CAPSTONE PROJECT: BATTLE OF THE NEIGHBORHOODS

Opening a Chinese Restaurant in Boston

I. Introduction

Boston is the capital and most populous city of the Commonwealth of Massachusetts in the United States, as well as the 21st most populous city in the United States. Boston is one of the oldest municipalities in the United States, founded on the Shawmut Peninsula in 1630 by Puritan settlers from England. Today, Boston is a thriving port city. The Boston area's many colleges and universities make it an international center of higher education, including law, medicine, engineering, and business, and the city is considered to be a world leader in innovation and entrepreneurship, with nearly 2,000 startups. Along with its long history, food is a quintessential component of New York City. Cuisine in Boston is similar to the rest of New England cuisine, in that it has a large emphasis on seafood and dairy products. Its best-known dishes are New England clam chowder, fish and chips (usually with cod or scrod), baked beans, lobsters, steamed clams, and fried clams.

The **Union Oyster House** is the oldest operating restaurant in the United States. Their menu includes oysters on the half-shell served straight from an oyster bar, New England clam chowder, and other seafood dishes. Quincy Market, part of Faneuil Hall

Marketplace, has a variety of restaurants and food shops. Nearby Cheers is a popular tourist dining spot.

Boston's **Chinatown** has a variety of Asian restaurants, bakeries, grocery stores, and medicinal herb and spice vendors. In addition to dim sum and other Chinese dining styles, there are Vietnamese, Japanese, Korean and Thai restaurants in the neighborhood.

The **North End** has a variety of Italian restaurants, pizzerias, and bakeries and is well known as Boston's "Little Italy." A favorite spot bringing in tourists is Mike's Pastry, located on Hanover Street and is extremely popular for its cannolis. Newbury Street has many ethnic street cafes, while Copley Place houses a multitude of restaurants, also the home of Legal Sea Foods, a New England institution that offers gourmet seafood dishes.

The objective of this project is to locate and recommend which neighborhood of Boston will be best choice to start a Chinese restaurant and explain the rationale of the recommendations.

II. Data Acquisition

This demonstration will make use of the following data sources:

Boston Neighborhoods Data

Data will retrieved from Boston open dataset from https://data.boston.gov website.

The Neighborhood boundaries data is a combination of zoning neighborhood boundaries, zip code boundaries and 2010 Census tract boundaries. These boundaries are used in the broad sense for visualization purposes for zoning and planning studies.

Boston location data retrieved using Google maps API

Data coordinates of Neighborhood Venues will be retrieved using google API. I also make use of subway stations coordinate as a more important center of for all towns included in venue recommendations.

Boston Top Venue Recommendations from FourSquare API

(FourSquare website: www.foursquare.com)

I will be using the FourSquare API to explore neighborhoods in Boston. The Foursquare explore function will be used to get the most common venue categories in each neighborhood, and then use this feature to group the neighborhoods into clusters. The following information are retrieved on the first query:

- Venue ID
- Venue Name = Coordinates : Latitude and Longitude
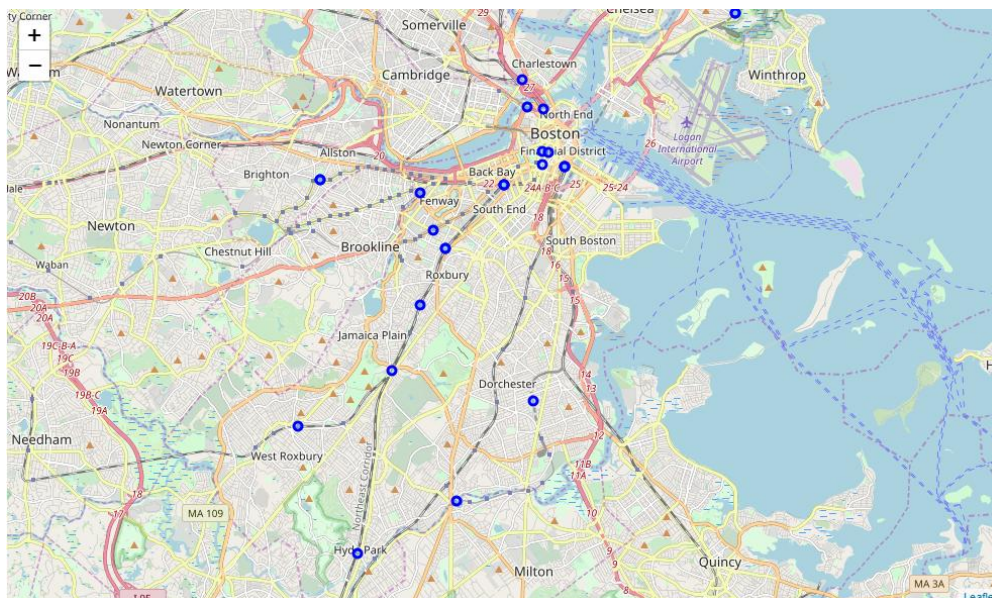- Category Name

III.   Methodology

First, I need to get the list of neighborhoods in Boston, MA. This is possible by extracting the list of neighborhoods from Boston open dataset from https://data.boston.gov website. However, it is only a list of neighborhood names. I will need to get their coordinates to utilize Foursquare to pull the list of venues near these neighborhoods. To get the coordinates, I used Google Geocoding API. After gathering these coordinates, I visualized the map of Boston using Folium package to verify whether these are correct coordinates.

Next, I used Foursquare API to pull the list of top 20 venues within 500 meters radius. I have created a Foursquare developer account in order to obtain account ID and API key to pull the data. From Foursquare, I am able to pull the names, categories, latitude and longitude of the venues. With this data, I can also check how many unique categories that I can get from these venues. Then, I analyze each neighborhood by grouping the rows by neighborhood and taking the mean on the frequency of occurrence of each venue category. This is to prepare clustering to be done later.

Lastly, I performed the clustering method by using k-means clustering. K-means clustering algorithm identifies k number of centriods, and then allocates every data point to the nearest cluster, while keeping the centroids as small as possible. It is one of the simplest and popular unsupervised machine learning algorithms and it is highly suited for this project as well. I have clustered the neighborhoods in Boston into 5 clusters based on their frequency of occurrence.

IV.   Results

- Boston base map with neighborhood marked with blue circles

- Top 20 most common venue types in Boston

```
VenueCategory
Coffee Shop                 54
American Restaurant         48
Sandwich Place              38
Chinese Restaurant          35
Asian Restaurant            32
Gym                         31
Pizza Place                 30
Hotel                       30
Bakery                      27
Italian Restaurant          26
Gym / Fitness Center        26
Café                        24
Bar                         24
Seafood Restaurant          23
Mexican Restaurant          23
New American Restaurant     22
Park                        22
Donut Shop                  21
Steakhouse                  16
Salad Place                 15
Name: VenueName, dtype: int64
```

- Boston Neighborhood most visited venues

```
# Town=< Allston >
                     venue  freq
0                      Bar  0.14
1                 Pharmacy  0.07
2                  Dog Run  0.07
3              Coffee Shop  0.07
4     Gym / Fitness Center  0.07
5                Gastropub  0.07
6              Pizza Place  0.07
7                     Food  0.07
8             Liquor Store  0.07
9        Athletics & Sports  0.07
```

```
# Town=< Back Bay >
                     venue  freq
0      American Restaurant  0.06
1                      Gym  0.05
2                    Hotel  0.05
3       Seafood Restaurant  0.04
4     Gym / Fitness Center  0.03
5         Department Store  0.03
6           Ice Cream Shop  0.02
7             Dessert Shop  0.02
8  New American Restaurant  0.02
9              Coffee Shop  0.02
```

```
# Town=< Beacon Hill >
                     venue  freq
0              Coffee Shop  0.06
1           Sandwich Place  0.05
2      American Restaurant  0.04
3  New American Restaurant  0.04
4       Seafood Restaurant  0.03
5       Italian Restaurant  0.03
6       Falafel Restaurant  0.03
7               Steakhouse  0.03
8                    Hotel  0.03
9            Historic Site  0.03
```

```
# Town=< Bay Village >
                     venue  freq
0      American Restaurant  0.06
1                      Gym  0.05
2                    Hotel  0.05
3       Seafood Restaurant  0.04
4     Gym / Fitness Center  0.03
5         Department Store  0.03
6           Ice Cream Shop  0.02
7             Dessert Shop  0.02
8  New American Restaurant  0.02
9              Coffee Shop  0.02
```

```
# Town=< Brighton >
                     venue  freq
0                      Bar  0.14
1                 Pharmacy  0.07
2                  Dog Run  0.07
3              Coffee Shop  0.07
4     Gym / Fitness Center  0.07
5                Gastropub  0.07
6              Pizza Place  0.07
7                     Food  0.07
8             Liquor Store  0.07
9        Athletics & Sports  0.07
```

```
# Town=< Downtown >
                     venue  freq
0              Coffee Shop  0.06
1      American Restaurant  0.04
2           Sandwich Place  0.04
3  New American Restaurant  0.04
4               Steakhouse  0.03
5            Historic Site  0.03
6     Gym / Fitness Center  0.03
7       Falafel Restaurant  0.03
8                    Hotel  0.03
9               Restaurant  0.03
```

```
# Town=< Dorchester >                    # Town=< Fenway >                        # Town=< East Boston >
                venue  freq                              venue  freq                              venue  freq
0                Park  0.25              0    American Restaurant  0.06            0                 River  0.17
1       Metro Station  0.25              1  Furniture / Home Store  0.06           1      Business Service  0.17
2  Chinese Restaurant  0.25              2     Mexican Restaurant  0.06            2                  Park  0.17
3        Liquor Store  0.25              3                   Café  0.04            3  Colombian Restaurant  0.17
4    Accessories Store  0.00             4       Greek Restaurant  0.04            4         Metro Station  0.17
5  Performing Arts Venue  0.00           5                 Bakery  0.04            5              Ski Area  0.17
6              Office  0.00              6     Chinese Restaurant  0.04            6      Pedestrian Plaza  0.00
7         Opera House  0.00              7        Thai Restaurant  0.04            7                Office  0.00
8   Outdoor Sculpture  0.00              8           Cycle Studio  0.02            8           Opera House  0.00
9             Parking  0.00              9                    Spa  0.02            9     Outdoor Sculpture  0.00


# Town=< Chinatown >                     # Town=< Charlestown >                   # Town=< Harbor Islands >
                venue  freq                              venue  freq                              venue  freq
0       Asian Restaurant  0.08           0    American Restaurant  0.10            0                 River  0.17
1     Chinese Restaurant  0.08           1            Coffee Shop  0.10            1      Business Service  0.17
2                 Bakery  0.07           2             Skate Park  0.10            2                  Park  0.17
3            Coffee Shop  0.05           3          Grocery Store  0.05            3  Colombian Restaurant  0.17
4                Theater  0.04           4               Pharmacy  0.05            4         Metro Station  0.17
5            Pizza Place  0.03           5            Bus Station  0.05            5              Ski Area  0.17
6  Performing Arts Venue  0.03           6              Gastropub  0.05            6      Pedestrian Plaza  0.00
7         Sandwich Place  0.03           7                   Park  0.05            7                Office  0.00
8     Seafood Restaurant  0.03           8        Thai Restaurant  0.05            8           Opera House  0.00
9       Sushi Restaurant  0.03           9              Pet Store  0.05            9     Outdoor Sculpture  0.00


# Town=< Hyde Park >                     # Town=< Jamaica Plain >                 # Town=< Mattapan >
                venue  freq                              venue  freq                              venue  freq
0  American Restaurant  0.17             0                    Gym  0.12           0          Mobile Phone Shop  0.17
1        Grocery Store  0.08             1            Coffee Shop  0.12           1        Caribbean Restaurant  0.17
2          Pizza Place  0.08             2                Brewery  0.12           2                    Pharmacy  0.17
3  Fried Chicken Joint  0.08             3             Bagel Shop  0.06           3  Southern / Soul Food Restaurant  0.17
4              Theater  0.08             4               Tea Room  0.06           4                      Bakery  0.17
5                  Bar  0.08             5           Tennis Court  0.06           5        Fast Food Restaurant  0.17
6             Pharmacy  0.08             6     Mexican Restaurant  0.06           6           Accessories Store  0.00
7       Ice Cream Shop  0.08             7         Farmers Market  0.06           7                     Parking  0.00
8           Donut Shop  0.08             8          Shopping Mall  0.06           8                      Office  0.00
9       Discount Store  0.08             9     Chinese Restaurant  0.06           9                 Opera House  0.00


# Town=< Longwood >                      # Town=< Leather District >              # Town=< Mission Hill >
                venue  freq                              venue  freq                              venue  freq
0           Donut Shop  0.13            0         Sandwich Place  0.07            0                Donut Shop  0.19
1       Sandwich Place  0.09            1            Coffee Shop  0.07            1               Pizza Place  0.19
2          Pizza Place  0.09            2     Chinese Restaurant  0.06            2    New American Restaurant  0.06
3   Italian Restaurant  0.09            3       Asian Restaurant  0.06            3         Light Rail Station  0.06
4                  Gym  0.04            4                 Bakery  0.04            4    Furniture / Home Store  0.06
5            Bookstore  0.04            5             Food Truck  0.04            5                     Track  0.06
6   Falafel Restaurant  0.04            6    American Restaurant  0.03            6              Liquor Store  0.06
7          Coffee Shop  0.04            7                   Café  0.03            7               Burger Joint  0.06
8            Gastropub  0.04            8               Tea Room  0.02            8         African Restaurant  0.06
9                 Café  0.04            9             Steakhouse  0.02            9         Italian Restaurant  0.06
```
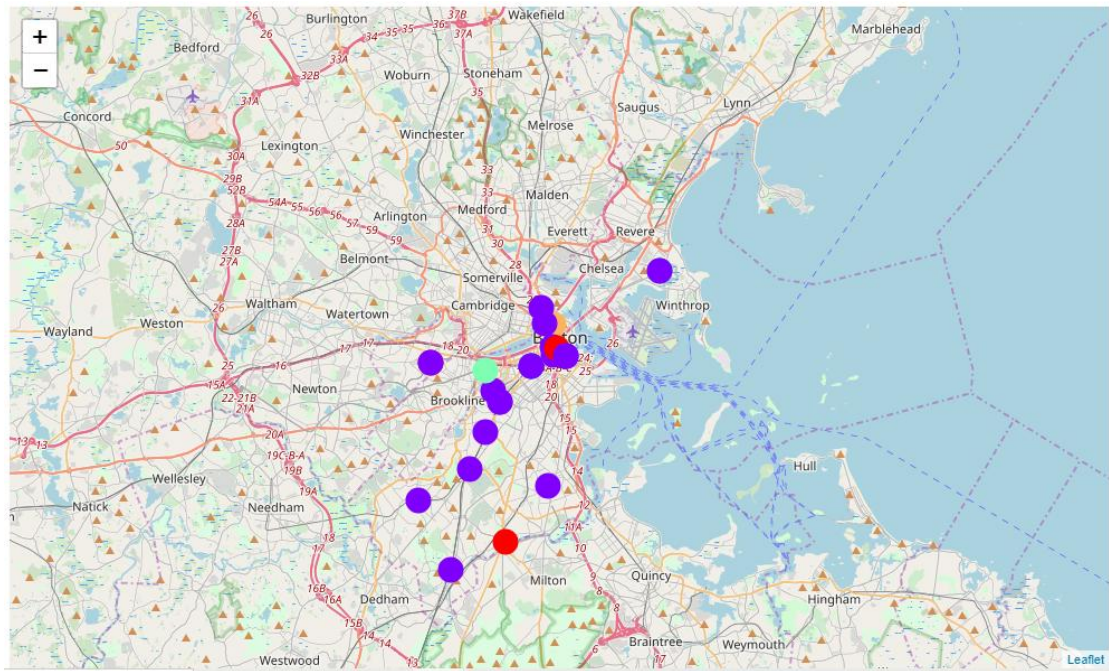
```
# Town=< North End >                  # Town=< Roslindale >                           # Town=< Roxbury >
                 venue  freq                           venue  freq                               venue  freq
0         Pizza Place  0.10    0                         Bar  0.12    0              Donut Shop  0.19
1   Italian Restaurant  0.07    1               Grocery Store  0.06    1              Pizza Place  0.19
2          Donut Shop  0.07    2           Indian Restaurant  0.06    2   New American Restaurant  0.06
3               Hotel  0.07    3                 Bus Station  0.06    3        Light Rail Station  0.06
4       Sandwich Place  0.05    4       New American Restaurant  0.06    4    Furniture / Home Store  0.06
5                 Bar  0.05    5              Breakfast Spot  0.06    5                    Track  0.06
6             Brewery  0.03    6                   Pet Store  0.06    6              Liquor Store  0.06
7          Coffee Shop  0.03    7                Comedy Club  0.06    7              Burger Joint  0.06
8          Sports Bar  0.03    8    Construction & Landscaping  0.06    8        African Restaurant  0.06
9                Park  0.03    9                 Pizza Place  0.06    9        Italian Restaurant  0.06


# Town=< South End >                  # Town=< South Boston >                         # Town=< West End >
                 venue  freq                        venue  freq                          venue  freq
0    American Restaurant  0.06    0       Sandwich Place  0.07    0   Science Museum  0.16
1                  Gym  0.05    1          Coffee Shop  0.07    1       Donut Shop  0.11
2                Hotel  0.05    2    Chinese Restaurant  0.06    2             Bar  0.08
3    Seafood Restaurant  0.04    3      Asian Restaurant  0.06    3             Café  0.05
4    Gym / Fitness Center  0.03    4               Bakery  0.04    4      Pizza Place  0.05
5      Department Store  0.03    5           Food Truck  0.04    5             Park  0.05
6        Ice Cream Shop  0.02    6    American Restaurant  0.03    6       Zoo Exhibit  0.03
7          Dessert Shop  0.02    7                 Café  0.03    7        Playground  0.03
8   New American Restaurant  0.02    8             Tea Room  0.02    8       Planetarium  0.03
9          Coffee Shop  0.02    9           Steakhouse  0.02    9        Food Truck  0.03


# Town=< South Boston Waterfront >    # Town=< West Roxbury >
                 venue  freq                          venue  freq
0       Sandwich Place  0.07    0    Convenience Store  0.11
1          Coffee Shop  0.07    1            BBQ Joint  0.11
2    Chinese Restaurant  0.06    2        Clothing Store  0.11
3      Asian Restaurant  0.06    3     Mexican Restaurant  0.11
4               Bakery  0.04    4                  Bar  0.11
5           Food Truck  0.04    5      Indian Restaurant  0.11
6    American Restaurant  0.03    6   Vietnamese Restaurant  0.11
7                 Café  0.03    7                  Spa  0.11
8             Tea Room  0.02    8    American Restaurant  0.11
9           Steakhouse  0.02    9            Playground  0.00
```

- Neighborhood clusters

V.   Discussions

In this notebook, analysis of neighborhood recommendations based on Food venue category has been presented. Based on the analysis above, Chinese restaurants appear in Cluster 0, 1 and 3. In Chinatown, Chinese restaurant is the most common venue, which is pretty resonable, and in Dorchester, South Boston Waterfront, South Boston and Allston, Chinese restaurant is the third most common venue. Therefore, apart from **Chinatown**, which is an obvious option for opening a Chinese restaurant, neighborhoods like **Dorchester**, **South Boston Waterfront**, **South Boston** and **Allston** could also be reasonable options.