# Capstone Project-The-Battle-of-Neighborhoods|

## Exploring Chennai, Tamil Nadu, INDIA

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# Introduction

- Chennai, the capital city of Tamil Nadu- India, attracts many visitors either as tourists or as part of its large workforce. The vast majority claim Chennai is one of the best cities in India.
- We know that Chennai is popular for IIT and for being an IT and industrial hub. The city is also renowned for its passion for music. But, there's more to the city than you think.
- From its varied culture and tradition, vibrant festivals, dainty delicacies to its quintessential "Chennai Tamil", this city doesn't fail to mesmerize the locals and the outsiders living here.

# Business Problem

The expectation of visitors to Chennai could be stated as follows:

- a. What are the local food/ native cuisine available from restaurants in and around Chennai?
- b. What services or value addition does the stop-over at a restaurant bring him, other than enjoying good food?

# Target Audience

- The goal of this exercise is to give a simple recommendation to visitors of Chennai, Tamil Nadu: in which area they will find a large number or concentration of which types of restaurants.
- The target audience are investors who would like to start a group or chain of restaurants in and around Chennai. This analysis will give an idea, which area is crowded with restaurants and where is it beneficial to open a restaurant around Chennai.
- Road Travelers, to find reasonable refreshment joint where they can dine and also get along to refresh themselves in an amusement park – rest and refresh during their long road trip.

# Data

- Foursquare API is used to collect data about restaurants in Chennai.

  In order to gain that information we will use “Foursquare” locational information. Foursquare is a location data provider with information about all manner of venues and events within an area of interest. Such information includes venue names, locations, menus and even photos. As such, the foursquare location platform will be used as the sole data source since all the stated required information can be obtained through the API.

- Once the data is retrieved from Foursquare contained information of venues within a specified distance of the longitude and latitude of the postcodes, Folium package is used to visualize  interactive maps for data exploration and communicating research.
  - Created a map centered at an inputted location
  - Created marker on the map

# Methodology - Data Visualization and Exploration

**Used Nominatim to get co-ordinates of Chennai using geocoder**

### 3.1. Using Nominatim to get co-ordinates of Chennai

[3]:
```
address = 'Chennai,IN'

geolocator = Nominatim()
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinate are {}, {}.'.format(latitude, longitude))
```

```
/opt/conda/envs/Python36/lib/python3.6/site-packages/ipykernel/__main__.py:3: DeprecationWarning: Using Nominatim with the default "geop
y/1.18.1" `user_agent` is strongly discouraged, as it violates Nominatim's ToS https://operations.osmfoundation.org/policies/nominatim/ a
nd may possibly cause 403 and 429 HTTP errors. Please specify a custom `user_agent` with `Nominatim(user_agent="my-application")` or by o
verriding the default `user_agent`: `geopy.geocoders.options.default_user_agent = "my-application"`. In geopy 2.0 this will become an exc
eption.
  app.launch_new_instance()
```

```
The geograpical coordinate are 13.0801721, 80.2838331.
```

# Methodology - Data Visualization and Exploration

Used Folium package to visualize the near-by venues.

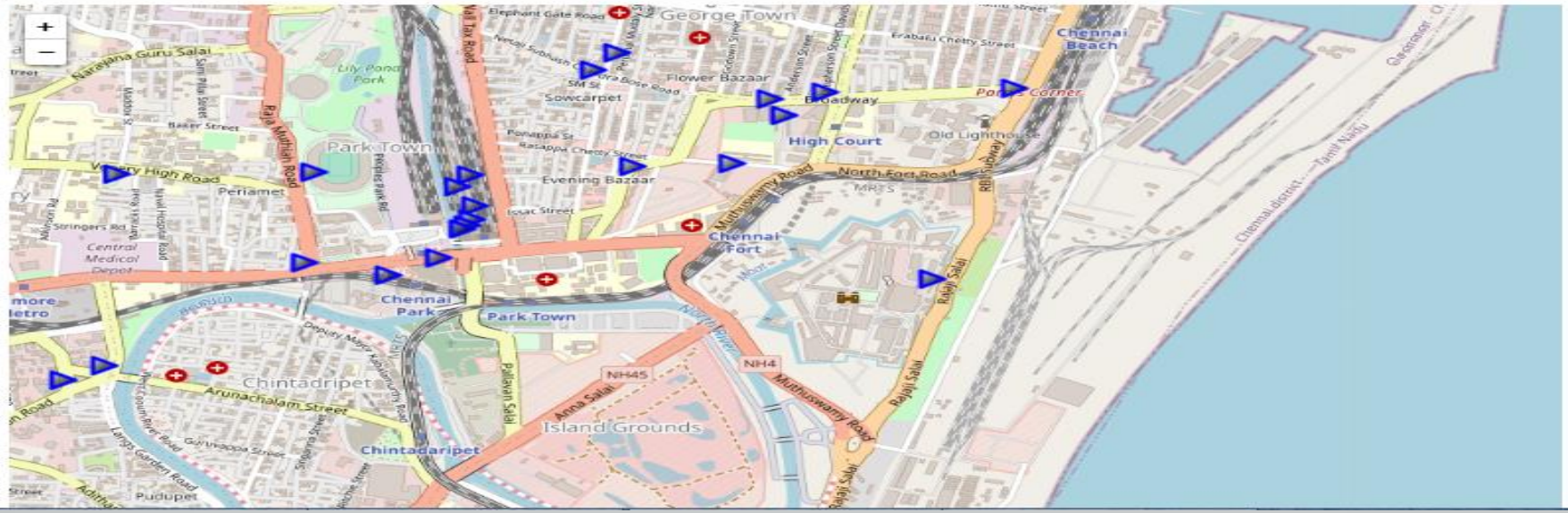
### 3.2. Visualizing near by venues using folium

In [14]:
```
map_chn = folium.Map(location=[latitude, longitude], zoom_start=15)

# add markers to map
for lat, lng, label in zip(nearby_venues['lat'], nearby_venues['lng'], nearby_venues['name']):
    label = folium.Popup(label, parse_html=True)
    folium.RegularPolygonMarker(
        [lat, lng],
        number_of_sides=3,
        radius=10,
        popup=label,
        color='blue',
        fill_color='#0f0f0f',
        fill_opacity=0.7,
    ).add_to(map_chn)

map_chn
```

Out[14]:



# Methodology - Data Visualization and Exploration

Used one hot coding to group neighborhood by venue categories. Retrieved the most common venue by the frequency.

In [26]:
```
# find out how many unique categories can be curated from all the returned venues

print('There are {} uniques categories.'.format(len(chennai_venues['Venue Category'].unique())))
```

```
There are 88 uniques categories.
```

In [27]:
```
# one hot encoding
Chennai_onehot = pd.get_dummies(chennai_venues[['Venue Category']], prefix="", prefix_sep="")

# add neighborhood column back to dataframe
Chennai_onehot['Neighborhood'] = chennai_venues['Neighborhood']

# move neighborhood column to the first column
fixed_columns = [Chennai_onehot.columns[-1]] + list(Chennai_onehot.columns[:-1])
Chennai_onehot = Chennai_onehot[fixed_columns]

Chennai_onehot.head()
```

Out[27]:

| | Neighborhood | African Restaurant | Asian Restaurant | Athletics & Sports | BBQ Joint | Bakery | Bar | Beach | Bengali Restaurant | Bistro | ... | Spa | Steakhouse | Surf Spot | Tea Room | Thai Restaurant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | National Durbar Hotel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ... | 0 | 0 | 0 | 0 | 0 |
| 1 | National Durbar Hotel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ... | 0 | 0 | 0 | 0 | 0 |
| 2 | National Durbar Hotel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ... | 0 | 0 | 0 | 0 | 0 |
| 3 | National Durbar Hotel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ... | 0 | 0 | 0 | 0 | 0 |
| 4 | National Durbar Hotel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ... | 0 | 0 | 0 | 0 | 0 |

5 rows × 89 columns

In [29]:
```
# examine the new dataframe size.

Chennai_onehot.shape
```

Out[29]: (5160, 89)

# Methodology - Data Visualization and Exploration

Used Kclusters to group the neighborhood by venues categories

In [38]:
```
# set number of clusters
kclusters = 5
# run k-means clustering
kmeans = KMeans(n_clusters = kclusters, random_state=0).fit(Chennai_grouped_clustering)
# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:10]
```

Out[38]:
```
array([0, 0, 0, 3, 0, 1, 1, 4, 4, 4], dtype=int32)
```

In [48]:
```
# add clustering labels
#neighbourhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)
chn_merged = nearby_venues
# match/merge SE London data with Latitude/Longitude for each neighborhood
chn_merged_latlong = chn_merged.join(neighbourhoods_venues_sorted.set_index('Neighborhood'), on = 'name')
chn_merged_latlong.head(5)
```

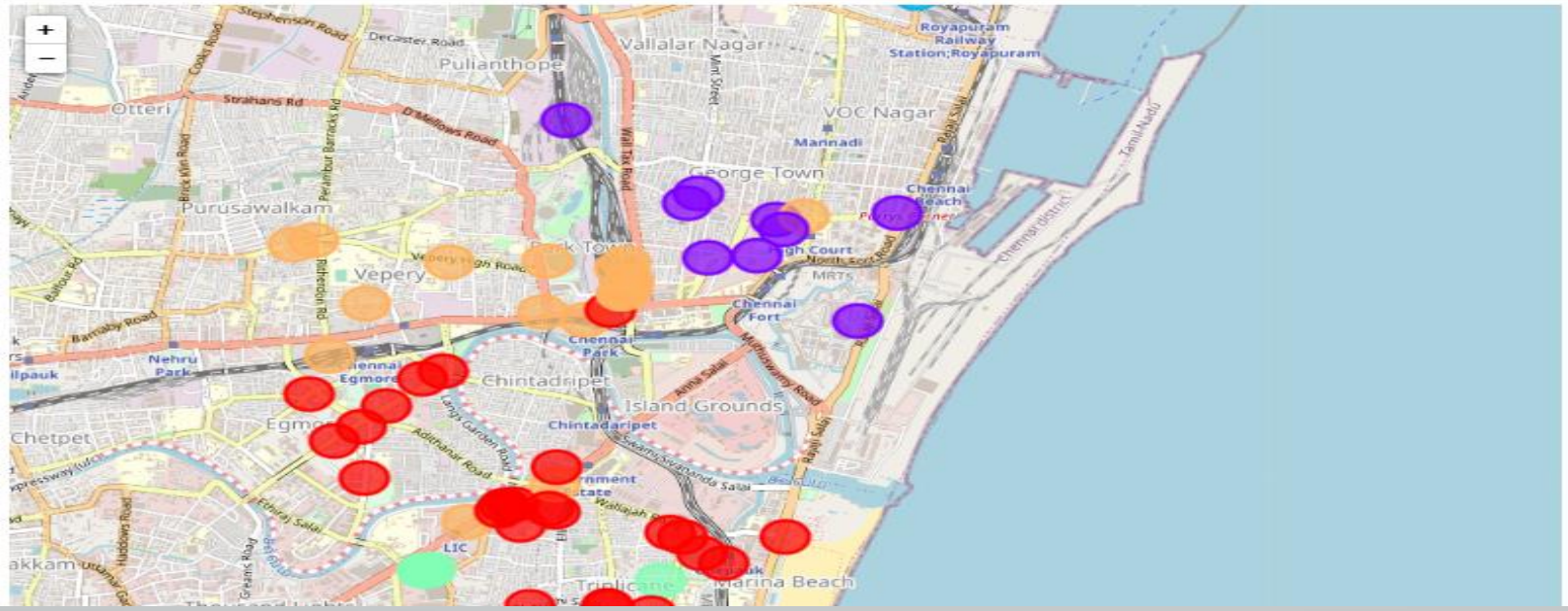
Out[48]:

| | name | categories | lat | lng | Cluster Labels1 | 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 M Comr Ve |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | National Durbar Hotel | Indian Restaurant | 13.081301 | 80.270601 | 4 | 4 | Indian Restaurant | Hotel | Pizza Place | Clothing Store | Sandwich Place | Middle Eastern Restaurant | Juice B |
| 1 | Fort Museum | Museum | 13.080618 | 80.287719 | 1 | 1 | Indian Restaurant | Platform | Vegetarian / Vegan Restaurant | Bookstore | Convenience Store | Nightclub | Museu |
| 2 | M A Chidambaram Stadium | Cricket Ground | 13.062830 | 80.279239 | 0 | 0 | Indian Restaurant | Hotel | Multiplex | Movie Theater | Restaurant | Middle Eastern Restaurant | Pizza Place |
| 3 | Kakada Ramprasad | Indian Restaurant | 13.090415 | 80.279111 | 1 | 1 | Indian Restaurant | Platform | Vegetarian / Vegan Restaurant | Pizza Place | Convenience Store | Department Store | Farmer Market |
| 4 | Bombay Lassi | Dessert Shop | 13.066040 | 80.271222 | 0 | 0 | Indian Restaurant | Hotel | Multiplex | Ice Cream Shop | Café | Juice Bar | Middle Eastern Restau |

# Methodology - Data Visualization and Exploration

Folium package is used to visualize the clusters

```
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=14)
# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]
# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(chn_merged_latlong['lat'], chn_merged_latlong['lng'], chn_merged_latlong['categories'], chn_me
rged_latlong['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=15,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(map_clusters)
display(map_clusters)
```



# Results

Snapshot of the cluster is shown below:

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 53 | Platform | 1 | Indian Restaurant | Pizza Place | Platform | Farmers Market | Vegetarian / Vegan Restaurant | Hotel | Fast Food Restaurant | Italian Restaurant | Department Store | Convenier Store |

In [63]:
```
# Cluster 3
chn_merged_latlong.loc[chn_merged_latlong['Cluster Labels'] == 2, chn_merged_latlong.columns[[1] + list(range(5, chn_merged_latlong.shape[1]))]]
```

Out[63]:

| | categories | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 58 | Fast Food Restaurant | 2 | Platform | Indian Restaurant | Video Store | Museum | Restaurant | Sandwich Place | Fast Food Restaurant | Market | Furniture / Home Store | Electronics Store |

In [64]:
```
# Cluster 4
chn_merged_latlong.loc[chn_merged_latlong['Cluster Labels'] == 3, chn_merged_latlong.columns[[1] + list(range(5, chn_merged_latlong.shape[1]))]]
```

Out[64]:

| | categories | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Bar | 3 | Indian Restaurant | Italian Restaurant | Multiplex | Hotel | Fast Food Restaurant | Sandwich Place | Platform | Beach | Bar | Café |
| 16 | Hotel | 3 | Indian Restaurant | Italian Restaurant | Multiplex | Hotel | Fast Food Restaurant | Sandwich Place | Platform | Beach | Bar | Café |
| 17 | Indian Restaurant | 3 | Indian Restaurant | Fast Food Restaurant | Multiplex | Bar | Beach | Platform | Ice Cream Shop | Train Station | Vegetarian / Vegan Restaurant | Café |
| 24 | Breakfast Spot | 3 | Indian Restaurant | Italian Restaurant | Multiplex | Hotel | Fast Food Restaurant | Sandwich Place | Platform | Beach | Bar | Café |

In [65]:
```
# Cluster 5
chn_merged_latlong.loc[chn_merged_latlong['Cluster Labels'] == 4, chn_merged_latlong.columns[[1] + list(range(5, chn_merged_latlong.shape[1]))]]
```

Out[65]:

| | categories | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

# Results

The following are derived based on the results of 5 clusters:

- As discussed in the introduction, data also supports the fact that Chennai is famous for food and movie.

- Although, the Clusters have variations, the most common venue is the Indian Restaurants.

# Discussion and Conclusion

Visitors of Chennai can enjoy Indian cuisine in all the 5 clusters. If the visitor is interested in visiting other venues other than restaurant then cluster 3 is the best suited to enjoy movie with food.