

# Analysis of neighborhoods of the city of San Diego

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## Introduction

San Diego, the city the author lives in, is a border city in the southwestern United States. Its beautiful seaside environment, pleasant climate, numerous high-tech companies and a good education system are attracting a large number of people to move in. For the person who would like to move in, finding the most suitable neighborhood according to his/her own preferences, like is there your favorite restaurant that best suits your taste, is there a grocery store nearby or is it near the beach and so on. If you live for a long time, you also need to consider the housing price level of the community.

Thus, the problem to be solved by this project is to take the city of San Diego as an example, giving a basic recommendation to the person who are preparing to move in San Diego: for different neighborhoods, what are the most common venues, what are the characteristics of this neighborhood, and what is the level of housing prices. Through this basic recommendation, people can get a general understanding of the community environment in San Diego, and then choose the most suitable place to live.

## Description of the data

We need data from reliable sources for further analysis. Focusing on this project, we will use following data:

- 1) Pulling the data of neighborhood of the city of San Diego out of HTML <https://web.archive.org/web/20080509171047/http://www.sandiego.gov/neighborhoodmaps/> . The neighborhoods of the City of San Diego are divided into regions. These regions are based on the neighborhood policing and community services areas.
- 2) Foursquare Developers Access to venue data. Foursquare is a US tech company from New York focusing on location data. I will use foursquare data such as the venue name, location and category.
- 3) The house price comes from Zillow. We use Zillow home value index, which means the typical value for a geographic area, to represent house price in that neighborhood.
- 4) The latitude and longitude data of each neighborhood comes from Google search, due to recently Google started charging for their API.

## Methodology

In this section, I will describe the data exploration, analysis and how I used the data to yield the results.

## 1) Scrape and explore dataset

Firstly, I scraped the data of neighborhood of the city of San Diego from <https://web.archive.org/web/20080509171047/http://www.sandiego.gov/neighborhoodmaps/>. For this, I used BeautifulSoup to scrape the data from HTML and the pandas to store the data. The neighborhoods of the City of San Diego are divided into regions. Thus, the dataset has 2 columns, i.e. 'Region' and 'Neighborhood'. From the dataset, we can find there are 8 regions in the city of San Diego, i.e. Northern, Eastern, Southeastern, Northeastern, Central, Southern, Western and Mid-City. There are totally 121 neighborhoods in these 8 regions. For illustration purposes, I will focus on the Northern region. Other regions can be analyzed in exactly the same way as here.

## 2) Explore neighborhood in Northern region

In Northern region, there are 16 neighborhoods. It is necessary to get all of latitude and longitude of these neighborhoods for the further exploration and creating a map with neighborhoods. Considering we cannot use Google's API geocoder freely, and only 16 neighborhoods, I just search the locations in Google search engine. And as we said, we are also interested in the house price for each neighborhood. I collect the house price data from ZILLOW website. The dataset that expanded location (latitude & longitude) and house prices is shown below.

	Region	Neighborhood	Latitude	Longitude	Price (\$)
0	Northern	Bay Ho	32.8242	-117.2176	878644
1	Northern	Bay Park	32.7918	-117.2000	993202
2	Northern	Carmel Valley	32.9439	-117.2308	1284041
3	Northern	Clairemont Mesa East	32.8124	-117.1676	757674
4	Northern	Clairemont Mesa West	32.8072	-117.1852	810498
5	Northern	Del Mar Heights	32.9515	-117.2529	1643284
6	Northern	La Jolla	32.8289	-117.2647	1874385
7	Northern	La Jolla Village	32.8429	-117.2320	784488
8	Northern	Mission Beach	32.7733	-117.2503	1287889
9	Northern	Mission Bay Park	32.7778	-117.2265	828656
10	Northern	North City	32.9771	-117.2162	1801601
11	Northern	North Clairemont	32.8328	-117.2000	790675
12	Northern	Pacific Beach	32.8064	-117.2382	1009741
13	Northern	Torrey Pines	32.8969	-117.2387	603162
14	Northern	Torrey Preserve	32.9194	-117.2461	1524588
15	Northern	University City	32.8636	-117.2121	784488

Table 1 The neighborhood of Northern region with location and price information

Using the folium package and dataset above, we can visualize Northern region with the neighborhoods in it.

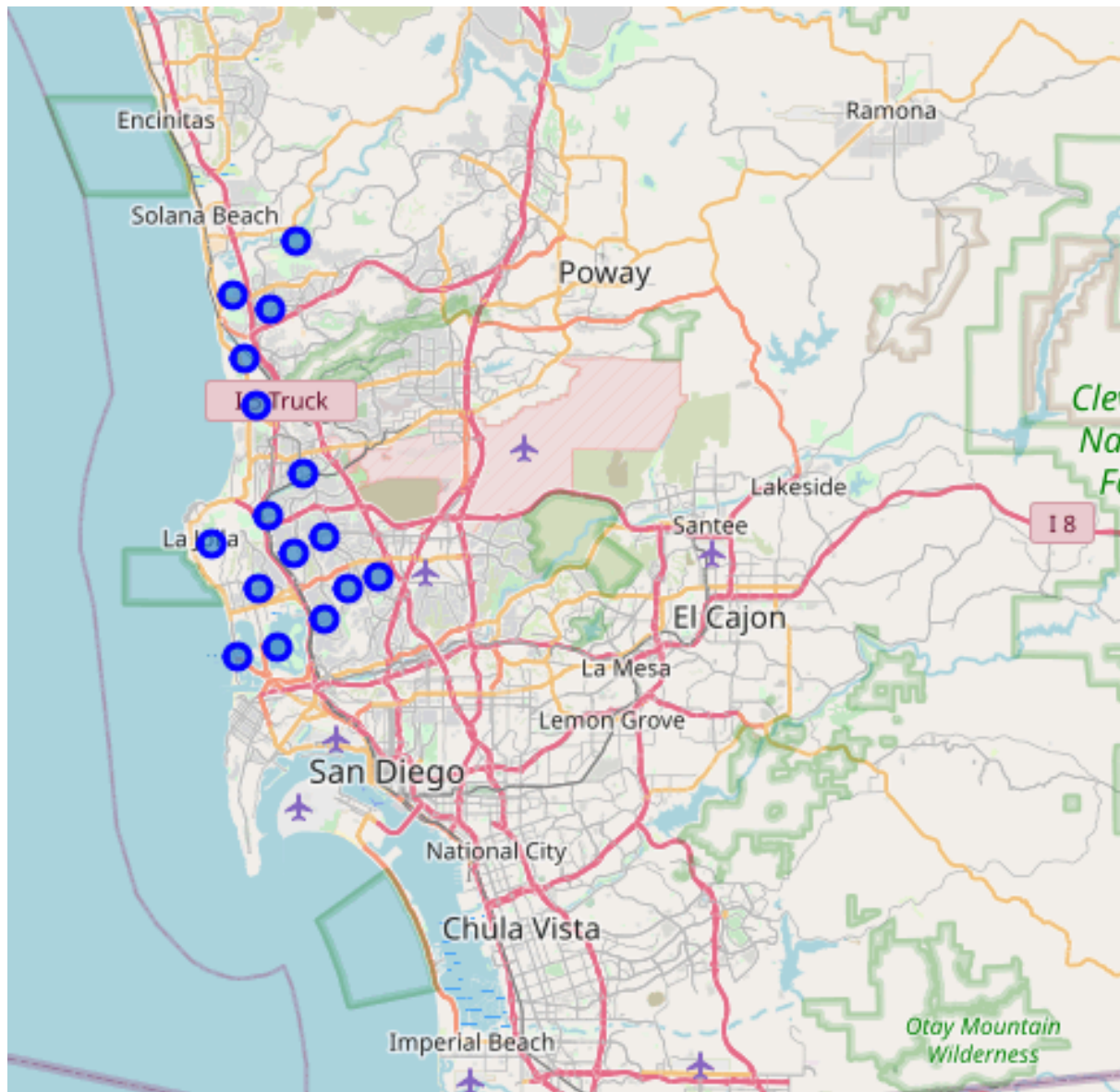


Fig. 1 The map of northern region with the neighborhoods.

In the next step, we collect venues for each neighborhood and see which venues are the most common. In this step, the venue data was collected from Foursquare via API. After collecting the data and organizing into a pandas dataframe, we have a table that looks like this (here only neighborhood of Bay Ho data is shown):

	name	categories	lat	lng
0	San Diego Harley-Davidson	Motorcycle Shop	32.822666	-117.226574
1	El Rey Taco Shop	Mexican Restaurant	32.823327	-117.214070
2	Costco Tire Center	Automotive Shop	32.822858	-117.224535
3	Costco Food Court	Food Court	32.821746	-117.224616
4	The Fruit Stand	Farmers Market	32.816834	-117.221380
...	...	...	...	...
73	SportRx	Optical Shop	32.814869	-117.220595
74	Frank's Starshine Market	Convenience Store	32.835927	-117.222804
75	McDonald's	Fast Food Restaurant	32.833172	-117.201923
76	Rose Canyon	Mountain	32.834580	-117.233023
77	Kate Sessions Canyon	Trail	32.819331	-117.238190

Table 2 Neighborhoods of Bay Ho

After getting all of venues including in 16 neighborhoods, we get 168 unique categories on these venues. Then the dataset is grouped rows by neighborhood and by taking the mean of the frequency of occurrence of each category. According to this, a new dataframe is created and display the top 10 venues 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	Bay Ho	Coffee Shop	Mexican Restaurant	Park	Grocery Store	Beach	Pizza Place	Seafood Restaurant	Fast Food Restaurant	Breakfast Spot	Burger Joint
1	Bay Park	Park	Mexican Restaurant	Pizza Place	Beach	Café	Thai Restaurant	Coffee Shop	American Restaurant	Seafood Restaurant	Brewery
2	Carmel Valley	Coffee Shop	Beach	Seafood Restaurant	Trail	Italian Restaurant	American Restaurant	Mediterranean Restaurant	New American Restaurant	Golf Course	Restaurant
3	Clairemont Mesa East	Japanese Restaurant	Sushi Restaurant	Grocery Store	Korean Restaurant	Café	Pizza Place	Dessert Shop	Mexican Restaurant	Noodle House	Fast Food Restaurant
4	Clairemont Mesa West	Japanese Restaurant	Grocery Store	Sushi Restaurant	Pizza Place	Fast Food Restaurant	Thai Restaurant	Korean Restaurant	Park	Coffee Shop	Mexican Restaurant
5	Del Mar Heights	Coffee Shop	Beach	Seafood Restaurant	Mexican Restaurant	American Restaurant	Trail	Italian Restaurant	Grocery Store	Breakfast Spot	Park
6	La Jolla	Beach	Breakfast Spot	Seafood Restaurant	Coffee Shop	Italian Restaurant	Park	American Restaurant	Mexican Restaurant	Café	Surf Spot
7	La Jolla Village	Coffee Shop	Seafood Restaurant	Beach	Park	Café	New American Restaurant	Grocery Store	Italian Restaurant	Scenic Lookout	Ice Cream Shop
8	Mission Bay Park	Park	Beach	Coffee Shop	Bar	Brewery	Seafood Restaurant	Grocery Store	Fast Food Restaurant	Breakfast Spot	Theme Park
9	Mission Beach	Beach	Park	Bar	American Restaurant	Brewery	Burger Joint	Mexican Restaurant	Coffee Shop	Seafood Restaurant	Café
10	North City	Golf Course	Coffee Shop	Restaurant	American Restaurant	Grocery Store	Italian Restaurant	Seafood Restaurant	Pizza Place	Breakfast Spot	New American Restaurant
11	North Clairemont	Coffee Shop	Grocery Store	Mexican Restaurant	Pizza Place	Park	Fast Food Restaurant	Japanese Restaurant	Korean Restaurant	Ice Cream Shop	Sporting Goods Shop
12	Pacific Beach	Beach	Park	Seafood Restaurant	Coffee Shop	Breakfast Spot	Mexican Restaurant	Bar	Pizza Place	Burger Joint	Café
13	Torrey Pines	Beach	Trail	New American Restaurant	Coffee Shop	Furniture / Home Store	Brewery	Burger Joint	Cosmetics Shop	Gym	Grocery Store
14	Torrey Preserve	Coffee Shop	Beach	Trail	Mexican Restaurant	Scenic Lookout	American Restaurant	Italian Restaurant	New American Restaurant	Seafood Restaurant	Hotel
15	University City	Coffee Shop	Sandwich Place	Burger Joint	Grocery Store	New American Restaurant	Furniture / Home Store	Park	Cosmetics Shop	Gym	Clothing Store

Table 3 Display the top 10 venues for each neighborhood

### 3) Cluster neighborhoods

Now we run k-means to cluster the neighborhood into 5 clusters, and visualize the resulting clusters:



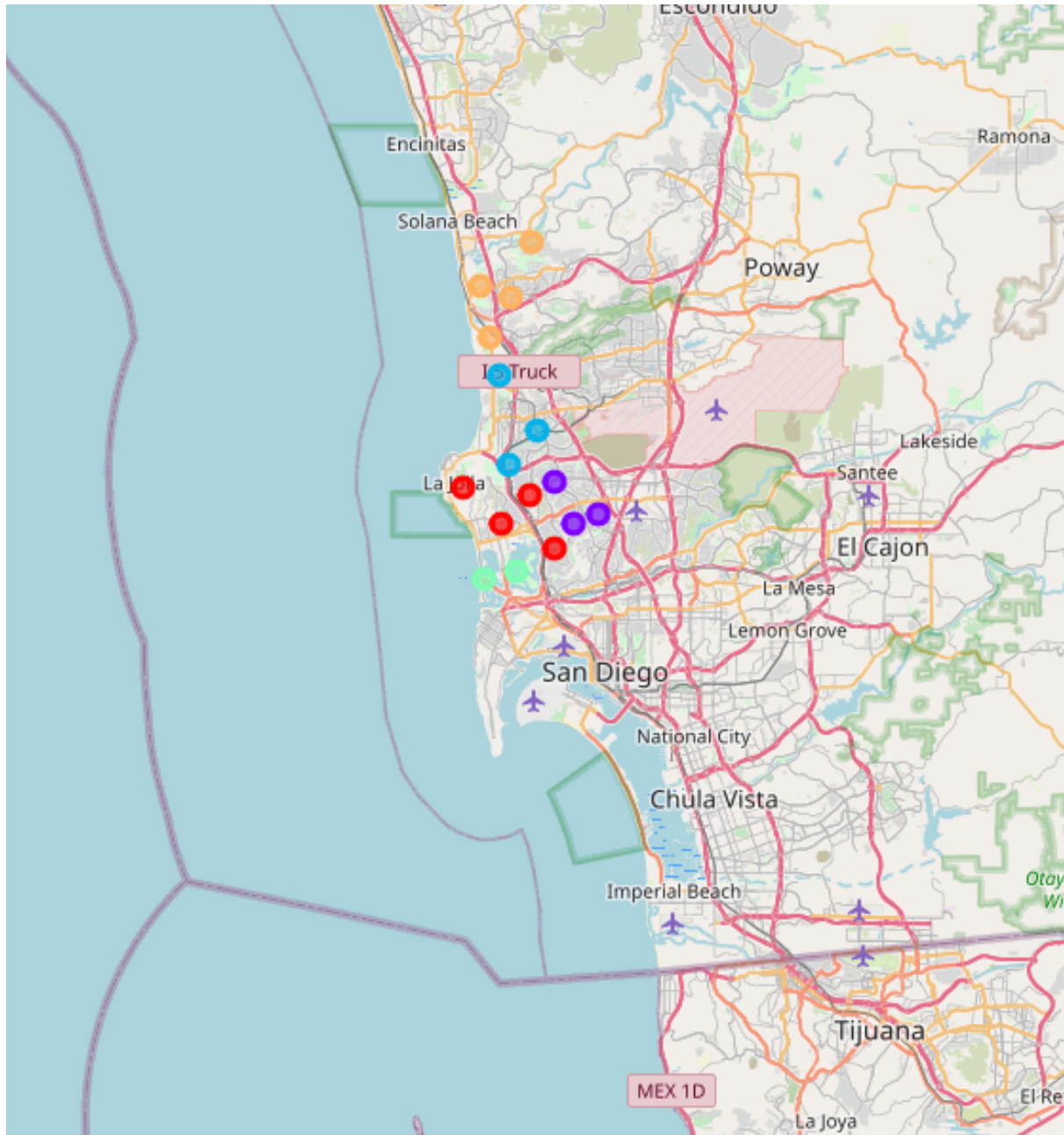


Fig.2 The map of northern region with cluster labels

## Results

By looking at the cluster data, we can get some basic ideas about living in the northern region of the city of San Diego.

The first cluster (red points) includes the neighborhoods of Bay Ho, Bay Park, La Jolla and Pacific Beach. This area is characterized by beaches, parks, Mexican restaurants and seafood restaurants. If you like living near the sea, and you like Mexican food or seafood, this will be your best living choice. The house price of this area is moderate level of the city, except La Jolla, which is very closed to sea and have the most excellent seascape in Southern California. The figure below shows the most common venues for the first cluster.

	Neighborhood	Price (\$)	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	Bay Ho	878644	0	Coffee Shop	Mexican Restaurant	Park	Grocery Store	Beach	Pizza Place	Seafood Restaurant	Fast Food Restaurant	Breakfast Spot	Burger Joint
1	Bay Park	993202	0	Park	Mexican Restaurant	Pizza Place	Beach	Café	Thai Restaurant	Coffee Shop	American Restaurant	Seafood Restaurant	Brewery
6	La Jolla	1874385	0	Beach	Breakfast Spot	Seafood Restaurant	Coffee Shop	Italian Restaurant	Park	American Restaurant	Mexican Restaurant	Café	Surf Spot
12	Pacific Beach	1009741	0	Beach	Park	Seafood Restaurant	Coffee Shop	Breakfast Spot	Mexican Restaurant	Bar	Pizza Place	Burger Joint	Café

Table 4 The most common venues for the first cluster

The second cluster (purple points) includes the neighborhoods of Clairemont Mesa East, Clairemont Mesa West and North Clairemont. From the naming of the neighborhoods, we can also see their similarities. This area is characterized by Japanese/Korean food (and other Asian food), grocery store and pizza place. The house price is lower than other areas of cluster. This is a typical living area, and you can find many Asian food here. Life is also very convenient. Since it is not close to the sea, the house prices are also more friendly. The figure below shows the most common venues for the second cluster. And I also show all of the venues which two of neighborhoods have, and you can find more similarities of them.

	Neighborhood	Price (\$)	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
3	Clairemont Mesa East	757674	1	Japanese Restaurant	Sushi Restaurant	Grocery Store	Korean Restaurant	Café	Pizza Place	Dessert Shop	Mexican Restaurant	Noodle House	Fast Food Restaurant
4	Clairemont Mesa West	810498	1	Japanese Restaurant	Grocery Store	Sushi Restaurant	Pizza Place	Fast Food Restaurant	Thai Restaurant	Korean Restaurant	Park	Coffee Shop	Mexican Restaurant
11	North Clairemont	790675	1	Coffee Shop	Grocery Store	Mexican Restaurant	Pizza Place	Park	Fast Food Restaurant	Japanese Restaurant	Korean Restaurant	Ice Cream Shop	Sporting Goods Shop

Table 5 The most common venues for the second cluster

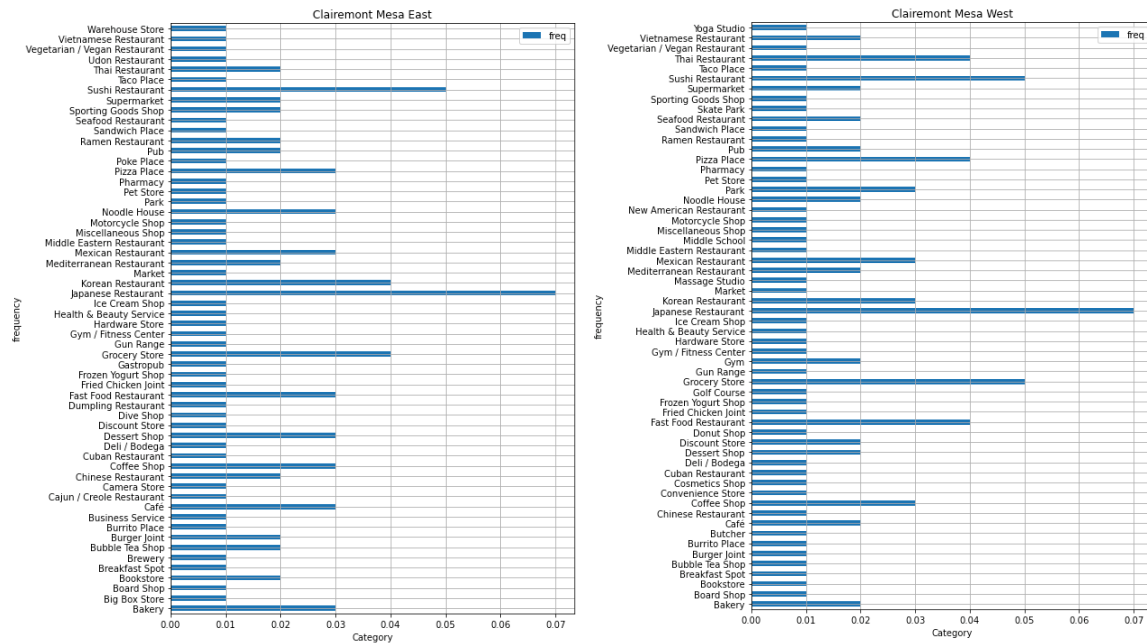


Fig.3 All of the venues which two of neighborhoods have

The third cluster (blue points) includes the neighborhoods of La Jolla Village, Torrey Pines and University City. This area is characterized by coffee shop, New American restaurant, grocery store and different kinds of shops. This area and the area of last cluster have the low level of house price in the northern part of the city of San Diego. Further research for this area, you will find there are a large number of technology companies and university campuses here, so these venues are also very suitable for the needs of the people who work and live here. If you are an employee of a nearby company or a university student, you can consider living in this area. The lower price also means that renting a house in this area is also very cost-effective. Of course, the most important thing is the convenience of life, which meets the needs of fast-paced life. The figure below shows the most common venues for the third cluster. I also show all of venues of neighborhood of University City, you can find how this neighborhood meets the requirement of modern fast-paced life.

	Neighborhood	Price (\$)	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
7	La Jolla Village	784488	2	Coffee Shop	Seafood Restaurant	Beach	Park	Café	New American Restaurant	Grocery Store	Italian Restaurant	Scenic Lookout	Ice Cream Shop
13	Torrey Pines	603162	2	Beach	Trail	New American Restaurant	Coffee Shop	Furniture / Home Store	Brewery	Burger Joint	Cosmetics Shop	Gym	Grocery Store
15	University City	784488	2	Coffee Shop	Sandwich Place	Burger Joint	Grocery Store	New American Restaurant	Furniture / Home Store	Park	Cosmetics Shop	Gym	Clothing Store

Table 6 The most common venues for the third cluster



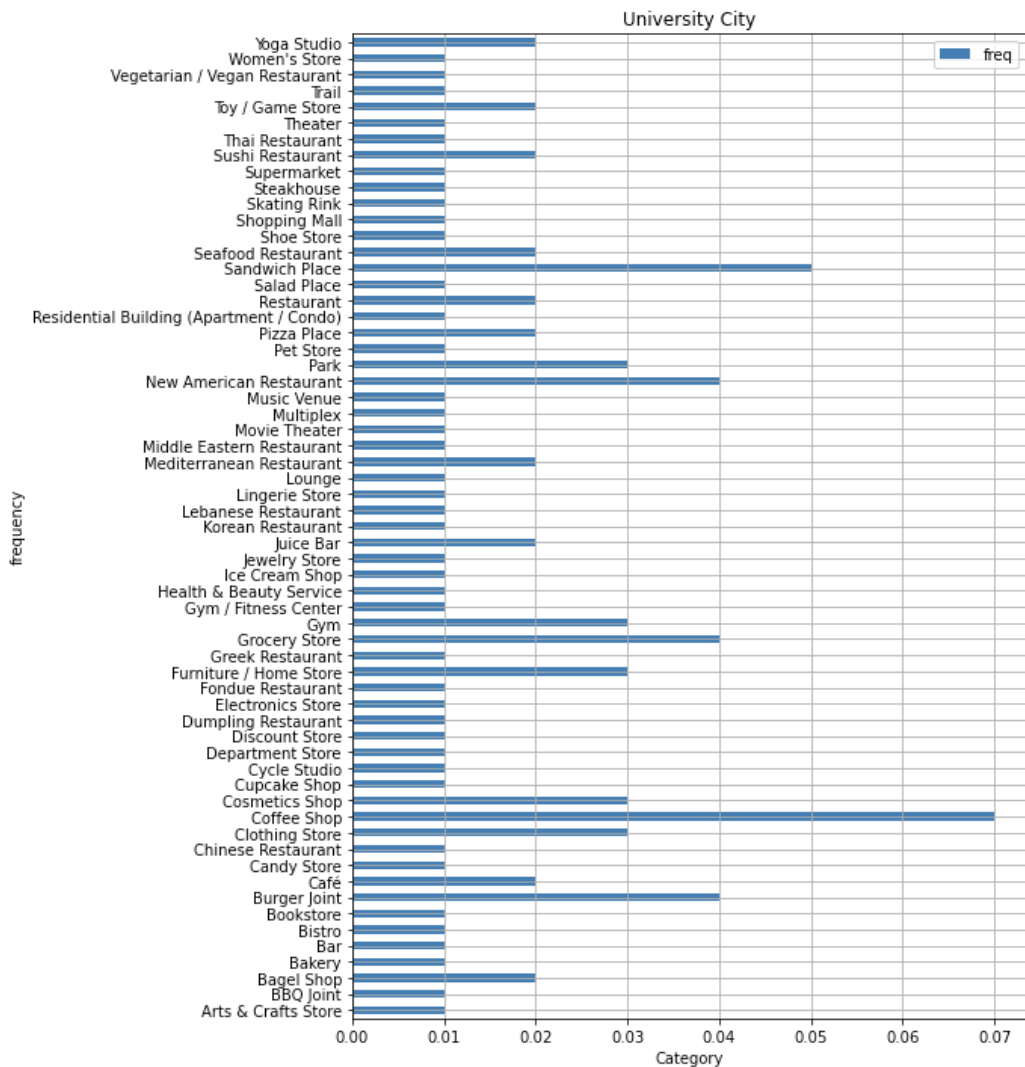


Fig.4 All of the venues in University City

The fourth cluster (green points) includes the neighborhoods of Mission Beach and Mission Bay Park. This area is characterized by beach, park, brewery, bar and seafood restaurant. This area is similar to the first area (the area in cluster 1) in that it contains lots of venues of beach, park and seafood restaurants. But the difference is that there are many bars and breweries here. The house price belongs to the moderate-high level. If you like living near the sea and drink with friends, this area will be a good choice. The figure below shows the most common venues for the fourth cluster.

	Neighborhood	Price (\$)	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
8	Mission Beach	1287889	3	Beach	Park	Bar	American Restaurant	Brewery	Burger Joint	Mexican Restaurant	Coffee Shop	Seafood Restaurant	Café
9	Mission Bay Park	828656	3	Park	Beach	Coffee Shop	Bar	Brewery	Seafood Restaurant	Grocery Store	Fast Food Restaurant	Breakfast Spot	Theme Park

Table 6 The most common venues for the fourth cluster

The fifth cluster (orange points) includes the neighborhoods of Carmel Valley, Del Mar Heights, North City and Torrey Preserve. The area is characterized by coffee shop, beach, all

kinds of restaurant, trail and golf course. You can easily see that this is a densely populated area, and the catering industry is very prosperous. House prices are the highest level of Northern region and even in the whole city of San Diego. Most of the people who live here are in a better financial situation, so you can find some high-end facilities here like Golf. The figure below shows the most common venues for the fifth cluster.

	Neighborhood	Price (\$)	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
2	Carmel Valley	1284041	4	Coffee Shop	Beach	Seafood Restaurant	Trail	Italian Restaurant	American Restaurant	Mediterranean Restaurant	New American Restaurant	Golf Course	Restaurant
5	Del Mar Heights	1643284	4	Coffee Shop	Beach	Seafood Restaurant	Mexican Restaurant	American Restaurant	Trail	Italian Restaurant	Grocery Store	Breakfast Spot	Park
10	North City	1801601	4	Golf Course	Coffee Shop	Restaurant	American Restaurant	Grocery Store	Italian Restaurant	Seafood Restaurant	Pizza Place	Breakfast Spot	New American Restaurant
14	Torrey Preserve	1524588	4	Coffee Shop	Beach	Trail	Mexican Restaurant	Scenic Lookout	American Restaurant	Italian Restaurant	New American Restaurant	Seafood Restaurant	Hotel

Table 7 The most common venues for the fifth cluster

## Discussion

Now that we have a basic understanding of neighborhoods in northern region of the city of San Diego. Based on this, we can provide some living suggestions for people who are new to this city (northern). For example:

- 1) If you like living near the sea, and you like Mexican food or seafood, the neighborhoods in Cluster 1 will be your best living choice. You also can find some house with moderate prices, except in La Jolla, which has the most wonderful seascape in Southern California.
- 2) If you like Asian food, especially Japanese/Korean food, the neighborhoods of Cluster 2 will be your dream place. Life will be very convenient and the house price is also low comparing other areas.
- 3) If the company you will join places in the neighborhoods of Cluster 3, you could choose the living place here directly. The venues in this area meet all of requirement of modern fast-paced life. You also find the house price and renting price are also friendly.
- 4) If you like living near the sea and drink with friends, this area of Cluster 4 will be a good choice. It is quite similar with the area of Cluster 1 but if you are not a big fan of Mexican food and loves drink with friend or by yourself, believe me, this is your best choice.
- 5) If you have good financial situation, choose the area of Cluster 5. This area contains all the characteristics of the above area, except for the most expensive housing price.

## Conclude

This report discusses the process of coming up with an answer for the problem we raised at the beginning: if you plan to move to San Diego (Northern region for example) to live, which area is best for you to live in. The data processing and analysis used mainly come from python, pandas, BeautifulSoup, folium and the k-means cluster method of Machine Learning. The method of thinking about similar problems can be applied to any cities or areas.