IBM Applied Data Science Capstone

Recommending a Business at a Tourist Venue

- *Rishabh Bhatt*

Introduction

Tourism has always been a booming industry across the globe. No matter which country you live in, you can always come across a group of people, big or small, who always like to visit places. Being an adventurer myself, I can acknowledge this fact as to how tourism plays a salient role for a traveler/explorer. Tourism is not only an important aspect of a country's economy but also for its global standing.

Why Tourism is important to any country?

The tourism industry is important for the benefits it brings and due to its role as a commercial activity that creates demand and growth for many more industries. Tourism not only contributes to more economic activities but also generates more employment, revenues, and play a significant role in development.

i. Tourism activity creates demand.
ii. Tourism industry value chain meets & spreads demand across industries & boosts more economic activities.
iii. Tourism induces more consumption.

Business Problem

All the benefits of tourism tend to reflect on the employment opportunity which it gives to the people of that country. The objective of this project is to analyze the tourist places of a given state in India and try to recommend the best location where they can open a restaurant or lodging to make the best use of the opportunity.

The target audience for this project includes people who are interested in opening a restaurant, lodging, transport services, or any other similar businesses which fall within the tourism industry. This also recommends travelers' tourist venues to be visited in a given state of a country.

Data Anatomization

To tackle the above-mentioned problem, we need to have the dataset that contains –

i. All the districts of a particular country.
ii. Latitude and longitudes of all the districts.

The Wikipedia page https://en.wikipedia.org/wiki/List_of_districts_in_India is the major source of data that is being used to obtain all the districts of India. We then use beautifulsoup4 package, a Python module that helps to scrape information from the web pages to extract all the tables from this Wikipedia page and convert it into a pandas dataframe. Then we use Python's geopy package to obtain the latitude and longitude of all the districts present in the dataframe.

Description of the data

The output shows the transition of data scraped to the final dataset. The final dataset consists of a single Dataframe with 9 columns containing state, districts, latitude and longitudes of the district etc. Other columns like code, headquarters, population, area and density have also been scraped from the website which can be used for further analysis.

	State	Total Districts	State Population	Population/District
0	Andhra Pradesh	13	49386799	3798985
1	Arunachal Pradesh	25	1383727	57656
2	Assam	34	31169272	944523
3	Bihar	38	104099452	2739459
4	Chhattisgarh	28	25545198	946118

(37, 4)

	State	District #	Code	District	HQ	District Population	Area	Density
0	Andhra Pradesh	1	AN	Anantapur	Anantapur	4083315	19130	213
1	Andhra Pradesh	2	CH	Chittoor	Chittoor	4170468	15152	275
2	Andhra Pradesh	3	EG	East Godavari	Kakinada	5151549	10807	477
3	Andhra Pradesh	4	GU	Guntur	Guntur	4889230	11391	429
4	Andhra Pradesh	5	CU	Kadapa	Kadapa	2884524	15359	188

(741, 8)

	State	District #	Code	District	HQ	District Population	Area	Density	Total Districts	State Population	Population/District
0	Andhra Pradesh	1	AN	Anantapur	Anantapur	4083315	19130	213	13	49386799	3798985
1	Andhra Pradesh	2	CH	Chittoor	Chittoor	4170468	15152	275	13	49386799	3798985
2	Andhra Pradesh	3	EG	East Godavari	Kakinada	5151549	10807	477	13	49386799	3798985
3	Andhra Pradesh	4	GU	Guntur	Guntur	4889230	11391	429	13	49386799	3798985
4	Andhra Pradesh	5	CU	Kadapa	Kadapa	2884524	15359	188	13	49386799	3798985

(741, 11)

Final Cleaned Dataset:

	State	Code	District	Headquarters	Population(2011)	Area(km2)	Density(/km2)	Latitude	Longitude
0	Andaman and Nicobar	NI	Nicobar	Car Nicobar	36842	1841.0	20	7.000000	93.000000
1	Andaman and Nicobar	NaN	North and Middle Andaman	Mayabunder	105597	3736.0	28	12.611239	92.831654
2	Andaman and Nicobar	SA	South Andaman	Port Blair	238142	2672.0	89	10.705690	92.487468
3	Andhra Pradesh	AN	Anantapur	Anantapur	4083315	19130.0	213	14.654623	77.556260
4	Andhra Pradesh	CH	Chittoor	Chittoor	4170468	15152.0	275	13.160105	79.155551

Literature Review

There are specific factors within the characteristics of the population which makes the tourism industry lead to an improvement of the socio-economic conditions of the population [1]. This will eventually result in low rates of unemployment and a higher percentage of the working population. The former improves the socioeconomic conditions of the population whereas the latter helps finance, through different tax burdens, public policies aimed at achieving a higher level of economic development. It also demonstrates that countries with regressive population pyramids have greater difficulties for tourism growth to improve their socio-economic conditions.

The survey from Annual Report Tourism of India provides us with the following facts –

i. Tourism has contributed around 5.06% share in GDP during 2016-17
ii. There were 1854.93 million domestic tourist visits all over the country during the year 2018.
iii. Foreign Tourist Arrivals during 2019 were 10.89 million (Provisional) with a growth of 3.2% over the same period of the previous year
iv. Foreign Exchange Earnings during the period during Jan 2019 – Dec 2019 were Rs.2,10,981 crores (Provisional estimates) with a growth of 8.3% over the same period of the previous year.
v. According to Tourist Satellite Account, the tourism industry has provided around 87.50 million people employment opportunities in the year 2018-19 vi. The above-obtained statistics highlight the importance of the Tourism Industry in the overall development of the country.

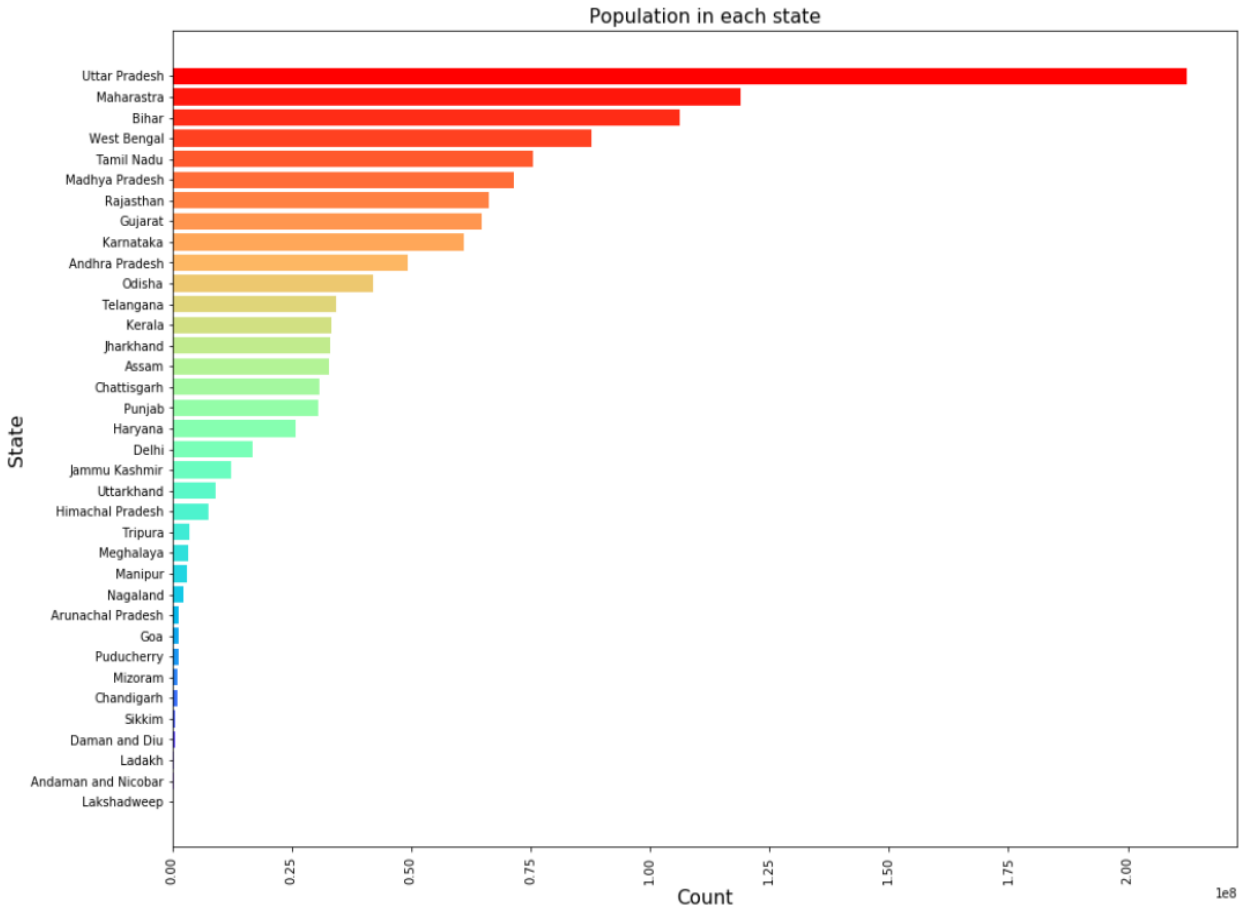
Methodology

The first step is to collect the data. This is done by scraping the Wikipedia page https://en.wikipedia.org/wiki/List_of_districts_in_India. Then we use geopy API to get the latitude and longitude of all the districts of the country. There existed some missing values in the dataset which were removed. The final dataset has nine columns as shown –

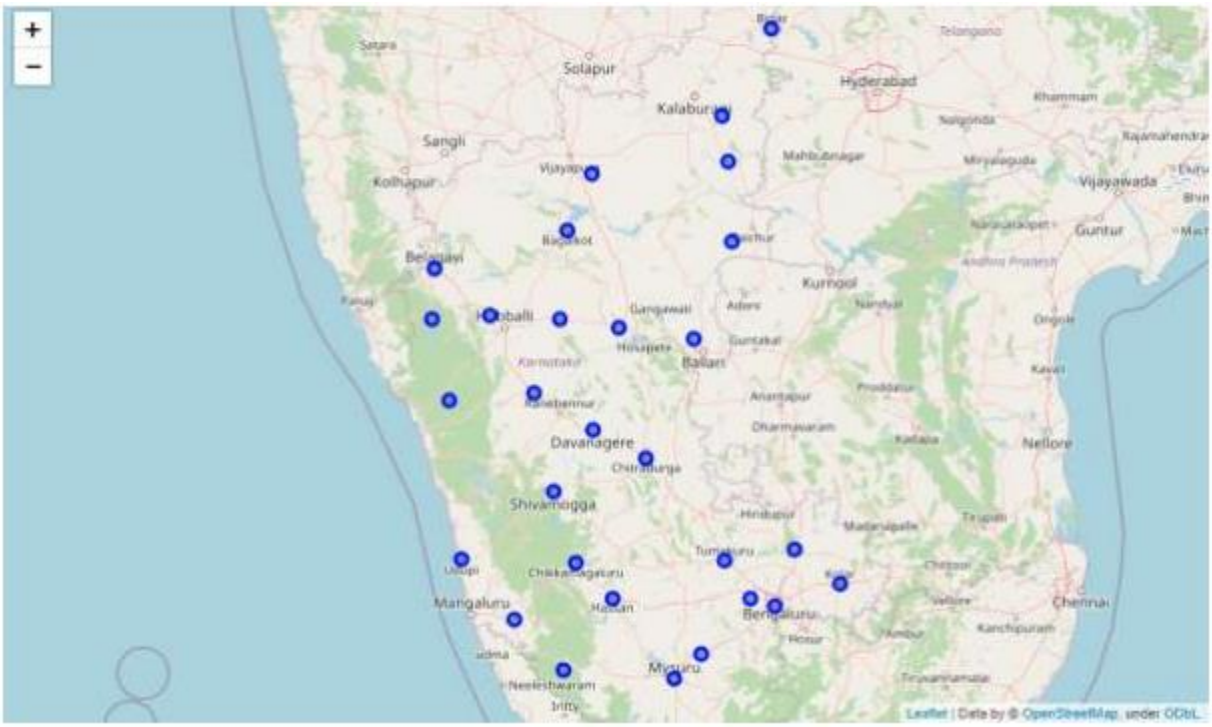
	State	Code	District	Headquarters	Population(2011)	Area(km2)	Density(/km2)	Latitude	Longitude
0	Andaman and Nicobar	NI	Nicobar	Car Nicobar	36842	1841.0	20	7.000000	93.000000
1	Andaman and Nicobar	NaN	North and Middle Andaman	Mayabunder	105597	3736.0	28	12.611239	92.831654
2	Andaman and Nicobar	SA	South Andaman	Port Blair	238142	2672.0	89	10.705690	92.487468
3	Andhra Pradesh	AN	Anantapur	Anantapur	4083315	19130.0	213	14.654623	77.556260
4	Andhra Pradesh	CH	Chittoor	Chittoor	4170468	15152.0	275	13.160105	79.155551

There are 36 states (including Union Territories) which have been retrieved from the webpage and stored in the dataset.

As mentioned in the literature review, there can be some impacts of the population of a state on tourism. The below graph shows the population in each state.

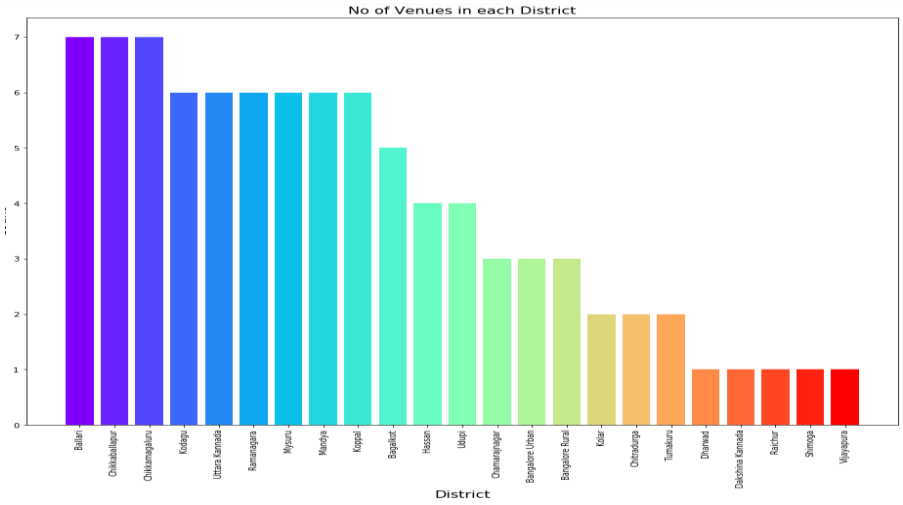


The user can enter the state of his choice among the given states. Here Karnataka is taken as a choice. A visualization with all the districts of the given state will be displayed as shown below –



Using the Foursquare API, we acquire only the categories which are related to tourism for tourist's category and which are related to tourist services for employment opportunities to people separately. The former includes Arts & Entertainment, Nightlife Spot, Outdoors & Recreation, whereas the latter includes Food, Shop & Service, Travel & Transport services.

The next step is to obtain the nearby tourist venues within a radius of 50km. This gives us multiple tourist spots if there are in a district. We visualize a bar graph by plotting District v/s count to obtain the number of venues in each district. The visualization can be shown below –



We then organize the unique venue categories obtained and create a one-hot encoding to analyze each district. This results in a Dataframe that displays the most common venue category in a particular district. We then aggregate all the venues which belong to the particular category in a particular district.

	District	Venue Category	Venue
0	Bagalkot	Historic Site	Aihole, Pattadakal - World Heritage Site
1	Bagalkot	Scenic Lookout	Badami
2	Bagalkot	Sculpture Garden	Aihole Rock Cut Shiva Temple, Pattadakal Temple
3	Ballari	Historic Site	Hampi, Hanuman Temple, Vitthala temple, Queens Bath
4	Ballari	Mountain	Martanga Hill, Hemakuta Hill

After obtaining the most common venue categories in all the districts, we replace the categories with the venues if they are present in the district.

	District	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue
0	Bagalkot	Aihole Rock Cut Shiva Temple, Pattadakal Temple	Aihole, Pattadakal - World Heritage Site	Badami				
1	Ballari	Hampi, Hanuman Temple, Vitthala temple, Queens Bath	Martanga Hill, Hemakuta Hill	Lotus Mahal				
2	Bangalore Rural	Wonderla Amusement Park, Wonder La	PVR bluO					
3	Bangalore Urban	M.G Road Boulevard	Rangashankara	Cubbon Park				
4	Chamarajnagar	Mudhumalai Forest	Rose Garden	Bandipur National Park				
5	Chikkaballapur	Bhartiya City	The Druid Garden	Gangamma Circle	Richard's Park	Our Native Village	Nandi Hills	nandi hills
6	Chikkamagaluru	Channakeshwara Temple, Hoysaleshwara Temple, Halebeedu	Mullainagiri, Shiradi Ghat	Mudigere	Mullayanagiri			

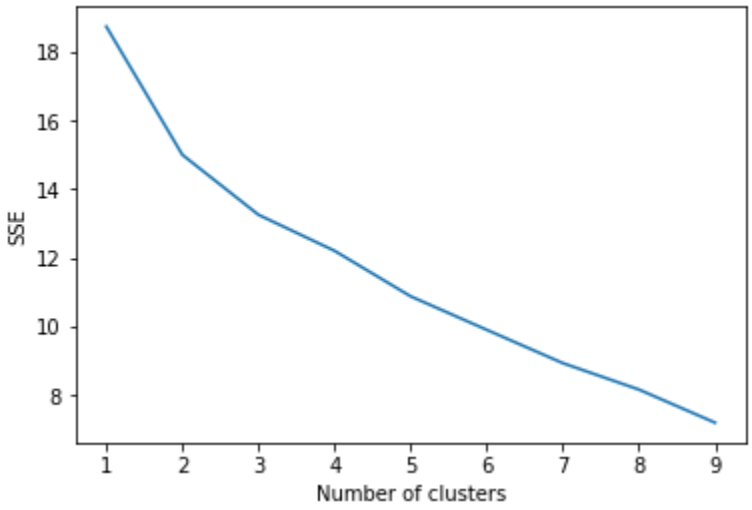
This gives an idea to a person as to where he could start his business in a particular district. But still, he can be not sure or have any idea as to what type of business he could open up at a given tourist venue. So, to make sure that his business attracts many tourists as possible, we then attempt to find the most sought business at the tourist spot. So, then we acquire the top businesses which are being established at the tourist venue within the range of 500 meters.

	Venue	Business	BLatitude	BLongitude	Business Category
13	Badami	Sangam Restaurant	15.924083	75.679891	Vegetarian / Vegan Restaurant
15	Badami	Hotel New Satkar Deluxe	15.924083	75.679891	Hotel
17	Badami	Hotel Mookambika Deluxe	15.922389	75.683092	Hotel
19	Hampi	Gopi Roof Restaurant	15.336163	76.460259	Indian Restaurant
20	Hampi	Funky monkey	15.336225	76.461525	Indian Restaurant
21	Hampi	Laughing Buddha	15.338600	76.456436	Café
22	Hampi	Mango Tree Restaurant	15.335544	76.460337	Indian Restaurant
23	Hampi	Ever Green Cafe	15.339529	76.458222	Indian Restaurant
25	Hampi	Laughing Buddha Guest house & Restaurant	15.338654	76.456447	Restaurant
26	Hampi	Archana Roof Restaurant	15.336337	76.460284	Restaurant
27	Hampi	Chill Out	15.336205	76.460921	Café

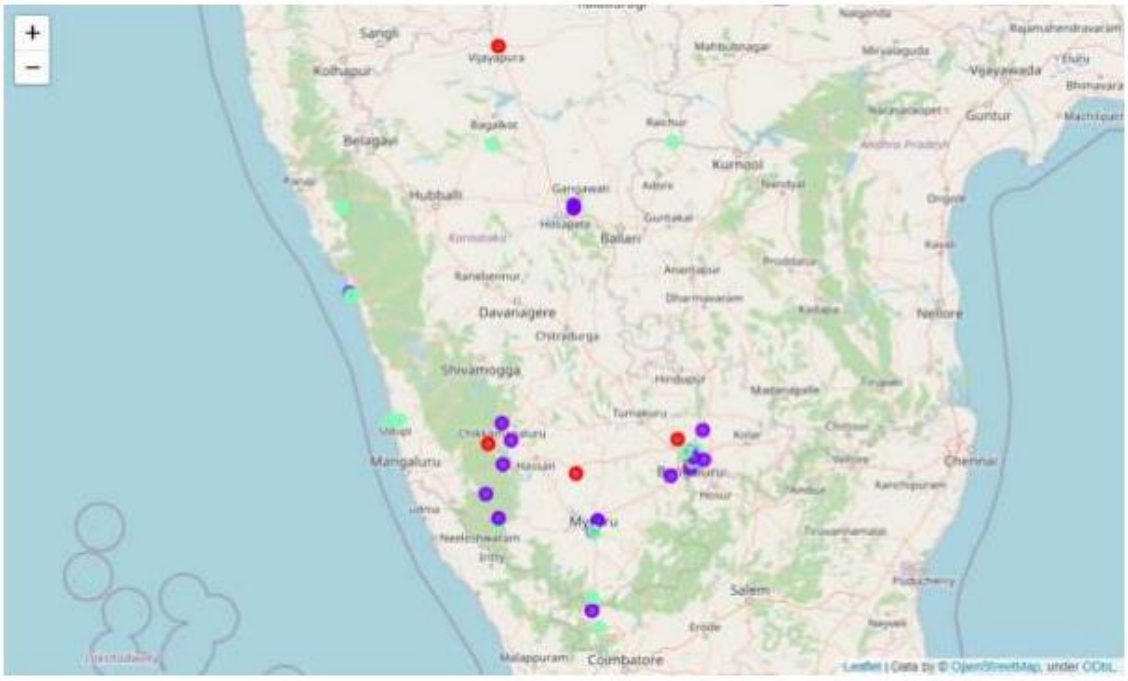
We then perform similar one hot encoding and analyse each venue to get the top businesses at a venue.

	Venue	1st Most Common Business	2nd Most Common Business	3rd Most Common Business	4th Most Common Business	5th Most Common Business	6th Most Common Business	7th Most Common Business	8th Most Common Business	9th Most Common Business	10th Most Common Business
0	Abbey Falls	Hotel	Indian Restaurant	Vegetarian / Vegan Restaurant	Comfort Food Restaurant	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop
1	Badami	Hotel	Vegetarian / Vegan Restaurant	Food Court	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store
2	Bandipur National Park	Rest Area	Vegetarian / Vegan Restaurant	Coffee Shop	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store
3	Bhartiya City	Garden Center	Pizza Place	Café	Vegetarian / Vegan Restaurant	Comfort Food Restaurant	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner
4	Channakeshwara Temple	Vegetarian / Vegan Restaurant	Indian Restaurant	Food Court	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store

We then use the K-means clustering algorithm to group the businesses into clusters that aim to partition ‘n’ observations into k clusters in which each observation belongs to the cluster. Here elbow method is used to determine the optimum value of k to perform K-means clustering. The graph obtained is –



Results and Discussion



The colors purple, green, and red represents cluster 1, 2, and 3 respectively. The results show that the most common business in cluster one at the respective venues are Indian Restaurants. So Indian Restaurants are popular in these tourist venues and opening up a similar one can attract many tourists. This is because India is a land with many cultures. Tourists always like to experience the flavor of local dishes available at a particular location and so this could be a nice opportunity to open up a business at that locality.

Cluster 1 – Whereas in cluster two the most sought business is the Hotel, Seafood Restaurants, and Cafeterias. This is clearly visible in the map above. The green clusters at the seaside clearly indicate that opening a seafood restaurant would help a person make the best use of the opportunity. Also, there are some green clusters in the middle of the map, which indicates Hotels and Cafeterias would be the best business at that tourist spot.

	Venue	1st Most Common Business	2nd Most Common Business	3rd Most Common Business	4th Most Common Business	5th Most Common Business	6th Most Common Business	7th Most Common Business	8th Most Common Business	9th Most Common Business	10th Most Common Business
19	Hampi	Indian Restaurant	Restaurant	Café	Vegetarian / Vegan Restaurant	Comfort Food Restaurant	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner
31	Hanuman Temple	Indian Restaurant	Vegetarian / Vegan Restaurant	Food Court	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store
38	Martanga Hill	Indian Restaurant	Vegetarian / Vegan Restaurant	Food Court	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store
45	Hemakuta Hill	Indian Restaurant	Restaurant	Café	Vegetarian / Vegan Restaurant	Comfort Food Restaurant	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner
54	Wonder La	Indian Restaurant	Restaurant	Pizza Place	Vegetarian / Vegan Restaurant	Coffee Shop	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop

Cluster 2 – Finally, in cluster three Fast Food/Vegetarian Restaurants have been given a top priority.

	Venue	1st Most Common Business	2nd Most Common Business	3rd Most Common Business	4th Most Common Business	5th Most Common Business	6th Most Common Business	7th Most Common Business	8th Most Common Business	9th Most Common Business	10th Most Common Business
13	Badami	Hotel	Vegetarian / Vegan Restaurant	Food Court	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store
58	PVR bluO	Clothing Store	Italian Restaurant	Coffee Shop	French Restaurant	Shopping Mall	Department Store	Gas Station	Hotel	Donut Shop	Motorcycle Shop
121	M.G Road Boulevard	Indian Restaurant	Café	Burger Joint	Toy / Game Store	Fried Chicken Joint	Coffee Shop	Clothing Store	Music Store	Pizza Place	American Restaurant
152	Bandipur National Park	Rest Area	Vegetarian / Vegan Restaurant	Coffee Shop	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store
154	Rose Garden	Coffee Shop	Hotel	Food Court	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store

Cluster 3 –

	Venue	1st Most Common Business	2nd Most Common Business	3rd Most Common Business	4th Most Common Business	5th Most Common Business	6th Most Common Business	7th Most Common Business	8th Most Common Business	9th Most Common Business	10th Most Common Business
113	Cubbon Park	Fast Food Restaurant	Sandwich Place	Vegetarian / Vegan Restaurant	Coffee Shop	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store
191	Our Native Village	Dry Cleaner	Vegetarian / Vegan Restaurant	Toy / Game Store	Fish & Chips Shop	Fast Food Restaurant	Electronics Store	Donut Shop	Diner	Dessert Shop	Department Store
217	Mudigere	Fast Food Restaurant	Vegetarian / Vegan Restaurant	Toy / Game Store	Fish & Chips Shop	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop	Department Store
252	Lord Bahubali Temple	Asian Restaurant	Vegetarian / Vegan Restaurant	Comfort Food Restaurant	Fish & Chips Shop	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop
479	Gol Gumbaz	Comfort Food Restaurant	Vegetarian / Vegan Restaurant	Toy / Game Store	Fish & Chips Shop	Fast Food Restaurant	Electronics Store	Dry Cleaner	Donut Shop	Diner	Dessert Shop

Conclusion

In this project, an attempt has been made to make use of the Foursquare API to get the famous tourist locations situated in a particular district of a State. K-means clustering algorithm has been used to cluster these tourist spots based on exploring the frequency of the businesses that are present which could help us indicate a business opportunity that could be established in the locality so that the business could attract as many tourists as possible. Future possible research could make use of other significant factors which includes the foot traffic where the tourists are likely to bypass the area (i.e a high traffic area), competition (i.e the number of similar businesses that could impact the new business being established), accessibility, and average business rates that could be incurred for a particular business. These above-mentioned factors could help the system make the analysis more accurate.