

Recommending a Location within Coimbatore City to open a Restaurant

1. Introduction:

1.1 Background :

Opening a Restaurant and running it successfully, is not a simple endeavour. There are quite a lot of things one has to brainstorm before opening a restaurant like target customers, frequency of the customers, parking facility, ambient environment, signature dishes, competitors, etc. It would be a business savy for restaurant owners to get places to open their restaurants which answers several questions like:

- Number of restaurants within 1000 meters from a place
- Type of restaurants within 1000 meters from a place
- Ratings and Reviews of restaurants
- What are the popular venues within 1000 meters from that place ?

1.2 Business Problem :

This project aims to solve the following research question : "In Coimbatore City, if someone is looking to open a restaurant, where would we recommend that they open it?"

1.3 Interest :

Restaurant owners or Entrepreneurs would be interested to get to know a likely place within Coimbatore City to open a restaurant.

2. Data

2.1 Data Sources :

Targeting Coimbatore city, we will be requiring all the localities within Coimbatore city. Hence I searched for pincode details of Coimbatore city, which helped me to land in the following page:

<https://www.mapsofindia.com/pincode/india/tamil-nadu/coimbatore/>

Scraped the webpage to get the table with features "Location", "Pincode", "State", "District" using BeautifulSoup and Python requests library.

Later, using geopy geocoders, generated Latitude and Longitude of the locations in that aforementioned table, which will be used to get the venues within 1000 meters or 2000 meters radius using FourSquare API.

In Particular, as we are only interested in "Restaurant" type venues, we will filter the "Restaurant" type venues from the dataframe.

Two data sources are used here:

- <https://www.mapsofindia.com/pincode/india/tamil-nadu/coimbatore/>
- FourSquare location data API

Example DataFrame from mapsofindia:

	Location	Pincode	State	District
0	A.Nagore	642205	Tamil Nadu	Coimbatore
1	Achipatti	642002	Tamil Nadu	Coimbatore
2	Agraharapudur	641663	Tamil Nadu	Coimbatore
3	Agraharasamakulam	641110	Tamil Nadu	Coimbatore
4	Akilandapuram	642004	Tamil Nadu	Coimbatore
5	Akkamalai	642127	Tamil Nadu	Coimbatore

Example DataFrame from geocoders:

	Location	Pincode	State	District	Latitude	Longitude
0	A.Nagore	642205	Tamil Nadu	Coimbatore	10.8167	79.8404
1	Akilandapuram	642004	Tamil Nadu	Coimbatore	10.8601	77.8747
2	Akkamalai	642127	Tamil Nadu	Coimbatore	10.3317	77.0195
3	Alandurai	641101	Tamil Nadu	Coimbatore	10.9541	76.7905
4	Alathur	641655	Tamil Nadu	Coimbatore	10.6459	76.5436
5	Amaravathi Nagar	642102	Tamil Nadu	Coimbatore	17.405	78.4633
6	Ammapatti	642205	Tamil Nadu	Coimbatore	10.3497	78.5634
7	Anaikatti	641108	Tamil Nadu	Coimbatore	12.818	79.7279
8	Anaimalai	642104	Tamil Nadu	Coimbatore	10.5823	76.9343
9	Andipalayam	641687	Tamil Nadu	Coimbatore	11.0999	78.1092
10	Angalakurichi	642007	Tamil Nadu	Coimbatore	10.5284	76.9963
11	Annur	641653	Tamil Nadu	Coimbatore	11.233	77.1035
12	Arasur	641402	Tamil Nadu	Coimbatore	10.0405	79.0118
13	Athipalayam	641110	Tamil Nadu	Coimbatore	11.1291	76.9807
14	Bharathiyar University	641046	Tamil Nadu	Coimbatore	11.0381	76.879

Example DataFrame from FourSquare API:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	A.Nagore	10.816698	79.840364	fathima oticals	10.810779	79.841934	Optical Shop
1	A.Nagore	10.816698	79.840364	RS wines	10.825323	79.834312	Bar
2	Alandurai	10.954117	76.790529	Vishali Bakes	10.951575	76.775734	Bakery
3	Alandurai	10.954117	76.790529	Alandurai	10.961470	76.805166	Bus Station
4	Alathur	10.645897	76.543608	basics life	10.645089	76.546015	Men's Store
5	Alathur	10.645897	76.543608	Alathur New Bus Stand	10.645226	76.539772	Bus Station
6	Alathur	10.645897	76.543608	HANA HOTEL	10.644548	76.550011	Fast Food Restaurant
7	Alathur	10.645897	76.543608	Hotel Gayathri	10.646148	76.553765	Hotel
8	Amaravathi Nagar	17.404956	78.463251	Cafe Niloufer & Bakers	17.399715	78.462881	Café
9	Amaravathi Nagar	17.404956	78.463251	Nizam club	17.403221	78.468729	Lounge

2.2 Data Cleaning

Initially "Coimbatore" pincodes were extracted as table using Beautiful Soup and Python requests library. Then, using geocoders, latitude and longitude coordinates have been found for all the locations in Coimbatore. But for some locations, latitude and longitude were not returned, for which I've inserted "NaN" values. In total 584 locations were there which later after removing "NaN" observations resulted in 224 locations.

Using FourSquare location data API, queried for venues within a radius of 2000 meters from the latitude and longitude of the locations. In total, 1938 rows of venues were returned for 224 locations by FourSquare API.

The head portion of the resulted dataframe is as follows:

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	A.Nagore	10.816698	79.840364	fathima oticals	10.810779	79.841934	Optical Shop
1	A.Nagore	10.816698	79.840364	RS wines	10.825323	79.834312	Bar
2	Alandurai	10.954117	76.790529	Vishali Bakes	10.951575	76.775734	Bakery
3	Alandurai	10.954117	76.790529	Alandurai	10.961470	76.805166	Bus Station
4	Alathur	10.645897	76.543608	basics life	10.645089	76.546015	Men's Store
5	Alathur	10.645897	76.543608	Alathur New Bus Stand	10.645226	76.539772	Bus Station
6	Alathur	10.645897	76.543608	HANA HOTEL	10.644548	76.550011	Fast Food Restaurant
7	Alathur	10.645897	76.543608	Hotel Gayathri	10.646148	76.553765	Hotel
8	Amaravathi Nagar	17.404956	78.463251	Cafe Niloufer & Bakers	17.399715	78.462881	Café
9	Amaravathi Nagar	17.404956	78.463251	Nizam club	17.403221	78.468729	Lounge

Totally 219 unique venue categories were there which includes but limited to 'Optical Shop', 'Bar' 'Bakery' 'Bus Station' 'Men's Store' 'Fast Food Restaurant' 'Hotel' 'Café' 'Lounge' 'Hyderabadi Restaurant' 'Indian Restaurant' 'Multiplex' 'Science Museum' 'Scenic Lookout' 'South Indian Restaurant' 'Bistro' 'Restaurant' 'Ice Cream Shop' 'BBQ Joint' 'Vegetarian / Vegan Restaurant' 'Middle Eastern Restaurant' 'Chaat Place' 'Chinese Restaurant' 'Performing Arts Venue' 'Lake' 'Smoke Shop' 'Donut Shop' 'Hotel Bar' 'Stadium' 'Park' 'Pub' 'Coffee Shop' 'Breakfast Spot' 'Garden' 'Bookstore' 'Pizza Place' 'Historic Site' 'Food Court' 'Gaming Cafe' 'Mobile Phone Shop' 'Snack Place', etc.

But as we are only interested in the "Restaurant" Venue type/category, those type of venues results alone filtered out from the data frame.

Calculated the frequency of common venues in each of the locations and the results were arranged in descending order based on the frequency of the venues.

Neighborhood	ATM	Accessories Store	Adult Boutique	Afghan Restaurant	African Restaurant	Airport	Airport Service	American Restaurant	Apres Ski Bar	...	Train Station	Travel & Transport	Turkish Restaurant	Udupi Restaurant	Vegetarian / Vegan Restaurant	Vietnamese Restaurant	Voting Booth	Wine Bar	Wings Joint	Women's Store
0	A.Nagore	0.000000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.0	0.0	0.000000
1	Alandurai	0.000000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.0	0.0	0.000000
2	Alathur	0.000000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.0	0.0	0.000000
3	Amaravathi Nagar	0.000000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.020000	0.0	0.000000	0.0	0.0	0.000000
4	Anaikatti	0.000000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.0	0.0	0.000000
5	Anaimalai	0.000000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.500000	0.0	0.000000	0.0	0.0	0.000000
6	Annur	0.250000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.0	0.0	0.000000
7	Bilichi	0.000000	0.000000	0.01	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.0	0.0	0.000000
8	Bodipalayam	0.000000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.0	0.0	0.000000
9	Chettipalayam	0.000000	0.000000	0.00	0.0	0.0	0.00	0.000000	0.0	...	0.000000	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.0	0.0	0.000000

Top 5 venues for each of the locations have been calculated.

----A.Nagore----		
	venue	freq
0	Optical Shop	0.5
1	Bar	0.5
2	Mobile Phone Shop	0.0
3	Motel	0.0
4	Motorcycle Shop	0.0
----Alandurai----		
	venue	freq
0	Bus Station	0.5
1	Bakery	0.5
2	ATM	0.0
3	Motel	0.0
4	Mountain	0.0

The top 5 venues for each of the location have been converted into a nice data frame filtered for only "Restaurants" data in it. After cleaning and ranking according to the frequency of the venues.

	Neighborhood	Venue	Frequency
0	Meenakshipuram	Restaurant	1.00
1	Naickenpalayam	South Indian Restaurant	1.00
2	Ettimadai	Indian Restaurant	0.75
3	Anaikatti	South Indian Restaurant	0.50
4	Anaimalai	Vegetarian / Vegan Restaurant	0.50
5	Anaimalai	Restaurant	0.50
6	Coimbatore Press colony	Fast Food Restaurant	0.50
7	Ganapathy	Indian Restaurant	0.50
8	Ganesapuram	Indian Restaurant	0.50
9	Kallipalayam	Asian Restaurant	0.50
10	Sholayar	Indian Restaurant	0.50
11	Sugunapuram	Indian Restaurant	0.50
12	V.Kallipalayam	Asian Restaurant	0.50

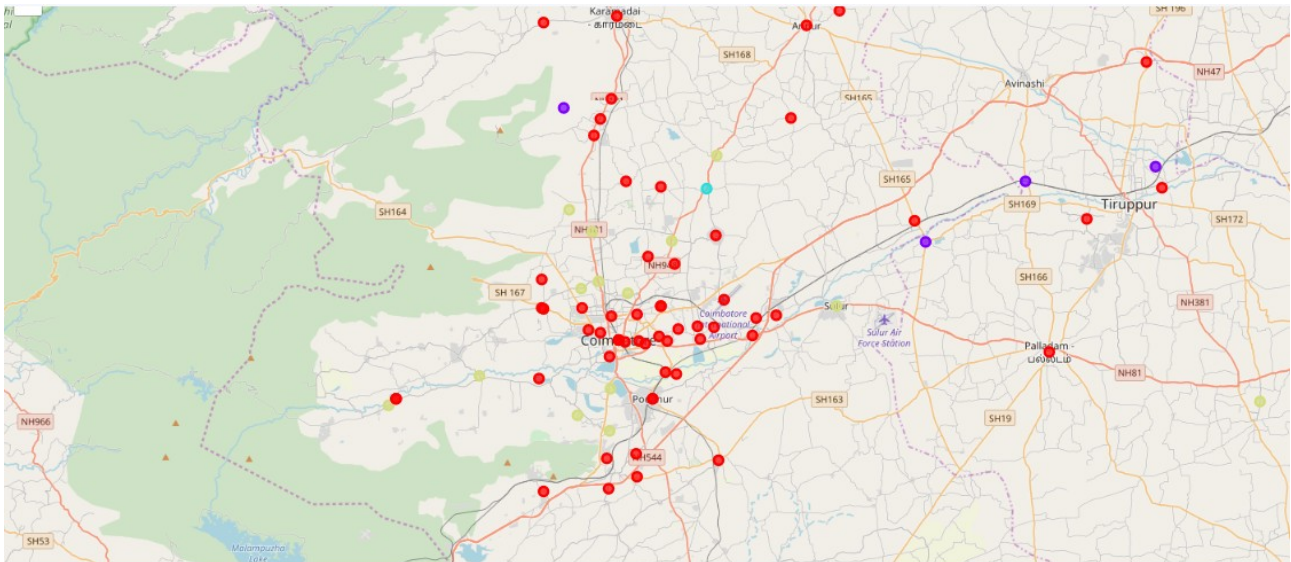
3. Methodology

3.1 Machine Learnings

Using unsupervised algorithm, K-Means, clusters were formed and k value adjusted to 4.

3.2 Exploratory Analysis

Map with the clusters were plotted using folium.



Most common venue (10 venues) have been derived out of the data. Individual clusters with the location venues have been reported.

3.2 Examine Clusters

Cluster 1

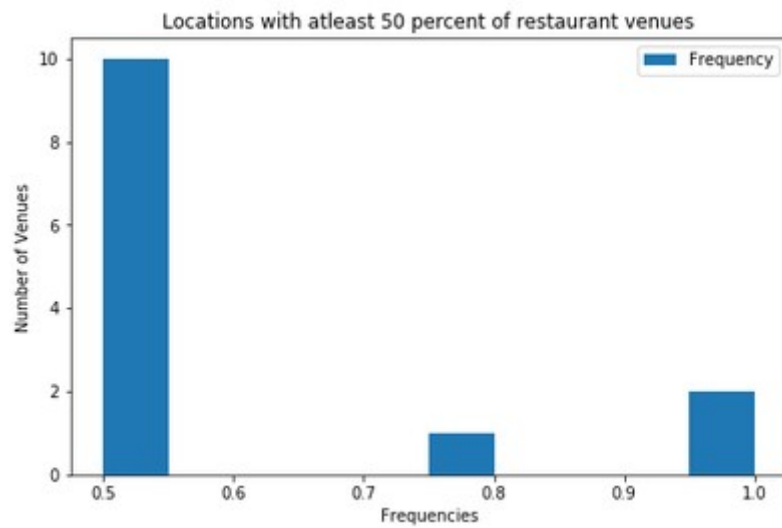
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coimbatore_merged.loc[coimbatore_merged['Cluster Labels'] == 0, coimbatore_merged.columns[[1] + list(range(5, coimbatore_merged.shape[1]))]]
```

}]:

	Pincode	Longitude	Cluster Labels	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	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
29	641021	78.0584	0.0	Bus Station	Indian Restaurant	Ice Cream Shop	Accessories Store	Dessert Shop	Diner	Flea Market	Fast Food Restaurant	Farmers Market	Farm
45	642122	77.8224	0.0	Bus Station	Women's Store	Dim Sum Restaurant	Fast Food Restaurant	Farmers Market	Farm	Exhibit	Event Space	Electronics Store	Donut Shop
66	641107	76.796	0.0	Asian Restaurant	Bus Station	Women's Store	Diner	Flea Market	Fast Food Restaurant	Farmers Market	Farm	Exhibit	Event Space
74	642203	77.3801	0.0	Bus Station	Women's Store	Dim Sum Restaurant	Fast Food Restaurant	Farmers Market	Farm	Exhibit	Event Space	Electronics Store	Donut Shop
95	642113	77.3636	0.0	Bus Station	Women's Store	Dim Sum Restaurant	Fast Food Restaurant	Farmers Market	Farm	Exhibit	Event Space	Electronics Store	Donut Shop
96	641106	76.9535	0.0	Platform	Racetrack	Bus Station	Women's Store	Dhaba	Farmers Market	Farm	Exhibit	Event Space	Electronics Store
119	641033	77.0338	0.0	Hotel	Bus Station	Vegetarian / Vegan Restaurant	Pharmacy	Women's Store	Dhaba	Farmers Market	Farm	Exhibit	Event Space
125	641107	77.0919	0.0	Bus Station	Women's Store	Dim Sum Restaurant	Fast Food Restaurant	Farmers Market	Farm	Exhibit	Event Space	Electronics Store	Donut Shop
134	641020	76.9443	0.0	Bus Station	ATM	Indian Restaurant	Scenic Outlook	Dim Sum Restaurant	Farmers Market	Farm	Exhibit	Event Space	Electronics Store
147	642002	77.1657	0.0	Bus Station	ATM	Dim Sum Restaurant	Fast Food Restaurant	Farmers Market	Farm	Exhibit	Event Space	Electronics Store	Donut Shop

4. Results

Either the investor can choose location with lesser number of restaurants as there will not be any competitors or choose a location with more number of already established restaurants and offering the facilities or ambience which the old restaurants failed to accomplish. In that case, there are two types of results presented below.



The data result for the same is as follows:

	Neighborhood	Venue	Frequency
0	Meenakshipuram	Restaurant	1.00
1	Naickenpalayam	South Indian Restaurant	1.00
2	Ettimadai	Indian Restaurant	0.75
3	Anaikatti	South Indian Restaurant	0.50
4	Anaimalai	Vegetarian / Vegan Restaurant	0.50
5	Anaimalai	Restaurant	0.50
6	Coimbatore Press colony	Fast Food Restaurant	0.50
7	Ganapathy	Indian Restaurant	0.50
8	Ganesapuram	Indian Restaurant	0.50
9	Kallipalayam	Asian Restaurant	0.50
10	Sholayar	Indian Restaurant	0.50
11	Sugunapuram	Indian Restaurant	0.50
12	V.Kallipalayam	Asian Restaurant	0.50

Locations with least number of Restaurant venues:

	Neighborhood	Venue	Frequency
0	Coimbatore Collectorate	Chinese Restaurant	0.01
1	Tatabad	North Indian Restaurant	0.01
2	Bilichi	Caucasian Restaurant	0.01
3	Bilichi	Japanese Restaurant	0.01
4	Vellonie	Mexican Restaurant	0.01
5	Vellonie	Restaurant	0.01
6	Tatabad	Vegetarian / Vegan Restaurant	0.01
7	Vellonie	Mediterranean Restaurant	0.01
8	Coimbatore	Vegetarian / Vegan Restaurant	0.02
9	Coimbatore South	Vegetarian / Vegan Restaurant	0.02
10	Coimbatore South	Restaurant	0.02
11	Coimbatore	Restaurant	0.02
12	Amaravathi Nagar	Vegetarian / Vegan Restaurant	0.02
13	Sahs College	American Restaurant	0.02
14	Siddhapudur	Chinese Restaurant	0.02
15	Siddhapudur	Restaurant	0.02
16	Sahs College	Japanese Restaurant	0.02
17	Sahs College	Vegetarian / Vegan Restaurant	0.02
18	Coimbatore West	Restaurant	0.02
19	Coimbatore Bazaar	Vegetarian / Vegan Restaurant	0.02

Locations where no restaurant venues are reported:

	Neighborhood	Venue	Frequency
0	A.Nagore	Afghan Restaurant	0.0
1	Ramanathapuram	Afghan Restaurant	0.0
2	Ramachandrapuram	Moroccan Restaurant	0.0
3	Ramachandrapuram	Middle Eastern Restaurant	0.0
4	Ramachandrapuram	Mexican Restaurant	0.0
5	Ramachandrapuram	Seafood Restaurant	0.0
6	Ramachandrapuram	Afghan Restaurant	0.0
7	Puliampatti	Moroccan Restaurant	0.0
8	Puliampatti	Middle Eastern Restaurant	0.0
9	Puliampatti	Mexican Restaurant	0.0
10	Puliampatti	Seafood Restaurant	0.0
11	Puliampatti	Afghan Restaurant	0.0
12	Pudupalayam	Mexican Restaurant	0.0
13	Pudupalayam	Restaurant	0.0
14	Pudupalayam	Afghan Restaurant	0.0
15	Poosaripatti	Middle Eastern Restaurant	0.0
16	Poosaripatti	Mexican Restaurant	0.0
17	Poosaripatti	Malay Restaurant	0.0
18	Poosaripatti	Afghan Restaurant	0.0
19	Pollachi R.s	Middle Eastern Restaurant	0.0

5. Discussion

There are many locations where Restaurant venue category was not reported as of FourSquare location data API. But I believe that, using Google places API and other API's we can wrangle more Restaurant venue category data from those places. Doing analysis with more data would yield more accurate analysis I believe. Like I said before, an investor or business person or restaurant owner can take this data to see the current trend of the Restaurants in each of the locations within coimbatore as a continued analysis to improve his business and also they can use the data to open a restaurant in any of the reported places.

He can consider opening restaurant based on the following:

- Locations with more restaurants
- Locations with less restaurants
- Locations with no restaurants

6. Conclusion

As to conclude, I used FourSquare API to get the venues nearby the locations of Coimbatore within 2000 meters radius and upto 100 venues resulted in 1938 observations. Upon which, the K-means clustering algorithm was used to cluster the venues in each of the locations and analysed the individual clusters. Frequency for the occurrence of the venue category "Restaurants" were filtered out and results were reported for three types of locations. Locations with more restaurants, locations with less number of restaurants, and locations with no

restaurants. From which, An investor or restaurant owner or anyone who wants to open a restaurant in coimbatore can choose. It can be extended to look for the reviews and ratings for each of the restaurants reported and can be arranged based on the good reviews and ratings. We can also look for the nearby venues with colleges, IT offices and other workplaces or industries so as to think of regular crowd to the restaurant which is about to be opened.