg?ce=0&s=1024x768', 'room_size': '200m²', 'amenities': ['Outdoor view', 'Balcony/terrace', 'Bathtub', 'Free Wi-Fi', 'Free Wi-Fi in all rooms!', 'Telephone', 'TV', 'BBQ facilities', 'Seating area', 'Washing machine'], 'city': 'Bangalore', 'link': 'https://agoda.com/en-gb/raj-residency-h21978829/hotel/bangalore-in.html?finalPriceView=1&isShowMobileAppPrice=false&cid=1844104&numberOfBedrooms=&familyMode=false&adults=2&children=0&rooms=1&maxRooms=0&checkIn=2023-03-18&isCalendarCallout=false&childAges=&numberOfGuest=0&missingChildAges=false&travellerType=1&showReviewSubmissionEntry=false&currencyCode=INR&isFreeOccSearch=false&isCityHaveAsq=false&los=1&searchrequestid=ce50a25e-9b0a-4a21-8024-02d485d62919'}

Sorted dic with frequency of amenities

{'Detached': 1, 'Park view': 1, 'Mobility accessibility': 1, 'Bathtub grab bar': 1, 'Non-slip grab bar': 1, 'Smartphone device': 1, 'Close-caption TV': 1, 'Braille and tactile signage': 1, 'Partial lake view': 1, 'Lake view': 1, 'Blu-ray player': 1, '2 bathrooms': 1, 'TV [in bathroom]': 2, '21 bathrooms': 2, 'Sauna': 2, 'Private pool': 2, 'Pajamas': 2, 'Lowered electrical outlet': 2, 'Lever handle on door': 2, 'Adjustable height hand-held shower wand': 2, 'Semi-detached': 2, 'Computer': 2, 'Open air bath privileges': 2, 'Courtyard view': 2, 'Mountain view': 2, 'In-room tablet': 3, 'Pets allowed in room': 3, 'Visual alarm': 3, 'Internet access – wireless': 3, 'Electric blanket': 3, 'Landmark view': 3, 'BBQ facilities': 3, 'Private apartment in building': 4, 'Video game console': 4, 'Free use of business areas': 4, 'Self-closing door': 4, 'Pool view': 5, 'Separate living room': 6, 'Board games': 6, 'Books/DVDs/music for children': 7, 'Additional bathroom': 8, 'Whirlpool bathtub': 9, 'Board games/puzzles': 10, 'Shower chair': 10, 'Carbon monoxide detector': 10, 'Dishwasher': 11, 'Street view': 12, 'iPod docking station': 13, 'High chair': 15, 'Baby safety gates': 15, 'Free instant coffee': 15, 'Separate shower/bathtub': 15, 'Adapted bath': 15, 'Garden view': 16, 'Free welcome drink': 16, 'On-demand movies': 17, 'Scale': 17, 'Outdoor furniture': 17, 'Complimentary tea': 17, 'Exterior corridor': 17, 'Radio': 18, 'Umbrella': 18, 'Kitchenware': 19, 'Streaming service like Netflix': 19, 'Reading light': 20, 'Sewing kit': 21, 'Fruits/snacks': 21, 'Smoking allowed': 22, 'High floor': 22, 'Washing machine': 23, 'Air purifier': 25, 'Accessible vanities': 25, 'Shoeshine kit': 26, 'Roll-in shower': 26, 'Hypoallergenic': 27, 'Pool facilities': 29, 'Shared bathroom': 30, 'DVD/CD player': 31, 'Dressing room': 34, 'Bathroom phone': 34, 'Executive lounge access': 34, 'Microwave': 35, 'Heating': 38, 'Additional toilet': 40, 'Full kitchen': 41, 'Concierge': 43, 'Wine glasses': 43, 'Fireplace': 45, 'Carpeting': 46, 'Daily housekeeping': 47, 'Kitchenette': 49, 'Dining table': 50, 'Laptop safe box': 57, 'Accessible by stairs': 59, 'Trouser press': 60, 'Clothes dryer': 62, 'Accessible toilet': 63, 'Interconnecting room(s) available': 65, 'Mosquito net': 66, 'Laptop workspace': 66, 'Adapter': 83, 'Cleaning products': 84, 'Shower and bathtub': 89, 'Separate dining area': 89, 'Private entrance': 95, 'Balcony/terrace': 96, 'Outdoor view': 100, 'First aid kit': 100, 'Window': 102, 'Wooden/parqueted flooring': 105, 'Bathrobes': 113, 'Slippers': 120, 'Blackout curtains': 123, 'Sleep comfort items': 126, 'Locker': 127, 'Sofa': 131, 'Alarm clock': 137, 'Daily newspaper': 143, 'Alcohol': 151, 'Hand sanitizer': 152, 'Soundproofing': 154, 'Refrigerator': 157, 'City view': 170, 'Smoke detector': 191, 'Accessible by elevator': 213, 'Hair dryer': 213, 'Tile/marble flooring': 215, 'In-room safe box': 215, 'Non-smoking': 229, 'Fire extinguisher': 231, 'Safety/security feature': 239, 'TV': 241, 'Seating area': 270, 'Coffee/tea maker': 279, 'Wake-up service': 300, 'Ironing facilities': 319, 'Trash cans': 321, 'Mirror': 323, 'Clothes rack': 325, 'Free bottled water': 384, 'Linens': 406, 'Desk': 408, 'Telephone': 423, 'Satellite/cable channels': 435, 'Fan': 473, 'Shower': 473, 'Closet': 507, 'Towels': 550, 'Toiletries': 574, 'Free Wi-Fi': 655, 'Air conditioning': 673}

Selected 25 amenities

['Bathrobes', 'Slippers', 'Blackout curtains', 'Sleep comfort items', 'Locker', 'Sofa', 'Alarm clock', 'Daily newspaper', 'Alcohol', 'Hand sanitizer', 'Soundproofing', 'Refrigerator', 'Clothes rack', 'Free bottled water', 'Linens', 'Desk', 'Telephone', 'Satellite/cable channels', 'Fan', 'Shower', 'Closet', 'Towels', 'Toiletries', 'Free Wi-Fi', 'Air conditioning']

Methodology

System Backend

Major steps in backend of program

- Creating a Hotel Ranking System
- Image Detection using Similarity

Hotel Ranking System

- Creating a ranking system and filtering it on the base of needs and requirements of amenities.
- Creating scores for hotels depending on the basis of reviews and ratings provided. We used VADER (Valence Aware Dictionary and sEntiment Reasoner) for text in reviews.
- VADER is a rule-based sentiment analysis model that uses a sentiment lexicon to calculate the polarity of the text.
- Based on the text's polarity, each review is given a sentiment score i.e. a positive or negative score.

Hotel Ranking System

- After obtaining the sentiment scores for reviews.
- Scores are then multiplied to ratings(used as weight).
- We then added the results and generated a single aggregate score for each hotel in our dataset.
- These scores were used to rank the hotels. Hotels are arranged in descending order to obtain ranked dataset.
- Dataset is now sorted on the basis of selection made by customer.

Hotel Ranking on the Basis of Scores

	Unnamed: 0.2	details	Location	Name	Score	reviews	price	img_link	room_size	amenities	...	Bathrobes	Adapter	Slippers	gla
406	406	{'Location': 'No 1380 1 Near Morjim Football G...	No 1380 1 Near Morjim Football Ground, Tembwad...	Tropical Wave Hostel	9.912	[{'Review_Rating': '10.0', 'Review_Heading': '...	2,498	https://q-xx.bstatic.com/xdata/images/hotel/84...	14m²	['Balcony/terrace', 'Shower', 'Free Wi-Fi', 'T...	...	0	0	0	
415	415	{'Location': 'Arambol Beach, Goa, India', 'ove...	Arambol Beach, Goa, India	Goym Resort	9.814	[{'Review_Rating': '10.0', 'Review_Heading': '...	3,820	https://pix8.agoda.net/hotelImages/35712803/58...	10m²	['Balcony/terrace', 'Shower', 'Free Wi-Fi', 'T...	...	0	0	0	
465	465	{'Location': "Tito's lane 2, Saunta Vaddo, Bag...	Tito's lane 2, Saunta Vaddo, Baga Near Snow Pa...	Baga Bae	9.783	[{'Review_Rating': '10.0', 'Review_Heading': '...	1,800	https://q-xx.bstatic.com/xdata/images/hotel/84...	0	['Shower and bathtub', 'Free Wi-Fi', 'Toiletri...	...	0	0	0	
183	183	{'Location': 'Cola Goa Beach Resort, Agonda, G...	Cola Goa Beach Resort, Agonda, Goa, India, 403702	Cola Goa Beach Resort	9.694	[{'Review_Rating': '10.0', 'Review_Heading': '...	20,900	https://q-xx.bstatic.com/xdata/images/hotel/84...	30m²	['Balcony/terrace', 'Shower and bathtub', 'Fre...	...	1	1	1	
410	410	{'Location': 'Survey No, 155/1, Arpora Baga, O...	Survey No, 155/1, Arpora Baga, Opp - Radisson ...	Caravan Baga Aqua Resort	9.694	[{'Review_Rating': '10.0', 'Review_Heading': '...	3,000	https://q-xx.bstatic.com/xdata/images/hotel/84...	30m²	['Balcony/terrace', 'Shower', 'Toiletries', 'T...	...	0	0	0	

5 rows × 27 columns

- After obtaining the aggregate score based on reviews and ratings, we have created a ranking of the pin codes of the top ten tourist destinations within our specified cities.
- This list of ranks also helps provide a reference for tourism-specific hotel rankings by increasing the aggregate scores when a hotel belongs to the specified pin code area
- These scores obtained were stored within a column alongside our dataset and then were used to rank the hotels. Hotels with greater scores are ranked higher; thus, we obtain our ranked dataset.
- This dataset will further be reduced when the customer selects specific criteria (price, location, amenities etc.). Only the hotels fulfilling those criteria will be passed on for the image similarity step.

Hotel Ranking on the Basis of Tourism Scores

	Unnamed: 0.2	details	Location	Name	TouristScore	Score	reviews	price	img_link	room_size	...	Bathrobes	Adapter	Slippers
410	410	{'Location': 'Survey No, 155/1, Arpora Baga, O...	Survey No, 155/1, Arpora Baga, Opp - Radisson ...	Caravan Baga Aqua Resort	18.418600	9.694000	[{'Review_Rating': '10.0', 'Review_Heading': '...	3,000	https://q-xx.bstatic.com/xdata/images/hotel/84...	30m²	...	0	0	0
335	335	{'Location': 'Behind Campal Garden, Campal, Pa...	Behind Campal Garden, Campal, Panjim, Goa, Pan...	Surya Kiran Heritage Hotel	18.401400	9.200700	[{'Review_Rating': '9.6', 'Review_Heading': 'G...	6,579	https://pix8.agoda.net/hotelImages/18982190/-1...	26m²	...	0	1	1
479	479	{'Location': 'Opposite. St. Joseph School,, Ca...	Opposite. St. Joseph School,, Calangute, Goa, ...	Cassa-e-DiVaN	16.826248	8.855920	[{'Review_Rating': '9.2', 'Review_Heading': 'S...	3,999	https://q-xx.bstatic.com/xdata/images/hotel/84...	19m²	...	0	0	0
339	339	{'Location': 'Off Assagaon Badem Rd, Vagator, ...	Off Assagaon Badem Rd, Vagator, Goa, India, 40...	Mademoiselle Boutique Hotel and Cafe	14.926400	9.329000	[{'Review_Rating': '10.0', 'Review_Heading': '...	5,599	https://pix8.agoda.net/hotelImages/37124658/-1...	27m²	...	0	0	1
256	256	{'Location': '215/17 khobra vaddo, opposite to...	215/17 khobra vaddo, opposite to phoneshwar te...	Pajaros Blu	14.841787	7.811467	[{'Review_Rating': '10.0', 'Review_Heading': '...	4,417	https://q-xx.bstatic.com/xdata/images/hotel/84...	33m²	...	1	1	1

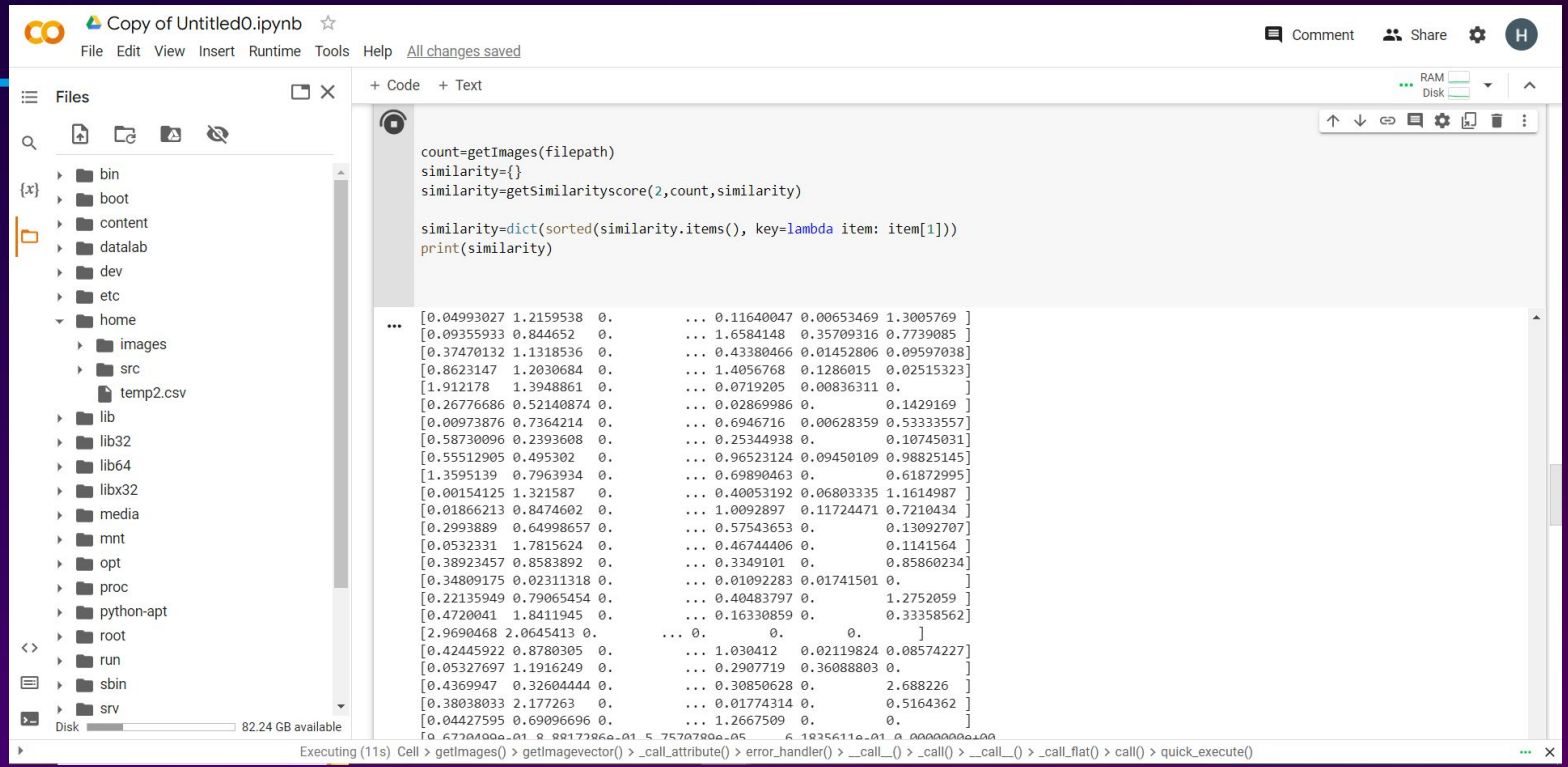
5 rows × 38 columns

Ranked Hotels

Image Detection using Similarity

- After user have selected some images, these are used to find similar images.
- For similarity vector representation of images are calculated using Tensorflow.
- Similarity scores are then calculated of each image to the given image using annoy library and are returned.
- New similar images are then shown to user.

Similarity detection



This output is the vector representation of image which will further will be used as similarity detection.

[8]
```
def forInputImages(Image_index,no_of_images,t):
  return t.get_nns_by_item(Image_index,no_of_images)

t = AnnoyIndex(1536, metric='angular')
# t = AnnoyIndex(1536, metric='cosine')

for i,j in dataset.items():
  t.add_item(i,j[0])

t.build(len(ImageVectors))
```

```
True
```

```
ans=forInputImages(0,50,t)
print(ans)
dbfile.close()
```

```
[0, 215, 91, 113, 117, 28, 463, 367, 153, 39, 240, 218, 125, 156, 7, 62, 67, 105, 312, 466, 160, 139, 269, 217, 200, 114, 9, 4, 259, 123, 109, 18
```

This is the array of index of the images which are similar to the given image.

Methodology

System Frontend

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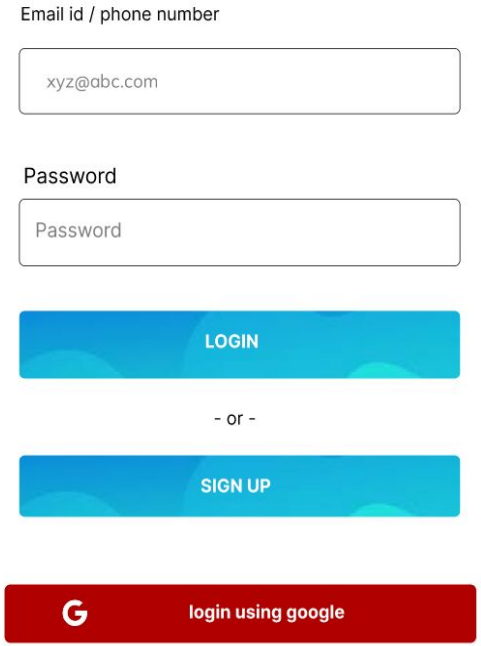

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SELECT A CITY

BUDGET

AMENITIES

MINIMUM RATING

SELECT SOME PHOTOS

SELECT HOTELS

ENJOY !

WHICH CITY WOULD YOU LIKE TO TRAVEL?

DELHI

BANGALORE

MUMBAI

TRAVEL.io

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SELECT A CITY

BUDGET

AMENITIES

MINIMUM RATING

SELECT SOME PHOTOS

SELECT HOTELS

ENJOY !

DELHI

WHAT IS YOUR BUDGET FOR THE HOTEL?

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SELECT A CITY

BUDGET

AMENITIES

MINIMUM RATING

SELECT SOME PHOTOS

SELECT HOTELS

ENJOY !

DELHI

Rs 2000 - Rs 3000 per day

SELECT BASIC AMENITITES

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SELECT A CITY

BUDGET

AMENITIES

MINIMUM RATING

SELECT SOME PHOTOS

SELECT HOTELS

ENJOY !

DELHI

Rs 2000 - Rs 3000 per day

BASIC ROOM AMENITIES + BREAKFAST BUFFET

SELECT MINIMUM RATING

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SELECT A CITY

BUDGET

AMENITIES

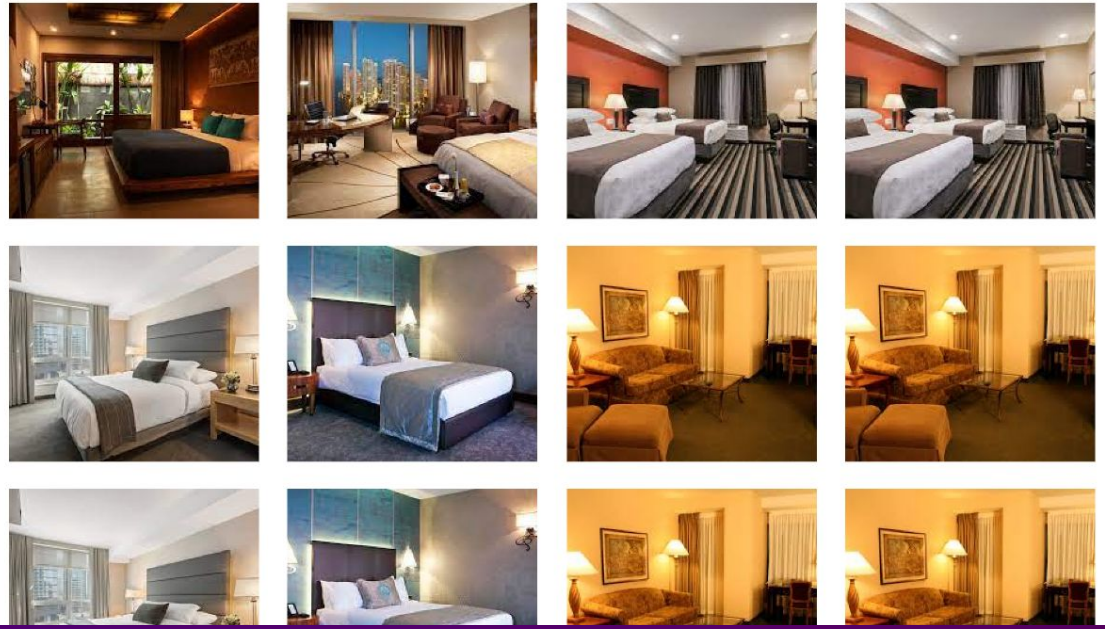
MINIMUM RATING

SELECT SOME PHOTOS

SELECT HOTELS

ENJOY !

SELECT SOME OF THEM



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SELECT A CITY

BUDGET

AMENITIES

MINIMUM RATING

SELECT SOME PHOTOS

SELECT HOTELS

ENJOY !

CHOOSE FROM THE SUGGESTED HOTELS

SGT HOTEL

Govindpuri, 3.5 ☆ 2500 P.D.

SGT HOTEL

Govindpuri, 3.5 ☆ 2500 P.D.

SGT HOTEL

Govindpuri, 3.5 ☆ 2500 P.D.

SGT HOTEL

SGT HOTEL

SGT HOTEL

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SELECT A CITY

BUDGET

AMENITIES

MINIMUM RATING

SELECT SOME PHOTOS

SELECT HOTELS

ENJOY

SGT HOTEL

Novelty

The system has undergone further personalization through the incorporation of an additional ranking criterion based on location. Specifically, the system considers the ranking of pincodes or postal codes in alignment with customer requirements, such as tourism, and integrates this parameter into the overall ranking algorithm.

Our system allows users to input sample images, which are then analyzed using computer vision algorithms to identify visual features. Based on these visual features, the system recommends hotels that share similar aesthetics. This feature is especially beneficial for users with specific aesthetic preferences or those seeking hotels with a particular style.

Future Work

We propose integrating social media data from social media networks to provide recommendations based on user activity and preferences. We also aim to improve the visualization of hotel amenities and locations to assist users in making more informed decisions. Additionally, we may integrate with other travel service providers, such as flight and vehicle rental companies, to offer a more comprehensive travel planning experience. Lastly, we intend to explore incorporating voice commands and other smart device features to enable consumers to make hotel reservations and receive recommendations.

This idea can be extended to other areas that play an important role in our day-to-day lives, such as choosing a restaurant, purchasing a new home, or renting a house, among others.

Individual Contributions

- Nittin Yadav(202093) - Web Scraping Data Collection
- Meenal Gurbaxani(2019434) - Ranking System, Literature Review
- Dishant Yadav(2020057) - Data Preprocessing
- Raman Yadav(2020111) - Frontend UI
- Harsh(2020061) - Similar Image Detection
- Daevaang Khairwal(2020369) - Frontend UI

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