Predicting the best Neighborhood to establish a new Italian restaurant in Houston, TX

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1. Introduction/Business Problem

1.1 Background

Houston, Texas is the largest city in Texas and is one of the largest Cities in the US and it has a total area of 637.4 square miles. Houston is divided into 88 different Super Neighborhoods that represents different areas of the city. Determining the best location to build/invest in a new restaurant will be critical to how well the restaurant preforms. Before investing in a new restaurant, you need to understand the demographics of the city, in order to determine an ideal location.

1.2 Problem

Data can might contribute to determining the ideal Super Neighborhood to establish a new Italian Restaurant are the number of competitor's (other Italian restaurants) per Super Neighborhood, the number of total restaurants per Super Neighborhood, the number of Other Venues per Super Neighborhood. This analysis of this data will help predict what Super Neighborhood will have the lowest number of competitors and have a larger number of potential customers (ie. Tourists).

2. Data

2.1 Data sources

- The geo data for the Super Neighborhoods boundaries will come from https://cohgis-mycity.opendata.arcgis.com/datasets/coh-super-neighborhoods, which is a geojson file of the 88 Super Neighborhoods in Houston.
- The restaurant data will be acquired through the Foursquare API for each Super Neighborhood. The restaurant data will be divided into two categories Italian Restaurants (competitors) and all other restaurants (these will still take away potential customers, but will not directly compete with an Italian Restaurant).
- The Other Venues (or things to do) will also be acquired through the Foursquare API for each Super Neighborhood. An increase number of attractions in a given Super Neighborhood will increase traffic of potential customers to include both tourist and residents. The number of attractions in a given neighborhood and also weighting the reviews of these attractions will help understand which neighborhoods will potentially have more people on a daily basis.

2.2 Data Cleaning

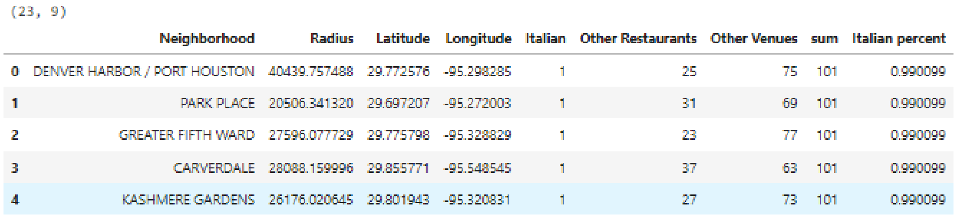
The geojson file for the super neighbor hoods was cleaned and converted into a panda's data frame. The geojson did not have center points for the neighborhoods, so I used Google Earth to load the layer and find the center points. I added the center point's lat/lons to a csv file with the neighborhood names. I combined the center point csv with the data frame made from the geojson file. After querying the

Foursquare API, I cleaned the results json and converted it in to a data frame. I then filtered the Foursquare results into three different categories (Italian Restaurants, Other Restaurants, and Other Venues). I then did a count of each category and added it to the data frame made from the geojson file.

3. Methodology

3.1 Data Exploration

Houston, TX is comprised of 88 Super Neighborhoods. Out of the 88 Super Neighborhoods I divided the data into three data frames based on the number of Italian Restaurants in each neighborhood. The three data frames are Neighborhoods with no Italian restaurants (40 Neighborhoods), Neighborhoods with only 1 Italian restaurant (23 Neighborhoods), and Neighborhoods with 2 or more Italian restaurants (25 Neighborhoods).



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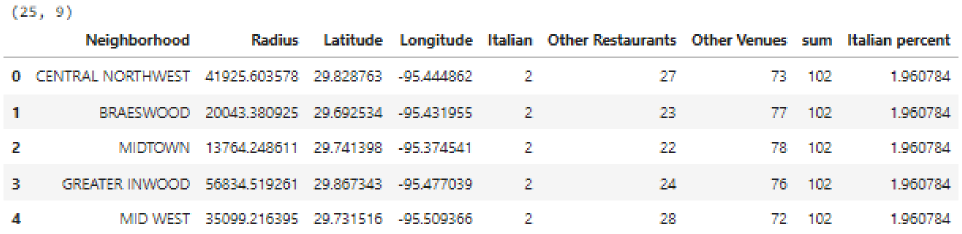
	Neighborhood	Radius	Latitude	Longitude	Italian	Other Restaurants	Other Venues	sum	Italian percent
0	DENVER HARBOR / PORT HOUSTON	40439.757488	29.772576	-95.298285	1	25	75	101	0.990099
1	PARK PLACE	20506.341320	29.697207	-95.272003	1	31	69	101	0.990099
2	GREATER FIFTH WARD	27596.077729	29.775798	-95.328829	1	23	77	101	0.990099
3	CARVERDALE	28088.159996	29.855771	-95.548545	1	37	63	101	0.990099
4	KASHMERE GARDENS	26176.020645	29.801943	-95.320831	1	27	73	101	0.990099



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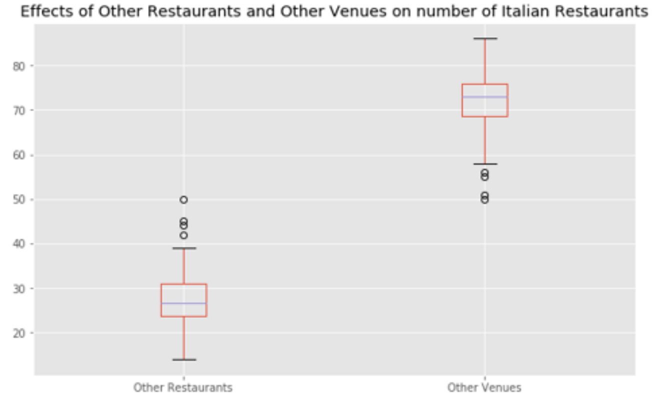
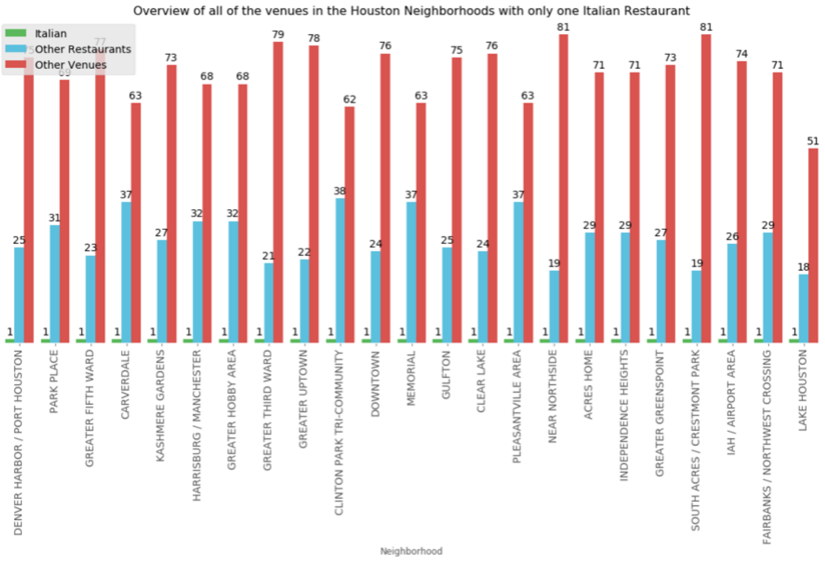
	Neighborhood	Radius	Latitude	Longitude	Italian	Other Restaurants	Other Venues	sum	Italian percent
0	CENTRAL NORTHWEST	41925.603578	29.828763	-95.444862	2	27	73	102	1.960784
1	BRAESWOOD	20043.380925	29.692534	-95.431955	2	23	77	102	1.960784
2	MIDTOWN	13764.248611	29.741398	-95.374541	2	22	78	102	1.960784
3	GREATER INWOOD	56834.519261	29.867343	-95.477039	2	24	76	102	1.960784
4	MID WEST	35099.216395	29.731516	-95.509366	2	28	72	102	1.960784

3.2 Relationship between the target variable and other Variables

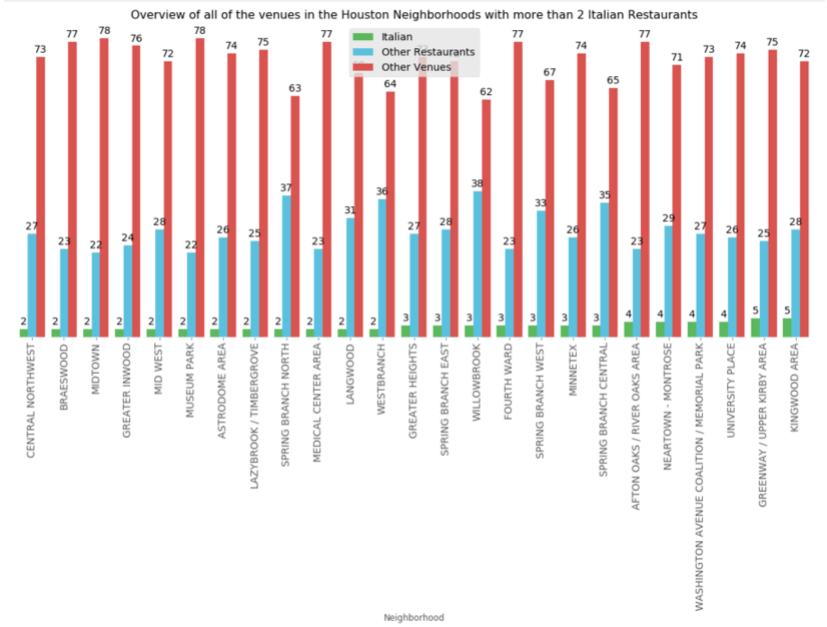
The data for Other Venues and other Restaurants were compared to Italian restaurants to determine if there is a correlation between the number and Other Venues and Other Restaurants to Italian restaurants in Houston Neighborhoods. The Box plot depicted below shows a correlation that a Italian restaurant is more likely in Neighborhoods with more Other Venues and less Other Restaurants.



3.3 Neighborhoods with 1 Italian Restaurant, Variable comparison



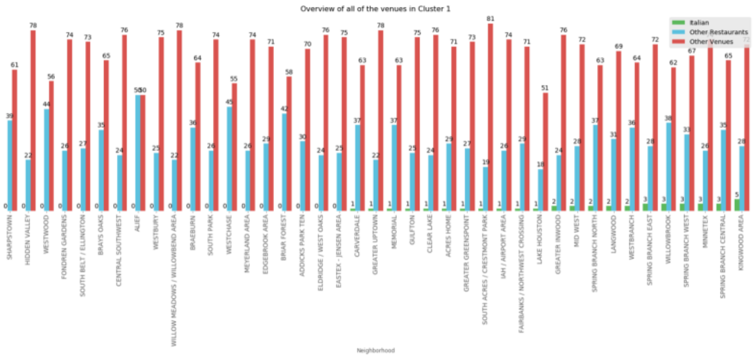
3.4 Neighborhoods with more than 2 Italian Restaurants, Variable comparison



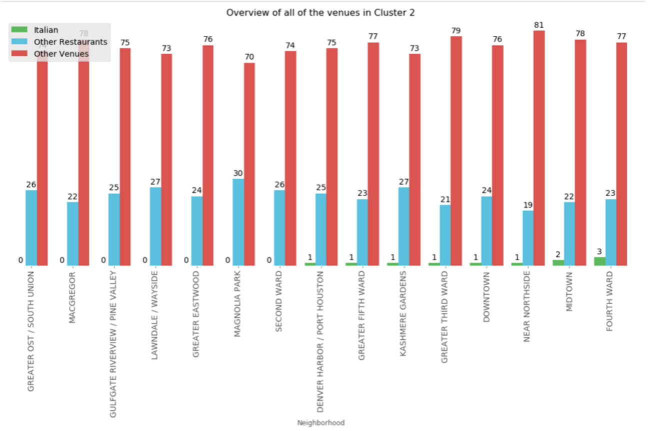
3.5 K_means clustering

I created 5 Clusters of the Super Neighborhoods in Houston, based on the most common venues in each neighborhood. Each neighborhood in a cluster will be similar to the other Neighborhoods in that cluster and will help determine which neighborhoods will support a new Italian Restaurant, based on the similar neighbor in the cluster.

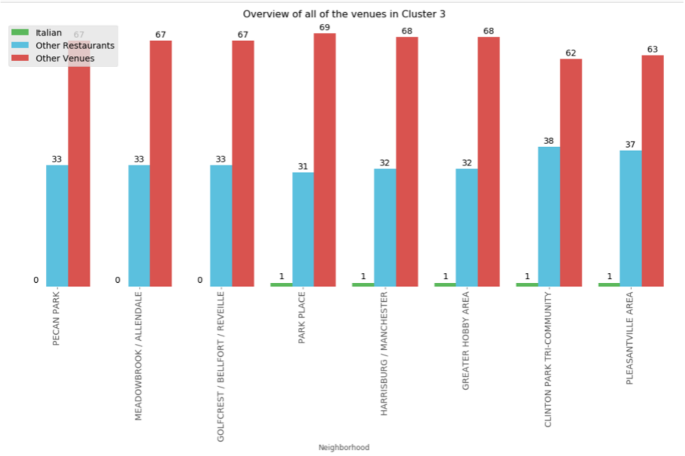
Cluster 1 is the largest cluster and almost half of the Neighborhoods with in Cluster 1 have no Italian Restaurants. The 2 most common venues in cluster 1 are Burger Joint and Mexican Restaurants.



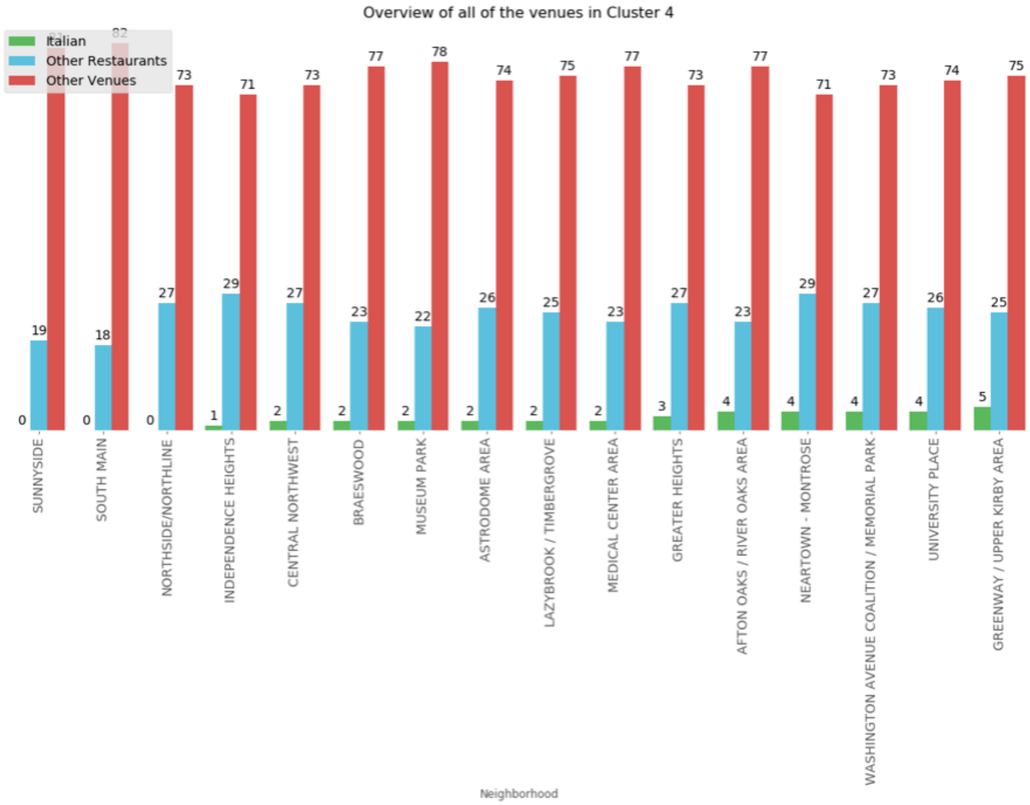
Cluster 2 is a smaller cluster with almost half of the Neighborhoods in Cluster 2 having no Italian Restaurants. The 2 most common Venues in Cluster 2 are Park and Coffee Shop.



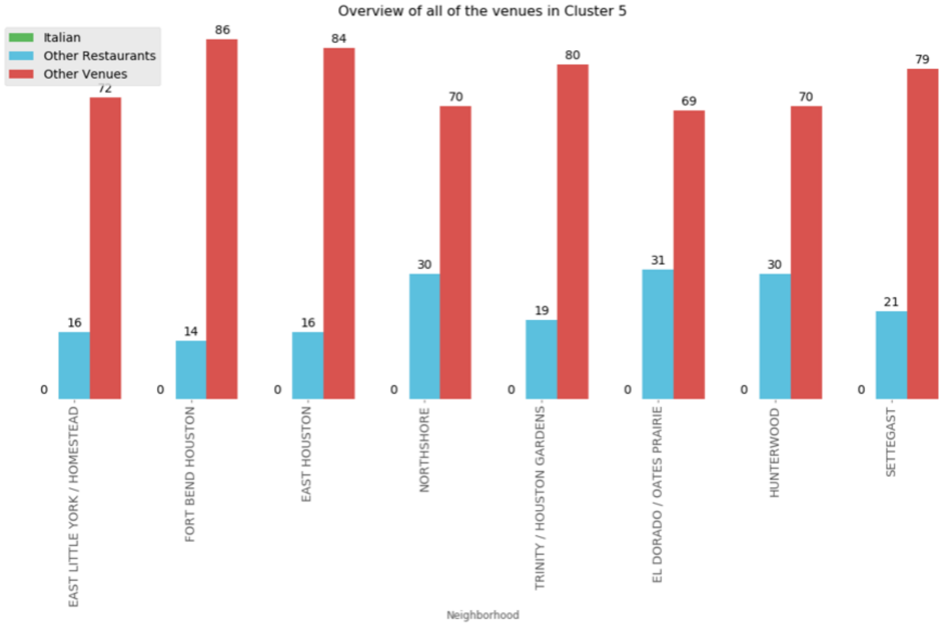
Cluster 3 is the smallest of the 5 clusters and the majority of the clusters have Italian Restuarts, but the Neighborhoods that do have Italian Restaurants only have one Italian Restaurant. The most common venues in Cluster 3 are Mexican Restaurants and Burger Joints.



Cluster 4 is primarily comprised of Neighborhoods with Multiple Italian Restaurants. Only three of the Restaurants in Cluster 4 do not have any Italian Restaurants. The most common venues in Cluster 4 consist of Trail, Zoo Exhibit, Parks, and Grocery stores.

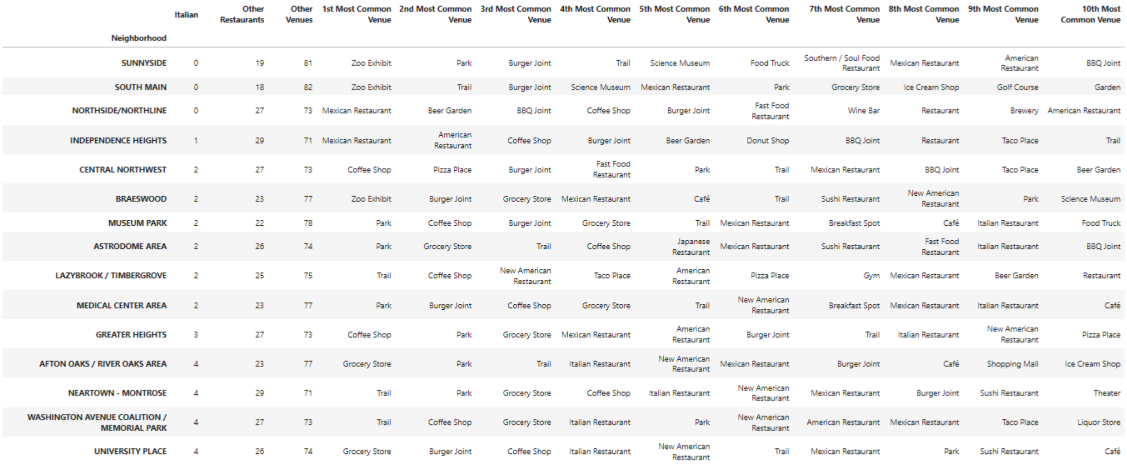


Cluster 5 is a small cluster and none of the Neighborhoods in cluster 5 have any Italian Restaurants. The most common venues in Cluster 4 are Discount Stores and Mexican Restaurants.



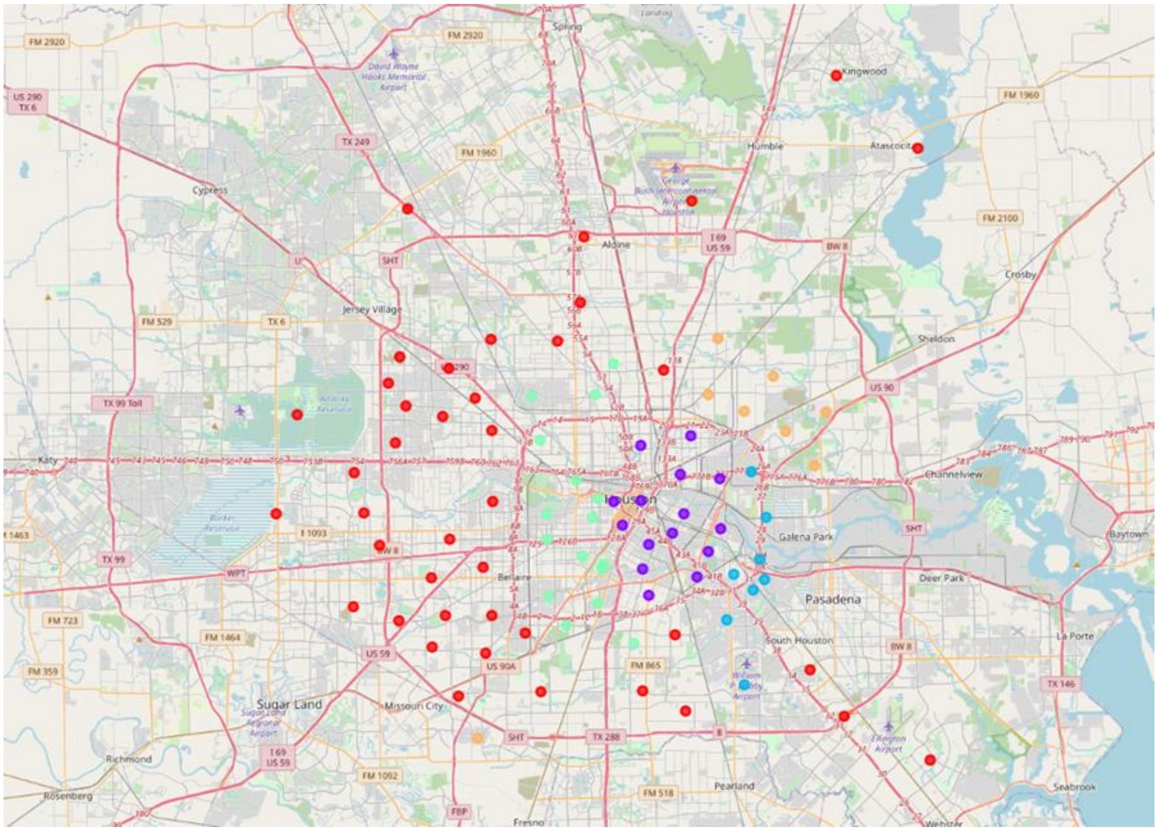
4. Results

I combined the K_means Clusters of the most common Venues with the count of each venue made at the beginning of this project. I created the all of the above charts using these tables.



	Italian	Other Restaurants	Other Venues	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
Neighborhood													
SUNNYSIDE	0	19	81	Zoo Exhibit	Park	Burger Joint	Trail	Science Museum	Food Truck	Southern / Soul Food Restaurant	Mexican Restaurant	American Restaurant	BBQ Joint
SOUTH MAIN	0	18	82	Zoo Exhibit	Trail	Burger Joint	Science Museum	Mexican Restaurant	Park	Grocery Store	Ice Cream Shop	Golf Course	Garden
NORTHSIDE/NORTHLINE	0	27	73	Mexican Restaurant	Beer Garden	BBQ Joint	Coffee Shop	Burger Joint	Fast Food Restaurant	Wine Bar	Restaurant	Brewery	American Restaurant
INDEPENDENCE HEIGHTS	1	29	71	Mexican Restaurant	American Restaurant	Coffee Shop	Burger Joint	Beer Garden	Donut Shop	BBQ Joint	Restaurant	Taco Place	Trail
CENTRAL NORTHWEST	2	27	73	Coffee Shop	Pizza Place	Burger Joint	Fast Food Restaurant	Park	Trail	Mexican Restaurant	BBQ Joint	Taco Place	Beer Garden
BRAESWOOD	2	23	77	Zoo Exhibit	Burger Joint	Grocery Store	Mexican Restaurant	Café	Trail	Sushi Restaurant	New American Restaurant	Park	Science Museum
MUSEUM PARK	2	22	78	Park	Coffee Shop	Burger Joint	Grocery Store	Trail	Mexican Restaurant	Breakfast Spot	Café	Italian Restaurant	Food Truck
ASTRODOME AREA	2	26	74	Park	Grocery Store	Trail	Coffee Shop	Japanese Restaurant	Mexican Restaurant	Sushi Restaurant	Fast Food Restaurant	Italian Restaurant	BBQ Joint
LAZYBROOK / TIMBERGROVE	2	25	75	Trail	Coffee Shop	New American Restaurant	Taco Place	American Restaurant	Pizza Place	Gym	Mexican Restaurant	Beer Garden	Restaurant
MEDICAL CENTER AREA	2	23	77	Park	Burger Joint	Coffee Shop	Grocery Store	Trail	New American Restaurant	Breakfast Spot	Mexican Restaurant	Italian Restaurant	Café
GREATER HEIGHTS	3	27	73	Coffee Shop	Park	Grocery Store	Mexican Restaurant	American Restaurant	Burger Joint	Trail	Italian Restaurant	New American Restaurant	Pizza Place
AFTON OAKS / RIVER OAKS AREA	4	23	77	Grocery Store	Park	Trail	Italian Restaurant	New American Restaurant	Mexican Restaurant	Burger Joint	Café	Shopping Mall	Ice Cream Shop
NEARTOWN - MONTROSE	4	29	71	Trail	Park	Grocery Store	Coffee Shop	Italian Restaurant	New American Restaurant	Mexican Restaurant	Burger Joint	Sushi Restaurant	Theater
WASHINGTON AVENUE COALITION / MEMORIAL PARK	4	27	73	Trail	Coffee Shop	Grocery Store	Italian Restaurant	Park	New American Restaurant	American Restaurant	Mexican Restaurant	Taco Place	Liquor Store
UNIVERSITY PLACE	4	26	74	Grocery Store	Burger Joint	Coffee Shop	Italian Restaurant	New American Restaurant	Trail	Mexican Restaurant	Park	Sushi Restaurant	Café

I then plotted all of the clusters on a map to display where the clusters are geographically. In the map below we can see all 5 clusters plotted on the Folium map. Red is Cluster 1, Purple is Cluster 2, Blue is Cluster 3, Green is Cluster 4, and Orange is Cluster 5



5. Discussion

Houston, TX is a large city comprised of 88 Super Neighborhoods. These neighborhoods are all unique and have different economies. However, by grouping similar neighborhoods in clusters we found the Neighborhoods that have similar economies. It is obvious which clusters will support similar venues.

I started this project by discovering the center points of each Super Neighborhood and then using those center points to query the Foursquare API. Then I had to clean the data to put them in to data to visualize it with bar charts.

I then conducted K-means clustering of the data frame to find the similar Super Neighborhoods, I set the K value to 5. This divided the 88 Neighborhoods into 5 clusters of similar Neighborhoods.

I ended the project by plotting the clusters on a map and depicting bar charts of each Neighborhood.

6. Conclusion

In Conclusion we can see that the two Super Neighborhoods that are most likely to respond well to a new Italian Restaurant are Sunnyside and Southmain. These two neighborhoods are both within Cluster 4 and they both have a low number of other restaurants and a high number of other venues.

The reason why I’m not recommending Northside, which is also in Cluster 4 and has no Italian Restaurants, is because of the high number of other Restaurants in the neighborhood.