The BATTLE OF NEIGHBORHOODS

Selecting Neighborhood of Houston

Contents

Introduction/Business Problem

1.1   Background

Houston is the largest city in Texas, the fourth-largest in America, and brimming with opportunity, excitement, culture and history. A diverse city where more than 145 languages are spoken results in a food, art and community fusion unmatched in other destinations.

Unparalleled performing arts and nightlife activity keep this city running 24/7. The city's relatively compact Downtown includes the Theater District, home to the renowned Houston Grand Opera, and the Historic District, with 19th-century architecture and

upscale restaurants. Tucked between the bustling Midtown and Medical Center areas, rests Houston's leafy, park-like Museum District. Nineteen world-class institutions, including the Menil Collection and Museum of Fine Arts, drawing seven million visitors to the district each year.

1.2 Business Problem

As a visitor who has never been to Houston before, it is always difficult to find out best places to visit and find something which really suits their liking in the restricted time period. The visitor may enjoy Houston's outstanding performing and visual arts venues. Try one of the countless restaurants available, offering cuisine in everything from Tex Mex and South American to Middle Eastern and Vietnamese. For sports fans we have local teams representing all major sports. Do some shopping; Houston offers something to fit every budget - from the exclusive shops in Houston's Uptown area to the outlet malls just outside the City.

Every person who visits Houston faces this problem to find suitable top-rated locations of their liking. Therefore, as part of this Capstone project I tried solving this problem by segregate different neighborhoods to find different types of locations based on the surrounding.

1.3 Interest

We will use data science to generate and clustering the neighborhood in Houston. The advantages and feature of venue categories in each Houston neighborhood will then be clearly expressed so that the best neighborhood to visit can be chose by our target tourist.

2 Data

2.1 Data Sources

Following data sources are used for the analysis of neighborhoods of Houston:

1. The name, location and boundaries for all the Houston neighborhoods can be retrieved from the following online open data:

    https://opendata.arcgis.com/datasets/deae15e7f3db4b198946c17f0d169c39_3.geojson

2. Get the latitude and longitude values of Houston using geopy library.

3. Explore the venues and neighborhoods using Foursquare API.

2.2   Data Cleaning

The data of Houston neighborhoods is imported and transformed to pandas dataframe.

The latitude and longitude of each Houston neighborhood can be calculated by taking the average center of all of its shape boundary points. If a neighborhood is defined by two or two more shape areas, only the first shape area will be used for the calculation of the latitude and longitude.

3   Methodology

In this project, we will devote our efforts on detecting and identifying the top common venue categories of each neighborhood in Houston.

3.1   Houston Neighborhoods

The data of neighborhoods of Houston is imported from the online json file. The imported json file is transformed from the nested python dictionaries into a pandas dataframe. This dataframe contains the geographical coordinates of the shape boundary of each Houston neighborhoods. The latitude and longitude of each Houston neighborhood is calculated by taking the average of all of its shape boundary points.
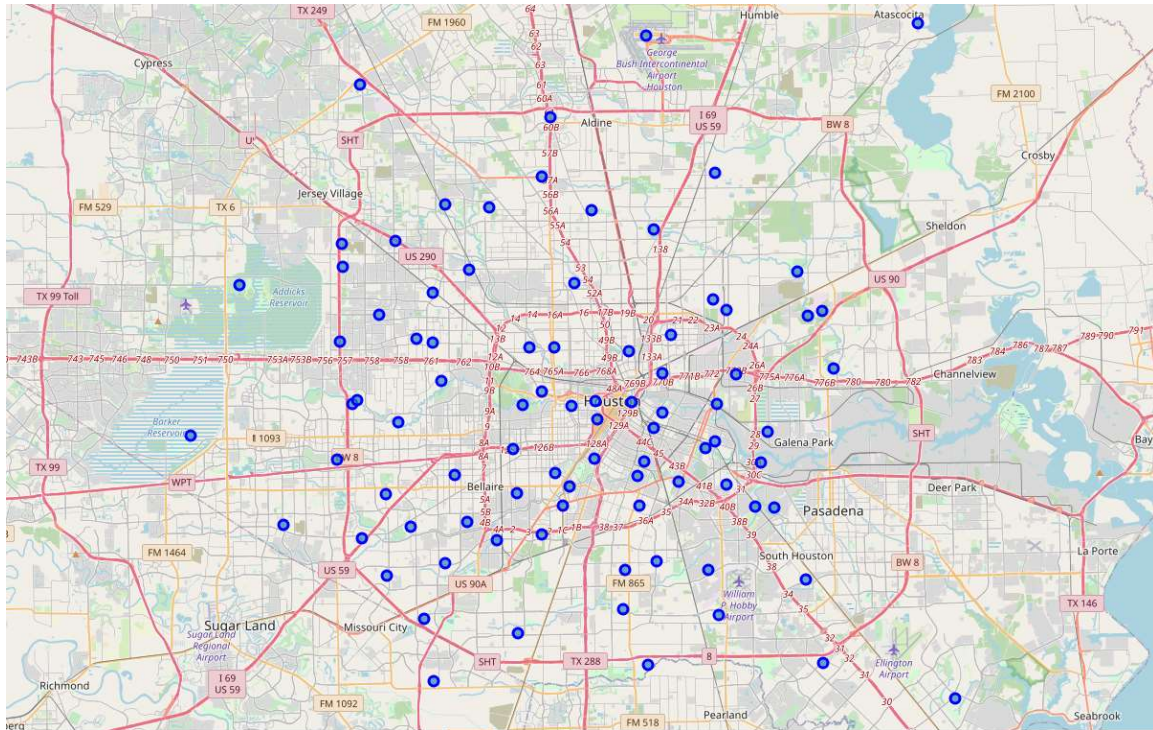
The resulting Houston neighborhood dataframe contains 88 neighborhoods information. The information of the first 10 neighborhoods are shown as in Table 1 below.

Table 1: First 10 neighborhood name and geospatial data of Houston

	Neighborhood	Latitude	Longitude
0	FOURTH WARD	29.759108	-95.380204
1	SECOND WARD	29.751715	-95.331634
2	DOWNTOWN	29.758336	-95.353891
3	CLINTON PARK TRI-COMMUNITY	29.739786	-95.255946
4	GREATER UPTOWN	29.771256	-95.490082
5	GREATER INWOOD	29.881288	-95.487484
6	GREATER HOBBY AREA	29.625936	-95.291085
7	GOLFCREST / BELLFORT / REVEILLE	29.653929	-95.298948
8	ELDRIDGE / WEST OAKS	29.737417	-95.670287
9	WASHINGTON AVENUE COALITION / MEMORIAL PARK	29.765147	-95.418188

The geographical coordinates of Houston can be obtained through geopy.geocoder and are given by (Latitude: 29.7589382, Longitude: -95.3676974). A map of Houston city with neighborhoods superimposed on top can be then created using the geographical coordinates of Houston and the previous neighborhood dataframe utilizing the folium library as shown in Figure 1.

Figure 1: Map of Houston and its neighborhoods in dotted blue circle markers.

The Foursquare API is used to explore neighborhoods in Houston city. Using the geographical coordinates of each neighbourhood foursquare API calls are made to get top 100 venues in a radius of 2000 meters. A function getNearbyVenues () was then defined in order to retrieve all the neighborhoods in Houston, TX and created a dataFrame (houston_venues) that contains a total of over 5000 venues in Houston neighborhoods. Table 2 shows the first 10 lines of the result of the venues around Houston neighborhoods. The number of venues for each neighborhood were then computed, with over 300 unique venue categories being identified. In this work, only a maximum of 100 venues per neighborhood is used as there is a 100-venue limit imposed by the free Foursquare account.

Table 2: The first 10 lines of venues around Houston neighborhoods

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	FOURTH WARD	29.759108	-95.380204	Eleanor Tinsley Park	29.761440	-95.379271	Park
1	FOURTH WARD	29.759108	-95.380204	Buffalo Bayou Walk	29.762177	-95.375844	Trail
2	FOURTH WARD	29.759108	-95.380204	Buffalo Bayou Cistern	29.762214	-95.375873	Public Art
3	FOURTH WARD	29.759108	-95.380204	Oporto Fooding House & Wine	29.753179	-95.380243	Portuguese Restaurant
4	FOURTH WARD	29.759108	-95.380204	Cafe Poetes	29.753348	-95.379776	Café
5	FOURTH WARD	29.759108	-95.380204	Sam Houston Park	29.759876	-95.371211	Park
6	FOURTH WARD	29.759108	-95.380204	The Fish Restaurant & Sushi Bar	29.752249	-95.376820	Sushi Restaurant
7	FOURTH WARD	29.759108	-95.380204	Paper Street Crossfit	29.757435	-95.385846	Gym
8	FOURTH WARD	29.759108	-95.380204	Lucio's BYOB	29.758326	-95.385591	Bar
9	FOURTH WARD	29.759108	-95.380204	Catalina Coffee	29.767968	-95.380662	Coffee Shop

3.2   Analysis of Each Neighborhood in Houston

In order to carry out the analysis categorical venue data were transformed to binaries using one-hot encoding approach. Venues rows were grouped by neighborhoods and the mean of the frequency of occurrence of each category was taken as shown in Table 3.

Table 3: A snip of data for venues frequency of occurrence of each category for each neighborhood

	Neighborhood	Zoo Exhibit	ATM	Accessories Store	Afghan Restaurant	African Restaurant	Airport	Airport Lounge	Airport Service	Airport Terminal	American Restaurant	Antique Shop	Aquarium	Arcade
0	ACRES HOME	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.00	0.000000
1	ADDICKS PARK TEN	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.00	0.046512
2	AFTON OAKS / RIVER OAKS AREA	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.034483	0.000000	0.00	0.000000
3	ALIEF	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.00	0.000000
4	ASTRODOME AREA	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.010000	0.000000	0.00	0.000000
5	BRAEBURN	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.016667	0.000000	0.00	0.000000
6	BRAESWOOD	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.010526	0.000000	0.00	0.000000
7	BRAYS OAKS	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.00	0.000000
8	BRIAR FOREST	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.021277	0.000000	0.00	0.000000
9	CARVERDALE	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.00	0.000000	0.000000	0.000000	0.000000	0.00	0.000000

From the results shown in Table 3, the best 10 top most common venue categories for each neighborhood was then retrieved for comparison and clustering purposes as shown in Table 4.

Table 4: A snip dataset of the top 10 most common venue categories for each neighborhood

	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	ACRES HOME	Discount Store	Fried Chicken Joint	Intersection	Pizza Place	Construction & Landscaping	Wings Joint	Thai Restaurant	Cosmetics Shop	Department Store	Park
1	ADDICKS PARK TEN	Mexican Restaurant	Park	Fast Food Restaurant	Grocery Store	Sushi Restaurant	Arcade	Latin American Restaurant	Bakery	Bank	Rental Car Location
2	AFTON OAKS / RIVER OAKS AREA	Park	Bank	Sandwich Place	New American Restaurant	Donut Shop	Trail	American Restaurant	Pharmacy	Cosmetics Shop	Salon / Barbershop
3	ALIEF	Pizza Place	Fast Food Restaurant	Discount Store	Grocery Store	Pharmacy	Fried Chicken Joint	Taco Place	Video Store	Pet Store	Diner
4	ASTRODOME AREA	Pizza Place	Burger Joint	Coffee Shop	Mexican Restaurant	Food Service	Food Truck	Chinese Restaurant	BBQ Joint	Italian Restaurant	Restaurant
5	BRAEBURN	Pharmacy	Discount Store	Pizza Place	Sandwich Place	Grocery Store	Cosmetics Shop	Chinese Restaurant	Liquor Store	Convenience Store	Fast Food Restaurant
6	BRAESWOOD	Park	Gym	Pizza Place	Pharmacy	Bakery	Ice Cream Shop	Italian Restaurant	Mexican Restaurant	Coffee Shop	Spa
7	BRAYS OAKS	Grocery Store	Fried Chicken Joint	Fast Food Restaurant	Gas Station	Pizza Place	Burger Joint	Discount Store	Sandwich Place	Pharmacy	Bank
8	BRIAR FOREST	Mexican Restaurant	Sandwich Place	Grocery Store	Bank	Cosmetics Shop	Pharmacy	Kids Store	Coffee Shop	Chinese Restaurant	Beer Garden
9	CARVERDALE	Home Service	Gas Station	Business Service	Hotel	Convenience Store	Burger Joint	Chinese Restaurant	Paper / Office Supplies Store	Auto Garage	Intersection

3.3 Cluster Neighborhoods Using K-Means Clustering

In this step, we run k-means to cluster the neighborhoods into 7 different clusters as shown in **Error! Reference source not found.**. This is aimed at grouping neighborhoods with similar type of venue categories together. This clusters are visualized using folium library on the map of Houston as shown in Figure 2.

Table 5:A snip of clustering result for each Houston neighborhood

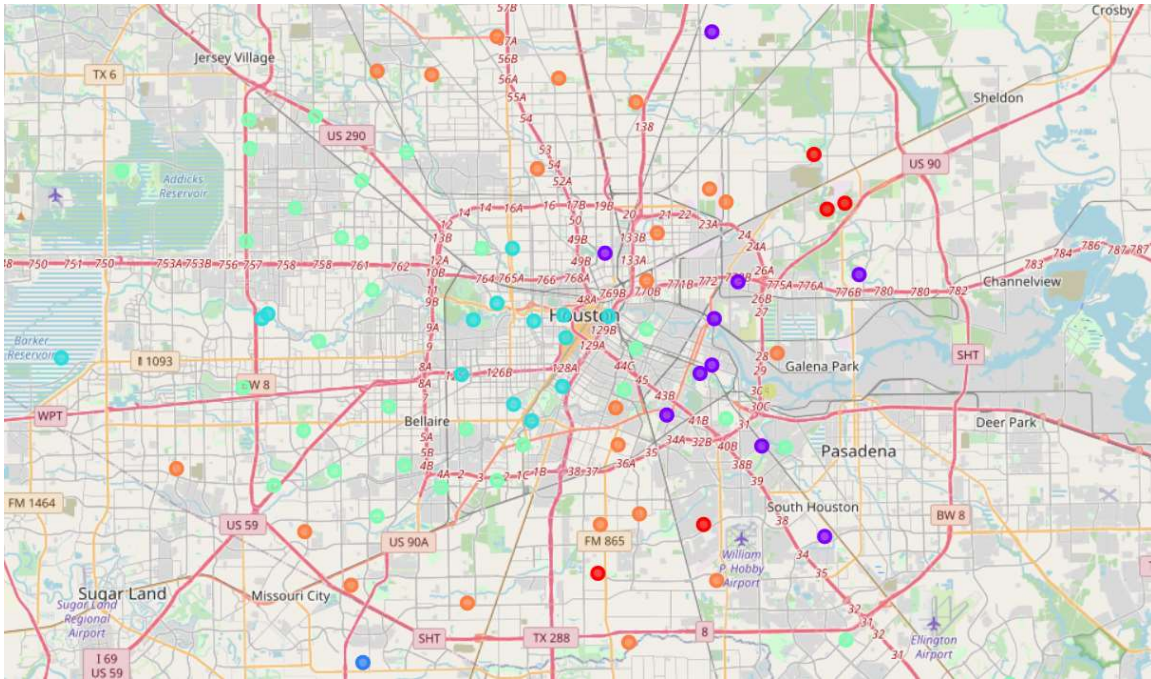|	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	FOURTH WARD	29.759108	-95.380204	3	Coffee Shop	Burger Joint	Pizza Place	Park	Beer Garden	American Restaurant	Brewery	Bar	Sandwich Place	Theater
1	SECOND WARD	29.751715	-95.331634	4	Mexican Restaurant	Music Venue	Gas Station	Park	Fast Food Restaurant	Video Store	Bar	Café	Gym	Discount Store
2	DOWNTOWN	29.758336	-95.353891	3	Hotel	Mexican Restaurant	Bar	Coffee Shop	Brewery	Pizza Place	Baseball Stadium	Beer Garden	Gym	Vietnamese Restaurant
3	CLINTON PARK TRI-COMMUNITY	29.739786	-95.255946	6	Boat or Ferry	Harbor / Marina	Discount Store	Sandwich Place	Baseball Field	Restaurant	Grocery Store	Park	Gas Station	Fast Food Restaurant
4	GREATER UPTOWN	29.771256	-95.490082	4	Pharmacy	Gym / Fitness Center	Coffee Shop	Yoga Studio	Fast Food Restaurant	Mexican Restaurant	Liquor Store	Sandwich Place	Sushi Restaurant	Intersection
5	GREATER INWOOD	29.881288	-95.487484	6	Pharmacy	Discount Store	Grocery Store	Fast Food Restaurant	Video Store	Spanish Restaurant	Convenience Store	Cosmetics Shop	Fried Chicken Joint	Gas Station
6	GREATER HOBBY AREA	29.625936	-95.291085	6	Food Truck	Gas Station	Mexican Restaurant	Airport Terminal	Fast Food Restaurant	Factory	Business Service	Donut Shop	Sandwich Place	Ice Cream Shop
7	GOLFCREST / BELLFORT / REVEILLE	29.653929	-95.298948	0	Rental Car Location	Gas Station	Airport Terminal	Mexican Restaurant	Donut Shop	Airport	History Museum	Park	Discount Store	Burger Joint
8	ELDRIDGE / WEST OAKS	29.737417	-95.670287	3	Bar	Park	Grocery Store	Movie Theater	Athletics & Sports	Italian Restaurant	Gas Station	Vietnamese Restaurant	Dog Run	Coffee Shop
9	WASHINGTON AVENUE COALITION / MEMORIAL PARK	29.765147	-95.418188	3	Bar	Mexican Restaurant	American Restaurant	Gym	Trail	Coffee Shop	New American Restaurant	Art Gallery	Cajun / Creole Restaurant	Golf Course

Figure 2: K-Means clustering of Houston neighborhoods.

4 Results

Data for the respective clusters are shown in tables 6, 7, 8. These respective clusters are then examined so that a determination of the discriminating venue categories that distinguish each cluster can be established.

Cluster 1 as shown in Table 6, which contains 5 neighborhoods, is analyzed that the most common venue categories are Rental Car Location and Gas Station

Table 6: The top 10 most common venue categories for 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
7	GOLFCREST / BELLFORT / REVEILLE	Rental Car Location	Gas Station	Airport Terminal	Mexican Restaurant	Donut Shop	Airport	History Museum	Park	Discount Store	Burger Joint
21	EL DORADO / OATES PRAIRIE	Rental Car Location	Ice Cream Shop	Gas Station	Sandwich Place	Intersection	Shipping Store	Eye Doctor	Dry Cleaner	Farmers Market	Dive Bar
23	HUNTERWOOD	Fried Chicken Joint	Fast Food Restaurant	Ice Cream Shop	Business Service	Donut Shop	Sandwich Place	Intersection	Rental Car Location	Gas Station	Gym / Fitness Center
31	EAST HOUSTON	American Restaurant	Golf Course	Gas Station	Tree	Rental Car Location	Empanada Restaurant	Dog Run	Donut Shop	Dry Cleaner	Dumpling Restaurant
48	SOUTH ACRES / CRESTMONT PARK	Grocery Store	Discount Store	Health Food Store	Nightclub	Pharmacy	Pet Store	Cocktail Bar	Gas Station	Electronics Store	Dog Run

Cluster 2 as shown in Table 7, which contains 10 neighborhoods, is analyzed that the most common venue categories are Mexican Restaurant and Fast Food Restaurant.

Table 7:The top 10 most common venue categories for 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
11	DENVER HARBOR / PORT HOUSTON	Mexican Restaurant	Boat or Ferry	Fast Food Restaurant	Intersection	Convenience Store	Restaurant	Optical Shop	Bay	Baseball Field	Pier
12	PLEASANTVILLE AREA	Rental Service	Gas Station	Mexican Restaurant	Brewery	Taco Place	Fast Food Restaurant	Office	Sandwich Place	Intersection	Fried Chicken Joint
13	NORTHSHORE	Mexican Restaurant	Fast Food Restaurant	Seafood Restaurant	Fried Chicken Joint	Convenience Store	Chinese Restaurant	Discount Store	Gas Station	BBQ Joint	Pizza Place
18	NEAR NORTHSIDE	Mexican Restaurant	Fast Food Restaurant	Sandwich Place	Fried Chicken Joint	Bank	Food Truck	Bar	Pizza Place	Gas Station	Food
35	EAST LITTLE YORK / HOMESTEAD	Mexican Restaurant	Fast Food Restaurant	Convenience Store	Gas Station	Park	Taco Place	Bakery	Cajun / Creole Restaurant	Discount Store	Wings Joint
62	PARK PLACE	Mexican Restaurant	Gas Station	Discount Store	Ice Cream Shop	Vietnamese Restaurant	Golf Course	Fast Food Restaurant	Convenience Store	Smoke Shop	Electronics Store
67	GULFGATE RIVERVIEW / PINE VALLEY	Fast Food Restaurant	Mexican Restaurant	Convenience Store	Discount Store	Taco Place	Grocery Store	Furniture / Home Store	Light Rail Station	Park	Diner
72	LAWNDALE / WAYSIDE	Mexican Restaurant	Pizza Place	Fried Chicken Joint	Convenience Store	Fast Food Restaurant	Pharmacy	Discount Store	Sandwich Place	Snack Place	Seafood Restaurant
80	EDGEBROOK AREA	Mexican Restaurant	Fast Food Restaurant	Discount Store	Sandwich Place	Bank	Video Store	Rental Car Location	Seafood Restaurant	Burger Joint	Latin American Restaurant
81	MAGNOLIA PARK	Mexican Restaurant	Fried Chicken Joint	Pizza Place	Discount Store	Fast Food Restaurant	Convenience Store	Chinese Restaurant	Sandwich Place	Grocery Store	Cosmetics Shop

Cluster 3 as shown in Table 8, which contains only one neighborhood, is analyzed that the most common venue category is Construction & Landscaping.

Table 8:The top 10 most common venue categories for 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
45	FORT BEND HOUSTON	Construction & Landscaping	Discount Store	Convenience Store	Fast Food Restaurant	Exhibit	Dry Cleaner	Dumpling Restaurant	Duty-free Shop	Electronics Store	Empanada Restaurant

Cluster 4 as shown in Table 9, which contains 15 neighborhoods, is analyzed that the most common venue categories are Hotel, Bar and Coffee Shop.

Table 9:The top 10 most common venue categories for 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	FOURTH WARD	Coffee Shop	Burger Joint	Pizza Place	Park	Beer Garden	American Restaurant	Brewery	Bar	Sandwich Place	Theater
2	DOWNTOWN	Hotel	Mexican Restaurant	Bar	Coffee Shop	Brewery	Pizza Place	Baseball Stadium	Beer Garden	Gym	Vietnamese Restaurant
8	ELDRIDGE / WEST OAKS	Bar	Park	Grocery Store	Movie Theater	Athletics & Sports	Italian Restaurant	Gas Station	Vietnamese Restaurant	Dog Run	Coffee Shop
9	WASHINGTON AVENUE COALITION / MEMORIAL PARK	Bar	Mexican Restaurant	American Restaurant	Gym	Trail	Coffee Shop	New American Restaurant	Art Gallery	Cajun / Creole Restaurant	Golf Course
15	GREATER HEIGHTS	Mexican Restaurant	Coffee Shop	Ice Cream Shop	Burger Joint	Cajun / Creole Restaurant	New American Restaurant	Gym / Fitness Center	Bar	American Restaurant	Gift Shop
38	IAH / AIRPORT AREA	Coffee Shop	Airport Lounge	Sandwich Place	Fast Food Restaurant	Airport Terminal	Airport Service	Pizza Place	Restaurant	American Restaurant	Airport
64	MEDICAL CENTER AREA	Zoo Exhibit	Food Truck	Burger Joint	Food Service	Restaurant	Coffee Shop	American Restaurant	Art Gallery	Hotel	Trail
69	UNIVERSITY PLACE	Zoo Exhibit	Coffee Shop	Burger Joint	Bar	Italian Restaurant	Bookstore	Sandwich Place	Food Service	American Restaurant	Wine Bar
71	MUSEUM PARK	Zoo Exhibit	Coffee Shop	Bar	Science Museum	Trail	American Restaurant	Art Gallery	Sculpture Garden	Park	Southern / Soul Food Restaurant
73	GREENWAY / UPPER KIRBY AREA	Coffee Shop	Mexican Restaurant	Café	American Restaurant	Bakery	Gym	Burger Joint	Chinese Restaurant	New American Restaurant	Clothing Store
77	MIDTOWN	Coffee Shop	Bar	Pizza Place	Park	Nightclub	Sandwich Place	Burger Joint	Vietnamese Restaurant	Breakfast Spot	American Restaurant
82	AFTON OAKS / RIVER OAKS AREA	Bank	Park	New American Restaurant	Trail	Cosmetics Shop	American Restaurant	Coffee Shop	Sandwich Place	Donut Shop	Sushi Restaurant

Cluster 5 as shown in Table 10 , which contains 35 neighborhoods, is analyzed that the most common venue categories are different kinds of restaurants, such as Mexican Restaurant, Chinese Restaurant and Fast Food Restaurant.

Table 10: The top 10 most common venue categories for Cluster 5

	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	SECOND WARD	Mexican Restaurant	Music Venue	Gas Station	Park	Fast Food Restaurant	Video Store	Bar	Café	Gym	Discount Store
4	GREATER UPTOWN	Pharmacy	Gym / Fitness Center	Coffee Shop	Yoga Studio	Fast Food Restaurant	Mexican Restaurant	Liquor Store	Sandwich Place	Sushi Restaurant	Intersection
14	LAZYBROOK / TIMBERGROVE	Bar	Park	Mexican Restaurant	American Restaurant	Gym / Fitness Center	Fast Food Restaurant	Smoothie Shop	Sandwich Place	Beer Bar	Sports Bar
19	SPRING BRANCH EAST	Mexican Restaurant	Sandwich Place	Pharmacy	Coffee Shop	Italian Restaurant	Pizza Place	Video Store	Donut Shop	Sporting Goods Shop	Sushi Restaurant
20	SPRING BRANCH NORTH	Mexican Restaurant	Korean Restaurant	Pizza Place	Pharmacy	Discount Store	Fried Chicken Joint	Vietnamese Restaurant	Sandwich Place	Grocery Store	Food Truck
22	SPRING BRANCH CENTRAL	Korean Restaurant	Mexican Restaurant	Gym / Fitness Center	Sandwich Place	BBQ Joint	Pharmacy	Bubble Tea Shop	Sporting Goods Shop	Bank	Bakery
25	LANGWOOD	Hotel	Fast Food Restaurant	Sandwich Place	Bank	Donut Shop	Pizza Place	Gas Station	Mexican Restaurant	Sports Bar	Convenience Store
27	CENTRAL NORTHWEST	Hotel	Fast Food Restaurant	Chinese Restaurant	Park	Dive Bar	Gym / Fitness Center	Donut Shop	Burger Joint	Sandwich Place	Pizza Place
29	CARVERDALE	Home Service	Donut Shop	Gas Station	Burger Joint	Hotel	Business Service	Sandwich Place	Music Store	Restaurant	Intersection
36	WILLOWBROOK	Clothing Store	Mexican Restaurant	Burger Joint	Cosmetics Shop	Furniture / Home Store	Coffee Shop	Chinese Restaurant	Latin American Restaurant	Electronics Store	Lingerie Store
37	GREATER GREENSPOINT	Fast Food Restaurant	Mexican Restaurant	Pizza Place	Hotel	Sandwich Place	Mobile Phone Shop	Shoe Store	Seafood Restaurant	Fried Chicken Joint	Discount Store
39	KINGWOOD AREA	Asian Restaurant	Pizza Place	Hotel	Mexican Restaurant	Gas Station	American Restaurant	Sandwich Place	Chinese Restaurant	Pharmacy	Bakery
40	LAKE HOUSTON	Mexican Restaurant	Burger Joint	Coffee Shop	Fast Food Restaurant	Cosmetics Shop	Donut Shop	Frozen Yogurt Shop	Bank	Sushi Restaurant	Arts & Crafts Store

Cluster 6 as shown in Table 11 , which also contains only one neighborhood, is analyzed that the most common venue categories is Park.

Table 11:The top 10 most common venue categories for Cluster 6

	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
68	HARRISBURG / MANCHESTER	Park	Mexican Restaurant	Harbor / Marina	Donut Shop	Restaurant	Athletics & Sports	Pier	Cosmetics Shop	Event Service	Construction & Landscaping

Cluster 7 as shown in, which contains 21 neighborhoods, is analyzed that the most common venue categories are Fast Food Restaurant and Discount Store.

Table 12: The top 10 most common venue categories for Cluster 7

	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
3	CLINTON PARK TRI-COMMUNITY	Boat or Ferry	Harbor / Marina	Discount Store	Sandwich Place	Baseball Field	Restaurant	Grocery Store	Park	Gas Station	Fast Food Restaurant
5	GREATER INWOOD	Pharmacy	Discount Store	Grocery Store	Fast Food Restaurant	Video Store	Spanish Restaurant	Convenience Store	Cosmetics Shop	Fried Chicken Joint	Gas Station
6	GREATER HOBBY AREA	Food Truck	Gas Station	Mexican Restaurant	Airport Terminal	Fast Food Restaurant	Factory	Business Service	Donut Shop	Sandwich Place	Ice Cream Shop
10	GREATER FIFTH WARD	Park	Sandwich Place	Pharmacy	Fast Food Restaurant	Gas Station	Intersection	Video Store	Discount Store	Music Venue	Beer Garden
16	KASHMERE GARDENS	Fast Food Restaurant	Discount Store	Fried Chicken Joint	Bus Stop	Grocery Store	Gas Station	Nightclub	Chinese Restaurant	Intersection	Restaurant
17	MINNETEX	Fast Food Restaurant	Golf Driving Range	Shipping Store	Locksmith	Liquor Store	Fried Chicken Joint	Donut Shop	Baseball Field	Lake	Discount Store
24	SETTEGAST	Convenience Store	Burger Joint	American Restaurant	BBQ Joint	Motel	Gas Station	Discount Store	Sandwich Place	Fried Chicken Joint	Event Service
26	INDEPENDENCE HEIGHTS	Discount Store	Fried Chicken Joint	Mobile Phone Shop	Fast Food Restaurant	Mexican Restaurant	Sandwich Place	BBQ Joint	Pharmacy	American Restaurant	Breakfast Spot
28	TRINITY / HOUSTON GARDENS	American Restaurant	Discount Store	Burger Joint	Fried Chicken Joint	BBQ Joint	Gas Station	Sandwich Place	Home Service	Motel	Convenience Store
30	EASTEX - JENSEN AREA	Fast Food Restaurant	Pizza Place	Discount Store	Pharmacy	Mexican Restaurant	Intersection	Brewery	Construction & Landscaping	Flea Market	Supermarket
32	ACRES HOME	Discount Store	Fried Chicken Joint	Park	Liquor Store	Baseball Field	Thai Restaurant	Intersection	Department Store	Pizza Place	Wings Joint
33	NORTHSIDE/NORTHLINE	Food Truck	Home Service	Flea Market	Discount Store	Convenience Store	Pizza Place	Clothing Store	Chinese Restaurant	Dessert Shop	Casino

5 Discussion

In this project, we have directed our efforts on detecting the most common venue category of each neighborhood of Houston. We have collected the required data and explored the neighborhoods and segment them using Foursquare API. We have explored the venues across different areas of Houston. After creating the dataframe to display the top 10 venues for each neighborhood, our analysis shows although there is a great number of different types of venue category in neighborhoods of Houston, these neighborhoods can be clustered to 7 different groups based on their most common venue categories.

Based on our clustering results: Cluster 1, where the rental car store and gas station are the most common venue categories, is the "suburb" area of Houston. Cluster 2 and Cluster 7, where fast food restaurant are the most common venue categories, are the "semi-suburb" area of Houston. Cluster 3 and cluster 6, which only contains one neighborhood each, can be considered as "outliners" in the analysis. Cluster 4, which features hotel, bar and coffee shop, is the "modern" area of Houston. Cluster 5, which features different varieties of restaurants, is the "restaurant" area of Houston.

Therefore, based on previous analysis result, tourists can select their choice of location to visit in Houston. People who like to taste varieties of food can choose cluster 5. People who enjoy the modern city feel, can visit cluster 4.

6 Conclusion

The purpose of this project was to identify the most common venue categories and clustering neighborhoods of Houston, in order to aid stakeholders in narrowing down the place to visit in the neighborhoods of Houston. To help arrive at this solution, K-means clustering was used to group neighborhoods in Houston. The visualization library was also used to visualize the clustering results.