Setting Up a New Coffee Shop in Los Angeles, US

By Tien Nguyen

1. Introduction

Coffee is one of those drinks that a lot of people can't do without. A good portion of the public starts their day with coffee, and many of them continue to drink it well past lunchtime and all through the day. According to the National Coffee Association USA, more than 450 million cups of coffee are consumed in the United States every day, and as much as 63% of American adults drink coffee daily. People have their coffee in two ways: making their coffee at home or going to a coffee shop. There are a lot of reasons people love to go to the coffee shop. Apart from getting a cup of coffee with the high-quality ingredients, best brewing recipes, consistency, fresh and appealing sweet & savory selections, people want to go to coffee houses because they want to meet up or gossip with their friends, do some work, read a book, entertain or simply to pass some time. Consequently, many businesses want to open a new coffee shop or expand their coffeehouse chain in the future.

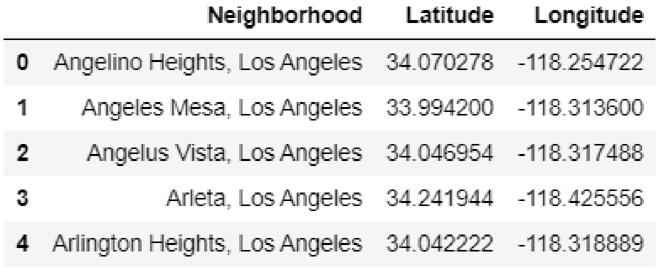
Opening a coffee shop can be extremely profitable if we do it right. The success of a coffee shop depends on many factors, and its location is one of them. In this project, we focus solely on the Los Angeles metropolitan area because it is also the most populated city in California. Being home and the workplace to many people, Los Angeles is considered a good place to start this business. However, "which neighborhoods in Los Angeles should a new coffee shop be located ?"

In this project, data science methodology and one of the machine learning techniques (clustering) are used to assist our contractors/clients in finding a matching neighborhood to open a new coffee shop.

2. Data Sets

There are two datasets in the project: neighborhoods in Los Angeles dataset and Foursquare venue dataset. The neighborhoods in Los Angeles dataset is scrapped directly from the Wikipedia website while the Foursquare venue dataset is crawled directly from Foursquare API.

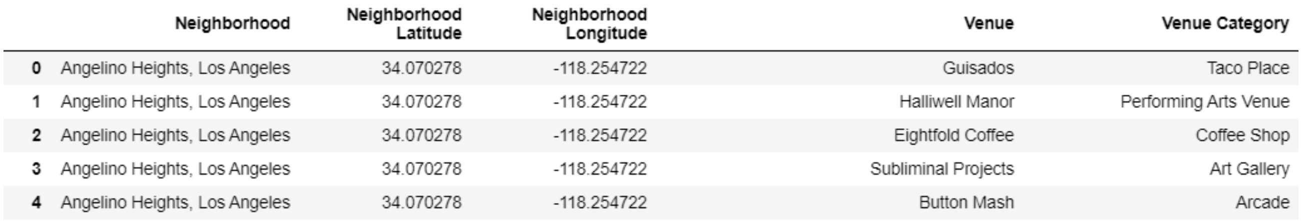
To get the neighborhoods in Los Angeles, we used the BeautifulSoup package to scrape the Wikipedia website and then parsed the geographical coordinates of the neighborhoods using the neighborhood Wikipedia pages along with the Python Geocoder package which would give us the latitude and longitude coordinates of the neighborhoods. As a result, the Los Angeles dataset has 190 neighborhoods. For each neighborhood, the data consists of the neighborhood's latitude and longitude.



	Neighborhood	Latitude	Longitude
0	Angelino Heights, Los Angeles	34.070278	-118.254722
1	Angeles Mesa, Los Angeles	33.994200	-118.313600
2	Angelus Vista, Los Angeles	34.046954	-118.317488
3	Arleta, Los Angeles	34.241944	-118.425556
4	Arlington Heights, Los Angeles	34.042222	-118.318889

Fig 1: An excerpt from the neighborhoods in Los Angeles dataset

After having the neighborhood's latitude and longitude data, we passed them to Foursquare API to get the top 100 venues that were within a radius of 2000 meters for those neighborhoods. As a result, the Foursquare venue dataset has 16909 observations where each observation consists of neighborhood latitude, neighborhood longitude, venue, and venue category.

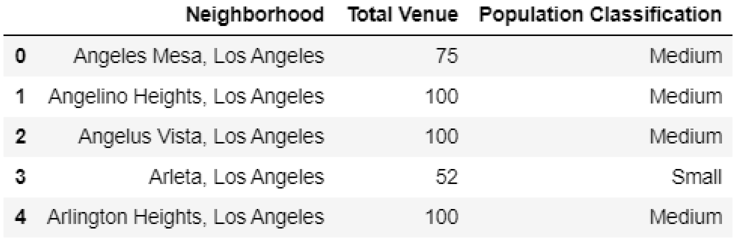


	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Category
0	Angelino Heights, Los Angeles	34.070278	-118.254722	Guisados	Taco Place
1	Angelino Heights, Los Angeles	34.070278	-118.254722	Halliwell Manor	Performing Arts Venue
2	Angelino Heights, Los Angeles	34.070278	-118.254722	Eightfold Coffee	Coffee Shop
3	Angelino Heights, Los Angeles	34.070278	-118.254722	Subliminal Projects	Art Gallery
4	Angelino Heights, Los Angeles	34.070278	-118.254722	Button Mash	Arcade

Fig 2: An excerpt from the neighborhoods in Los Angeles dataset

In addition to the locality, the population in a neighborhood also plays an essential role in the decision of opening a new coffee shop. However, there is no such service providing the population of each neighborhood. Therefore, we assume that the more venues of a neighborhood, the more residents living there. After that, we classified the population into three categories depending on the number of venues that each neighborhood has as follows,

- Small population: the number of venues between 0 and 20 (exclusive)
- Medium population: the number of venues between 21 and 100 (exclusive)
- Large population: the number of venues of 100 or more



	Neighborhood	Total Venue	Population Classification
0	Angeles Mesa, Los Angeles	75	Medium
1	Angelino Heights, Los Angeles	100	Medium
2	Angelus Vista, Los Angeles	100	Medium
3	Arleta, Los Angeles	52	Small
4	Arlington Heights, Los Angeles	100	Medium

Fig 3: An excerpt from the additional venue and population classification table

From the 3 tables above, the geographical coordinates are used to plot the map of Los Angeles with the neighborhoods while venue data is used to perform clustering on the neighborhoods. The number of coffee shops in each neighborhood is one of the most important features in the model. However, we don't want to set up a new coffee shop in a neighborhood that has a lot of coffee shops but less population. Therefore, we calculate the percent of coffee shops located in each neighborhood.

One more thing we should consider before calculating the percent of coffee shops located in each neighborhood is that we need to change all categories that are synonyms of Coffee to Coffee Shop such as “Café”.

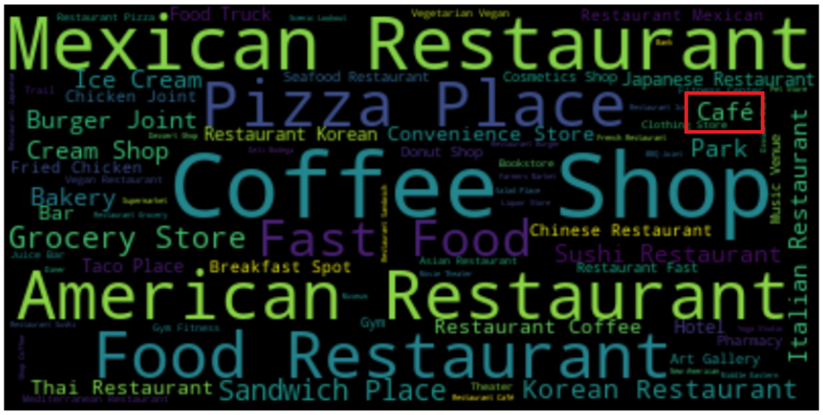
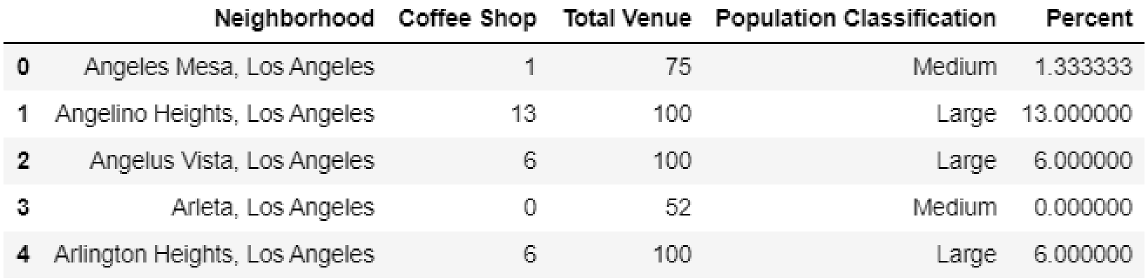


Fig 4: The generated word cloud for all venue categories



	Neighborhood	Coffee Shop	Total Venue	Population Classification	Percent
0	Angeles Mesa, Los Angeles	1	75	Medium	1.333333
1	Angelino Heights, Los Angeles	13	100	Large	13.000000
2	Angelus Vista, Los Angeles	6	100	Large	6.000000
3	Arleta, Los Angeles	0	52	Medium	0.000000
4	Arlington Heights, Los Angeles	6	100	Large	6.000000

Fig 5: An excerpt from the final table for performing clustering on the neighborhoods

3. Methodology

3.1 Exploratory data analysis

Before doing anything, let’s visualize a map of Los Angeles with neighborhoods superimposed on top.

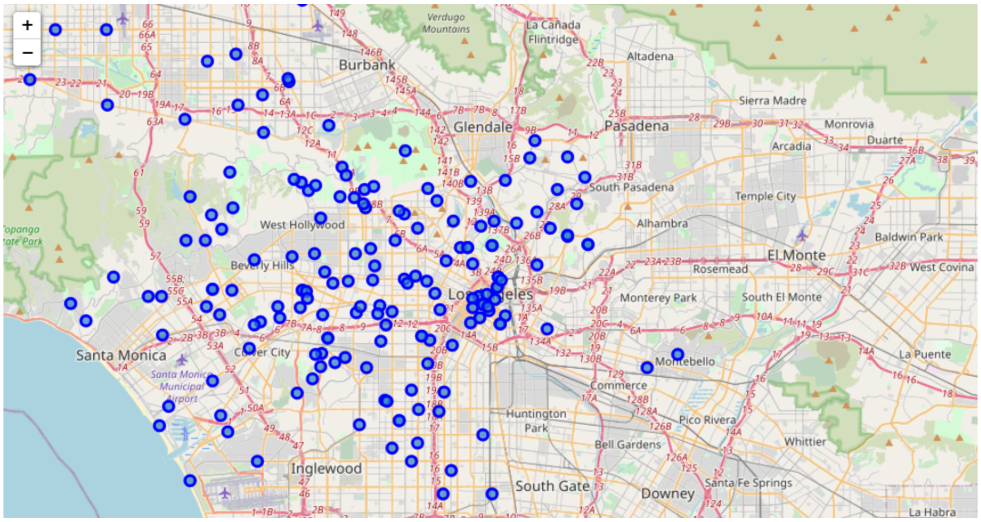


Fig 6: Los Angeles map containing all the neighborhoods

There are about 416 unique venue categories in Los Angeles and coffee shops are at the top of the charts as we can see in the plot below. It’s about 1.5 times the second most common venue category (Mexican Restaurant) in Los Angeles areas.

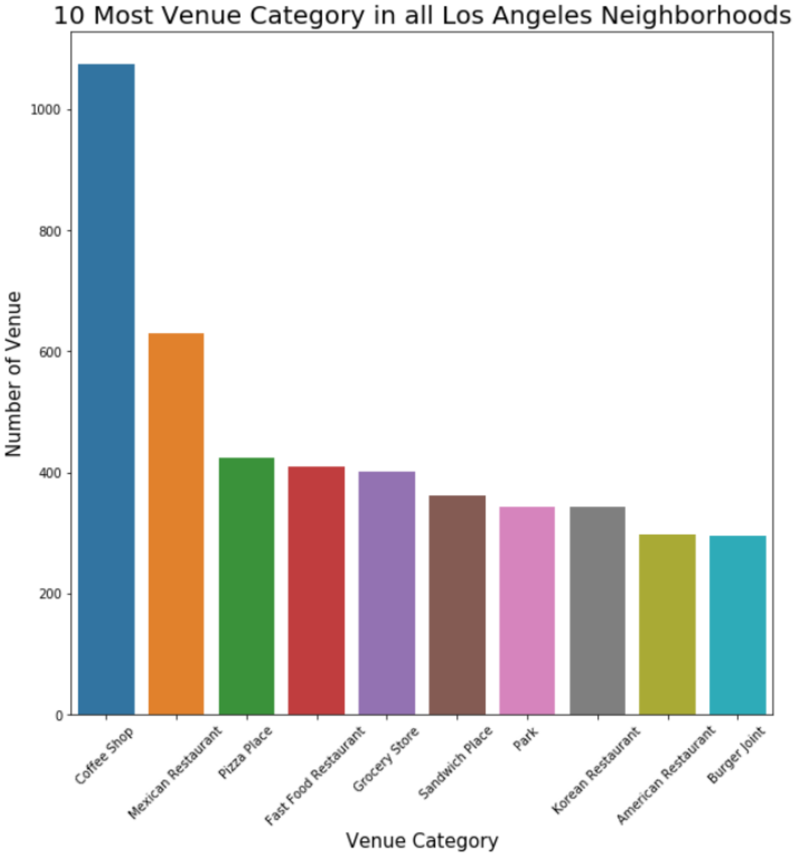


Fig 7: Top 10 most venue categories in the Los Angeles area

The top 10 neighborhoods with the most number of coffee shops are shown in the bar chart below

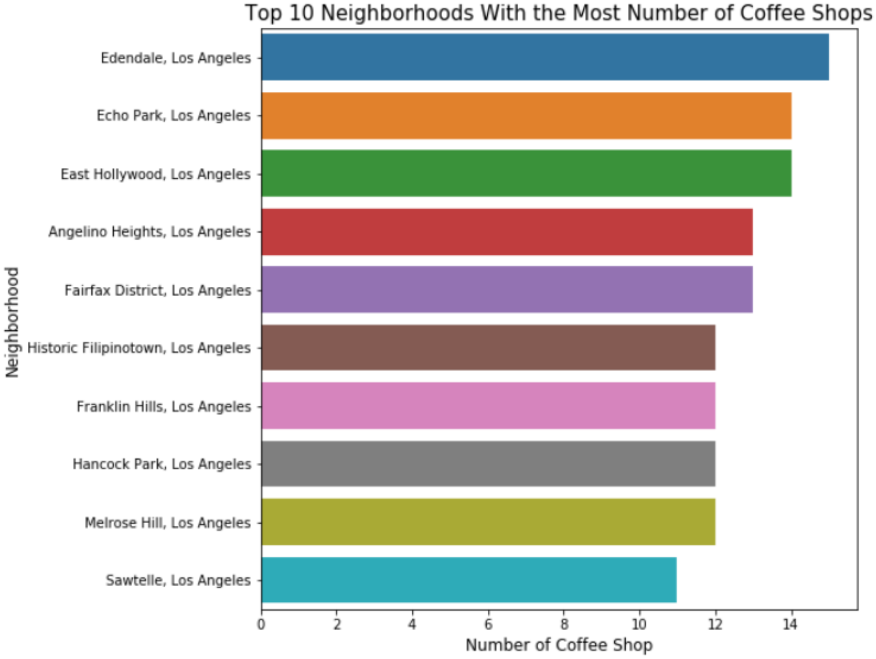


Fig 8: Neighborhoods that have the most number of coffee shops

Edendale, which has 15 coffee shops, is the neighborhood that has the most number of coffee shops. Among the top 10 positions, Historic Filipinotown, Franklin Hills, Hancock Park, and Melrose Hill have the same number of coffee houses.

Next, let visualize the bar chart about the population classification.

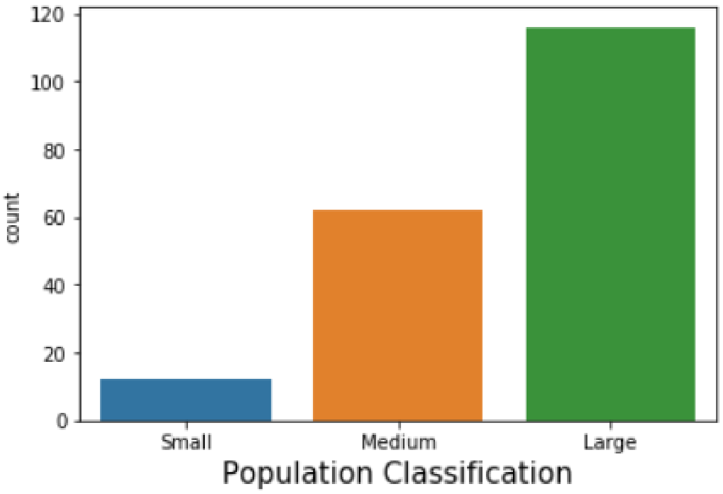


Fig 9: Number of the neighborhood in each population classification

About 18 neighborhoods are having fewer than 60 venues which are considered a low population while there are about 110 neighborhoods that have more than 100 venues which implies that these neighborhoods have many residents.

3.2 Clustering model

We performed K-mean clustering with the feature "Percent" in the table shown in figure 5 to cluster the neighborhood. K-mean algorithm is one of the most common cluster methods of unsupervised learning. To specify the number of clusters K, we used the elbow method.

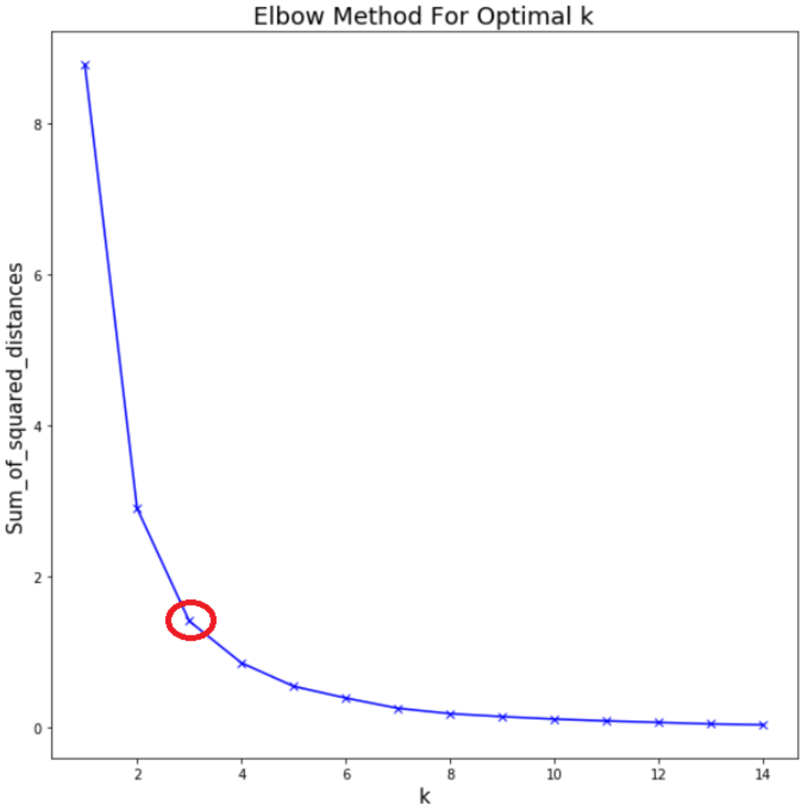


Fig 10: Elbow method to determine the number of clusters

We see that a good K to use in our model would be 3. We use the K-means algorithm in the sklearn library to fit clusters to our data.

4. Results

From K-means clustering, cluster 0 has 78 neighborhoods which is the highest number of neighborhoods among the three clusters. Cluster 1 has 60 neighborhoods. Cluster 2 has 52 neighborhoods. The results from the K-means clustering show that we can classify the neighborhoods into 3 clusters based on the frequency of occurrence for 'Coffee Shop' among the venues:

- Cluster 0: Neighborhoods that have a moderate number of coffee shops. Each neighborhood has between 1 to 8 coffee shops. It takes 4% to 8% of the total of those neighborhoods' venues.

- Cluster 1: Neighborhoods that have the fewest number of coffee shops. There are less than 8 coffee shops in each neighborhood. It takes 0% to 4% of the total of those neighborhoods' venues.
- Cluster 2: Neighborhoods that have a high number of coffee shops. The number of coffee shops in each neighborhood is between 2 to 15. It takes 9% to 16% of the total of those neighborhoods' venues.

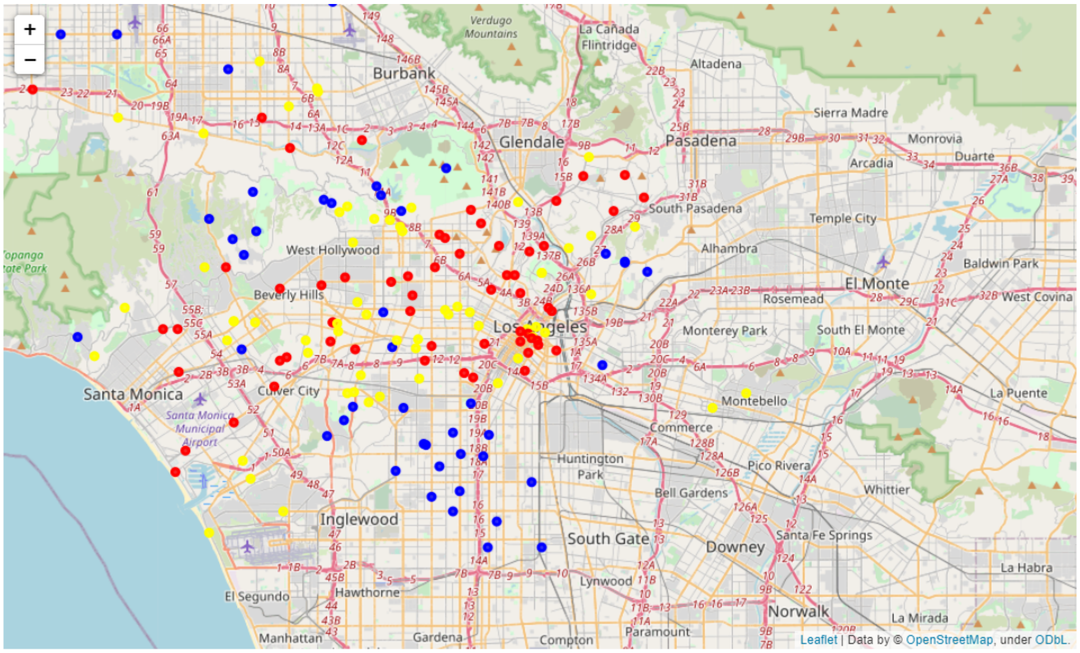


Fig 11: Los Angeles with neighborhood labeled with cluster color

We visualize the results of the clustering in the map with cluster 0 in red color, cluster 1 in blue color, and cluster 2 in yellow color.

5. Discussion

The moderate and high percent number of coffee shops are concentrated in the center of Los Angeles (Fig 11.) Cluster 1 (blue) has a very low percentage of coffee shops. This represents a great opportunity and high potential location to open a new coffee shop because there is very little to no competition to open a new coffee shop. As mentioned, the neighborhoods that have more than 100 venues are considered as large populations. From the graph below, we see that Reseda is a good neighborhood to set up a new coffee shop as it only has one coffee shop but it has a large population (Fig 12.)

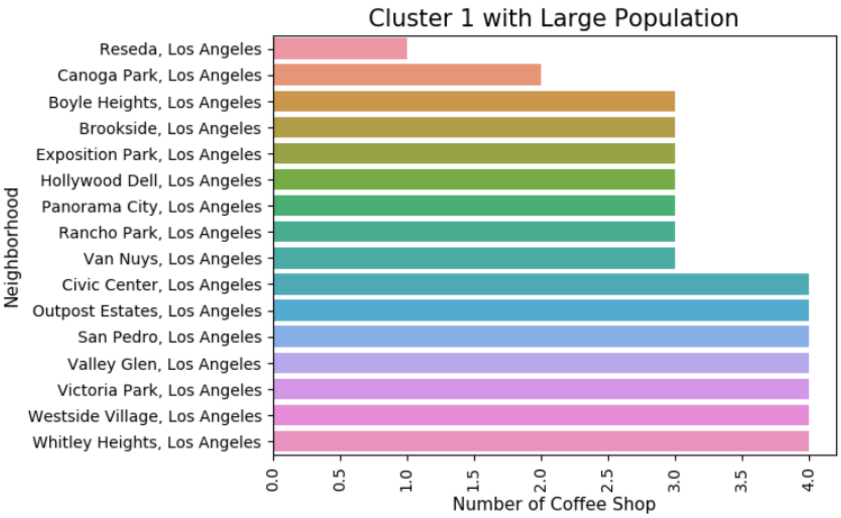


Fig 12: Number of coffee shop in cluster 1 with a large population

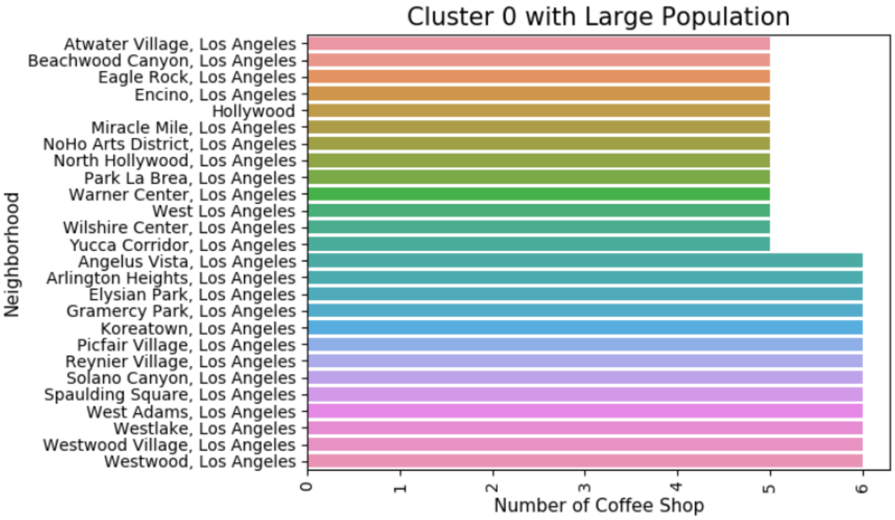


Fig 13: Number of coffee shop in cluster 0 with a large population

Cluster 0 can be chosen to open a new coffee shop if the population is large but the number of coffee shops is not too high (fig 13.) For example, Atwater Village has a large population but only 5 coffee shops.

Lastly, neighborhoods in cluster 2 should be avoided setting up a new coffee shop since they already have a high concentration of coffee shops and may suffer from intense competition.

6. Conclusion & Future Work

The purpose of this project is to assist our contractors/clients to find a neighborhood that their coffee shop should be set up in.

After fetching data from several data sources, processing them into a clean data frame, and applying the K-means clustering algorithm, we visualized and recommended potential neighborhoods that have a few coffee shops but have a large population. The finding of this project will help our contractors or clients to consider high potential locations while avoiding overcrowded neighborhoods in their decisions to open a new coffee shop.

Nevertheless, to open a coffee shop, we also need to consider other factors such as the cost of rent, the population of the neighborhood, etc. In this project, we classified the population of each neighborhood based on the number of venues in each neighborhood. Besides, this project made use of the free FourSquare API that came with limitations as to the number of API calls and results returned. For future work, we can build a better recommendation if we have more fields and more data for our K-means clustering algorithm.

7. References

"List Of Districts And Neighborhoods In Los Angeles".En.Wikipedia.Org, 2020, https://en.wikipedia.org/wiki/List_of_districts_and_neighborhoods_in_Los_Angeles.

"Log In". Foursquare.Com, 2020, https://foursquare.com/developers/apps. Accessed 12 Dec 2020.