Identifying an ideal location in New York City to open an Indian Restaurant

By
Sri Surya Sameer Vaddhiparthy

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1 INTRODUCTION

1.1 BACKGROUND OF NEW YORK CITY'S RESTAURANTS AND CUISINE

New York City's has attracted immigrants from various parts of the world which has resulted in it having the most diverse cuisines in world, to put that into perspective it would take 2 decades to cover every restaurant that is there if you eat at a new place every day, with this background, we can conclude that the restaurant business is highly competitive in New York City. The city is a major hub for banking, trade, transportation, tourism, real estate, hence there is huge potential for a business to be successful. The initial investment to start a restaurant in this city higher than average and for the business to be successful, the investor needs to make sound decision based on insights derived from analysis of data currently available.

1.2 CHALLENGES IN LOCATING AN IDEAL PLACE FOR NEW RESTAURANT

The diverse food culture of New York City, Indian food is one of popular foods in New York City due to fact that local people embrace the diversity and there are around 700,000 from India living in New York City. There is huge potential for a business to be successful and at the same time there are few challenges due to the fact that there are 1082 Indian restaurants in Ney York City as per the data from Four Square.

There are two ways to approach this

- Open a restaurant the serves foods like Kebabs, tandoori and other traditional Indian food for the elite Indian customer who are willing to pay more.
- Open an affordable all you can eat restaurant with a wider variety to cater the masses at an affordable price.

The client has chosen to go with the first choice, because he has the interest and necessary resources to open a restaurant that can serve highly specialized Indian delicacies to serve the elite customers, specifically in Manhattan. So, the focal point of our analysis will be Manhattan area, the Manhattan is highly competitive area and it is important we select the right location for the restaurant with huge potential and less competitors in the vicinity.

2 DATA

2.1.1 New York City Neighbourhood Data

Neighbourhood has a total of 5 boroughs and 306 neighbourhoods. In order to segment the neighbourhoods and explore them, we will essentially need a dataset that contains the 5 boroughs and the neighbourhoods that exist in each borough as well as the latitude and longitude coordinates of each neighbourhood. This dataset is from New York University, available in this link.

	Borough	Neighborhood	Latitude	Longitude
0	Manhattan	Marble Hill	40.876551	-73.910660
1	Manhattan	Chinatown	40.715618	-73.994279
2	Manhattan	Washington Heights	40.851903	-73.936900
3	Manhattan	Inwood	40.867684	-73.921210
4	Manhattan	Hamilton Heights	40.823604	-73.949688

Figure 1: NYC Neighbourhood with Latitude and Longitude data frame

2.1.2 Indian Restaurants in Manhattan Data

New York City's geographical coordinates data will be utilized as input for the Foursquare API, and get venues information for each neighbourhood. We will use the Foursquare API to explore neighbourhoods. Indian Restaurant category ID 4bf58dd8d48988d1d2941735 is used for retrieving data from Foursquare API, venue categories available in this link.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Marble Hill	40.876551	-73.910660	Riverdale Indian Cuisine	40.880886	-73.908800	Indian Restaurant
1	Marble Hill	40.876551	-73.910660	Tazmohol Indian Restaurant	40.878058	-73.903045	Indian Restaurant
2	Marble Hill	40.876551	-73.910660	Cumin Indian Cuisine	40.886459	-73.909816	Indian Restaurant
3	Chinatown	40.715618	-73.994279	Kabab Bites	40.720094	-73.995819	Indian Restaurant
4	Chinatown	40.715618	-73.994279	indi thai	40.719830	-73.990350	Indian Restaurant

Figure 2: Indian restaurants in Manhattan data frame

3 METHODOLOGY

The addresses have been converted into their equivalent latitude and longitude values, Then I have used the Foursquare API to explore food places in Manhattan, New York by using explore function to get the list of all food places in Indian restaurant categories in each neighbourhood.

The Folium library was used to visualize the location neighbourhoods in Manhattan and its emerging clusters and various categories of Indian restaurants have been converted into binary values and mean values have been computed.

Figure 3: Folium map of Indian restaurants in Manhattan

	Neighborhood	Asian Restaurant	Burrito Place	Chaat Place	Deli / Bodega	Diner	Dosa Place	Food Court	Food Truck	Himalayan Restaurant	Hookah Bar	Indian Restaurant
0	Marble Hill	0	0	0	0	0	0	0	0	0	0	1
1	Marble Hill	0	0	0	0	0	0	0	0	0	0	1
2	Marble Hill	0	0	0	0	0	0	0	0	0	0	1
3	Chinatown	0	0	0	0	0	0	0	0	0	0	1
4	Chinatown	0	0	0	0	0	0	0	0	0	0	1

Figure 4: Indian Restaurants categories encoded into binary form

Diner	Dosa Place	Food Court	Food Truck	Himalayan Restaurant	Hookah Bar	Indian Restaurant	Music Store	North Indian Restaurant	South Indian Restaurant	Tapas Restaurant	Vegetarian / Vegan Restaurant
0.0	0.0	0.0	0.00	0.0	0.0	0.944444	0.0	0.055556	0.000000	0.0	0.0
0.0	0.0	0.0	0.00	0.0	0.0	0.928571	0.0	0.000000	0.071429	0.0	0.0
0.0	0.0	0.0	0.00	0.0	0.0	1.000000	0.0	0.000000	0.000000	0.0	0.0
0.0	0.0	0.0	0.12	0.0	0.0	0.880000	0.0	0.000000	0.000000	0.0	0.0
0.0	0.0	0.0	0.00	0.0	0.0	0.941176	0.0	0.058824	0.000000	0.0	0.0

Figure 5: Indian Restaurants categories encoded and categorical mean.

Using data manipulations techniques, a new data frame containing the ranking of top category of restaurants has been created.

	Neighborhood	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 Ven
0	Battery Park City	Indian Restaurant	Food Truck	Tapas Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hool
1	Carnegie Hill	Indian Restaurant	North Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Fc Tr
2	Central Harlem	Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Fc Tr
3	Chelsea	Indian Restaurant	Food Truck	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalay Restaur
4	Chinatown	Indian Restaurant	North Indian Restaurant	Dosa Place	Deli / Bodega	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hool

Figure 6: Indian Restaurants categorical rankings in each neighbourhood.

3.1 K-MEANS CLUSTERING

The data frame with encoded categorical variables is used to group the neighbourhoods into clusters, K-means clustering algorithm will be used to complete this task.

After the clustering, the Folium library to visualize the neighbourhoods in Manhattan and its emerging clusters for various Indian restaurants spread across Manhattan.

4   RESULTS

4.1   K-MEAN CLUSTER RESULTS

Using K-mean to clustering data area to identify neighbourhoods with a smaller number of Indian restaurants, the number of clusters was set to 5,

The following output was obtained

```python
# set number of clusters
kclusters = 5

manhattan_grouped_clustering = manhattan_grouped.drop('Neighborhood', 1)

# run k-means clustering
kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(manhattan_grouped_clustering)

# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:10]
```

array([2, 1, 4, 2, 3, 2, 2, 4, 3, 2], dtype=int32)

Figure 7: K-mean clustering output array

The above generated clusters in Manhattan are colour coded and visualized using folium.

Figure 8: Visualization of Indian restaurant clusters.

4.2 CLUSTERED DATA

4.2.1 Cluster 0

	Neighborhood	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
27	Gramercy	Indian Restaurant	South Indian Restaurant	North Indian Restaurant	Chaat Place	Vegetarian / Vegan Restaurant	Music Store	Hookah Bar	Food Truck	Dosa Place	Deli / Bodega
37	Stuyvesant Town	Indian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Dosa Place	Deli / Bodega	Chaat Place	Tapas Restaurant	Music Store	Hookah Bar
38	Flatiron	Indian Restaurant	Food Truck	South Indian Restaurant	North Indian Restaurant	Vegetarian / Vegan Restaurant	Music Store	Hookah Bar	Dosa Place	Deli / Bodega	Chaat Place

Figure 9: first cluster entitled "Cluster 0"

This specific cluster has been chosen and justification is provided in further sections. The following 3 neighbourhoods are the 3 candidate neighbourhoods for opening an Indian restaurant.

1. Gramercy
2. Stuyvesant Town
3. Flatiron

4.2.2 Cluster 1

	Neighborhood	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
8	Upper East Side	Indian Restaurant	North Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
9	Yorkville	Indian Restaurant	North Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
12	Upper West Side	Indian Restaurant	South Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
13	Lincoln Square	Indian Restaurant	South Indian Restaurant	Food Truck	Vegetarian / Vegan Restaurant	Tapas Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Court
18	Greenwich Village	Indian Restaurant	North Indian Restaurant	Food Truck	Dosa Place	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
30	Carnegie Hill	Indian Restaurant	North Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court

Figure 10: second cluster entitled "Cluster 1"

4.2.3 Cluster 2

	Neighborhood	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
14	Clinton	Indian Restaurant	Food Truck	South Indian Restaurant	Diner	Vegetarian / Vegan Restaurant	Tapas Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
15	Midtown	Indian Restaurant	Food Truck	North Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Court
16	Murray Hill	Indian Restaurant	Food Truck	North Indian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	Chaat Place	Asian Restaurant	Tapas Restaurant	Music Store	Hookah Bar
17	Chelsea	Indian Restaurant	Food Truck	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Court
24	West Village	Indian Restaurant	Food Truck	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Court
28	Battery Park City	Indian Restaurant	Food Truck	Tapas Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
29	Financial District	Indian Restaurant	Food Truck	Tapas Restaurant	Asian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
32	Civic Center	Indian Restaurant	Food Truck	Tapas Restaurant	Dosa Place	Asian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar
33	Midtown South	Indian Restaurant	Food Truck	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Chaat Place	Asian Restaurant	Tapas Restaurant	Music Store	Hookah Bar
39	Hudson Yards	Indian Restaurant	Food Truck	South Indian Restaurant	Diner	Vegetarian / Vegan Restaurant	Tapas Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant

Figure 11: third cluster entitled "Cluster 2"

4.2.4 Cluster 3

	Neighborhood	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
1	Chinatown	Indian Restaurant	North Indian Restaurant	Dosa Place	Deli / Bodega	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
10	Lenox Hill	Indian Restaurant	North Indian Restaurant	Food Court	Asian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
11	Roosevelt Island	Indian Restaurant	Food Court	Asian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
19	East Village	Indian Restaurant	Deli / Bodega	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Dosa Place	Chaat Place	Tapas Restaurant	Music Store	Hookah Bar
20	Lower East Side	Indian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Deli / Bodega	Chaat Place	Tapas Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
21	Tribeca	Indian Restaurant	Food Truck	Tapas Restaurant	Dosa Place	Asian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar
22	Little Italy	Indian Restaurant	Dosa Place	North Indian Restaurant	Deli / Bodega	Asian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar
23	Soho	Indian Restaurant	Food Truck	Dosa Place	North Indian Restaurant	Deli / Bodega	Asian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store
31	Noho	Indian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant	North Indian Restaurant	Dosa Place	Deli / Bodega	Chaat Place	Tapas Restaurant	Music Store	Hookah Bar
34	Sutton Place	Indian Restaurant	Food Truck	Food Court	Asian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar
35	Turtle Bay	Indian Restaurant	Food Truck	North Indian Restaurant	Food Court	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant
36	Tudor City	Indian Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Food Truck	Chaat Place	Burrito Place	Asian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant

Figure 12: fourth cluster entitled "Cluster 3"

4.2.5 Cluster 4

	Neighborhood	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
0	Marble Hill	Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
2	Washington Heights	Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
4	Hamilton Heights	Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
5	Manhattanville	Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
6	Central Harlem	Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
7	East Harlem	Indian Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Himalayan Restaurant	Food Truck	Food Court
25	Manhattan Valley	Indian Restaurant	Himalayan Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Food Truck	Food Court
26	Morningside Heights	Indian Restaurant	Himalayan Restaurant	Vegetarian / Vegan Restaurant	Tapas Restaurant	South Indian Restaurant	North Indian Restaurant	Music Store	Hookah Bar	Food Truck	Food Court

Figure 13: fifth cluster entitled "Cluster 4"

5 DISCUSSION - INSIGHTS FROM RESULTS

5.1 CLUSTER SELECTION

The first cluster entitled 'Cluster 0' has only three locations and these locations hold a good potential for a new Indian restaurant.

5.2 ANALYSIS OF EACH OPTION IN 'CLUSTER 0'

The algorithms have helped us find 3 candidate neighborhoods; we now use some domain knowledge to further simplify the results, because we just need one location for the restaurant. The best choices are provided in order of their rank along with justification.

5.2.1 First Choice – Flatiron

Flatiron   Indian   Food Truck
                Restaurant

Justification

There is just one Indian restaurant and a Food truck in top 2 venues. Also, this place has historic tourist attractions like Flatiron Building, which translate into a high footfall, making this the number one location.
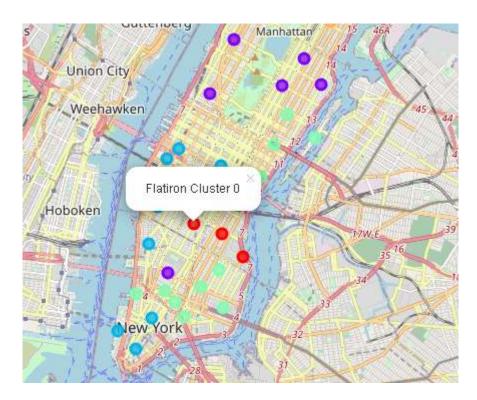

Figure 14: Flatiron Cluster 0 location

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5.2.2 Second Choice - Stuyvesant Town

Stuyvesant Town	Indian Restaurant	Vegetarian / Vegan Restaurant	South Indian Restaurant

Justification

The Stuyvesant Town demographics from the [Furman Centre](#) reveal that there around 18.5 % Asian population and top 2nd restaurant is vegetarian, which means there is only one restaurant the top serving Kebabs and other special Indian delicacies, making it the second-best option.

Figure 15: Stuyvesant Town Cluster 0 location

5.2.3 Third and last Choice - Gramercy

Gramercy	Indian Restaurant	South Indian Restaurant

There are already 2 Indian restaurants in the top serving Indian food and both of them serve non-vegetarian food, which tell us that this region relatively competitive, making this the least preferable choice in 'cluster 0'.

6   CONCLUSION

- This analysis is performed with limited data and limited computing resources hence the depth of insights would be proportionate to the extent.

- This analysis can be enhanced by adding more information on residential localities nearby, their choice of cuisine etc.
- The goal of identifying an ideal location to open an Indian restaurant in Manhattan has been successfully achieved.