

**‘WHAT’ TO OPEN AT  
‘WHERE’ IN BURSA?**

# INTRODUCTION

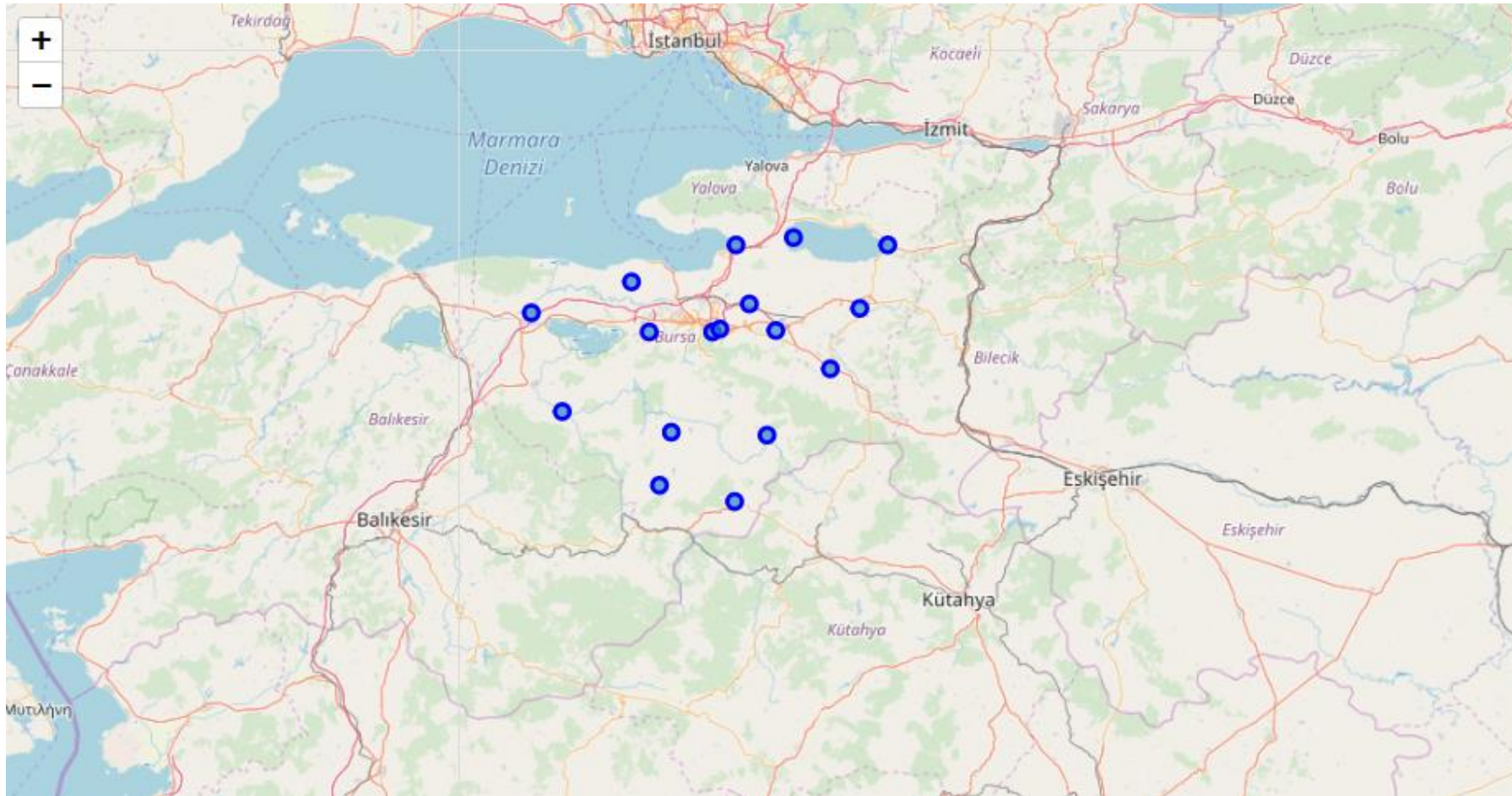
- ▶ Bursa is one of the crowded cities in the Turkey. There are almost three million people in Bursa. Bursa's rank in the "World's Liveable Cities, 2016" is 28 in the world and first in the Turkey.
- ▶ According to the industrial statistics Bursa is the heart of automotive production in Turkey. There are big automotive companies such as Bosch, Renault etc.
- ▶ So imagine that you have a money to invest but you still have questions about opening "**What**" at "**Where**". Bursa has 17 boroughs and all of them has their own people, own lifestyles, own incoming levels. So you can not open everything in everywhere.
- ▶ Starting from next slide we will see the most common venues of each borough and we will decide to open what at where.

# DATA

- ▶ I have used the location data of the boroughs of Bursa. Bursa has 17 boroughs. Before we find the venues we need to find the coordinates of the boroughs.
- ▶ I have used the geolocator library to find the latitude and longitude values for each borough.

|    | City  | Borough          | Neighborhood     | Latitude  | Longitude |
|----|-------|------------------|------------------|-----------|-----------|
| 0  | Bursa | Büyükorhan       | Büyükorhan       | 39.744199 | 28.870146 |
| 1  | Bursa | Gemlik           | Gemlik           | 40.430165 | 29.157070 |
| 2  | Bursa | Gürsu            | Gürsu            | 40.264367 | 29.206952 |
| 3  | Bursa | Harmancık        | Harmancık        | 39.699869 | 29.151777 |
| 4  | Bursa | İnegöl           | İnegöl           | 40.080014 | 29.509645 |
| 5  | Bursa | İznik            | İznik            | 40.430345 | 29.722373 |
| 6  | Bursa | Karacabey        | Karacabey        | 40.237546 | 28.396002 |
| 7  | Bursa | Keles            | Keles            | 39.889890 | 29.271753 |
| 8  | Bursa | Kestel           | Kestel           | 40.186927 | 29.304732 |
| 9  | Bursa | Mudanya          | Mudanya          | 40.325485 | 28.769453 |
| 10 | Bursa | Mustafakemalpaşa | Mustafakemalpaşa | 39.955087 | 28.512252 |
| 11 | Bursa | Nilüfer          | Nilüfer          | 40.182864 | 28.832399 |
| 12 | Bursa | Orhaneli         | Orhaneli         | 39.897180 | 28.913627 |
| 13 | Bursa | Orhangazi        | Orhangazi        | 40.452753 | 29.374641 |
| 14 | Bursa | Osmangazi        | Osmangazi        | 40.182737 | 29.067835 |
| 15 | Bursa | Yenişehir        | Yenişehir        | 40.248492 | 29.621070 |
| 16 | Bursa | Yıldırım         | Yıldırım         | 40.190099 | 29.097653 |

# Distribution of the Boroughs



# Number of Venues in each Borough

| Neighborhood     | Neighborhood Latitude | Neighborhood Longitude | Venue | Venue Latitude | Venue Longitude | Venue Category |
|------------------|-----------------------|------------------------|-------|----------------|-----------------|----------------|
| Büyükorhan       | 10                    | 10                     | 10    | 10             | 10              | 10             |
| Gemlik           | 100                   | 100                    | 100   | 100            | 100             | 100            |
| Gürsu            | 33                    | 33                     | 33    | 33             | 33              | 33             |
| Harmancık        | 17                    | 17                     | 17    | 17             | 17              | 17             |
| Karacabey        | 95                    | 95                     | 95    | 95             | 95              | 95             |
| Keles            | 17                    | 17                     | 17    | 17             | 17              | 17             |
| Kestel           | 28                    | 28                     | 28    | 28             | 28              | 28             |
| Mudanya          | 18                    | 18                     | 18    | 18             | 18              | 18             |
| Mustafakemalpaşa | 12                    | 12                     | 12    | 12             | 12              | 12             |
| Nilüfer          | 90                    | 90                     | 90    | 90             | 90              | 90             |
| Orhaneli         | 10                    | 10                     | 10    | 10             | 10              | 10             |
| Orhangazi        | 15                    | 15                     | 15    | 15             | 15              | 15             |
| Osmangazi        | 100                   | 100                    | 100   | 100            | 100             | 100            |
| Yenişehir        | 88                    | 88                     | 88    | 88             | 88              | 88             |
| Yıldırım         | 100                   | 100                    | 100   | 100            | 100             | 100            |
| İnegöl           | 100                   | 100                    | 100   | 100            | 100             | 100            |
| İznik            | 71                    | 71                     | 71    | 71             | 71              | 71             |

# METHODOLOGY

- ▶ First we will create a new data frame by using the data in Data section and we will use this data frame in clustering algorithm to create clusters which includes the Bursa's boroughs according to the number of boroughs.
- ▶ First we are using encoding operation to "Venue Category" column and creating a new dataframe by using this data which named as bursa\_onehot\_encode. We are assigning borough's neighborhood values to the bursa\_onehot\_encode data frame. And let's check the head and tail of the bursa\_onehot\_encode data frame.
- ▶ Head of the Data Frame;

|   | Neighborhood | Accessories Store | Airport Terminal | Arcade | Art Gallery | Arts & Crafts Store | Arts & Entertainment | Athletics & Sports | Auto Garage | BBQ Joint | ... | Travel & Transport | Tree | Tunnel | Turkish Coffeehouse | Turkish Home Cooking Restaurant |
|---|--------------|-------------------|------------------|--------|-------------|---------------------|----------------------|--------------------|-------------|-----------|-----|--------------------|------|--------|---------------------|---------------------------------|
| 0 | Büyükorhan   | 0                 | 0                | 0      | 0           | 0                   | 0                    | 0                  | 0           | 0         | ... | 0                  | 0    | 0      | 0                   | 0                               |
| 1 | Büyükorhan   | 0                 | 0                | 0      | 0           | 0                   | 0                    | 0                  | 0           | 0         | ... | 0                  | 0    | 0      | 0                   | 0                               |
| 2 | Büyükorhan   | 0                 | 0                | 0      | 0           | 0                   | 0                    | 0                  | 0           | 0         | ... | 0                  | 0    | 0      | 0                   | 0                               |
| 3 | Büyükorhan   | 0                 | 0                | 0      | 0           | 0                   | 0                    | 0                  | 0           | 0         | ... | 0                  | 0    | 0      | 0                   | 0                               |
| 4 | Büyükorhan   | 0                 | 0                | 0      | 0           | 0                   | 0                    | 0                  | 0           | 0         | ... | 0                  | 0    | 0      | 0                   | 0                               |

5 rows × 181 columns

# The Grouped Data Frame

|    | Neighborhood     | Accessories Store | Airport Terminal | Arcade   | Art Gallery | Arts & Crafts Store | Arts & Entertainment | Athletics & Sports | Auto Garage | BBQ Joint | ... | Travel & Transport | Tree     | Tunnel   | Turkish Coffeehouse |
|----|------------------|-------------------|------------------|----------|-------------|---------------------|----------------------|--------------------|-------------|-----------|-----|--------------------|----------|----------|---------------------|
| 0  | Büyükorhan       | 0.000000          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 1  | Gemlik           | 0.000000          | 0.000000         | 0.020000 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 2  | Gürsu            | 0.000000          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.000000             | 0.030303           | 0.000000    | 0.030303  | ... | 0.000000           | 0.060606 | 0.030303 | 0.030303            |
| 3  | Harmancık        | 0.000000          | 0.000000         | 0.058824 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.058824 | 0.000000            |
| 4  | Karacabey        | 0.000000          | 0.000000         | 0.031579 | 0.000000    | 0.000000            | 0.010526             | 0.000000           | 0.010526    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.010526            |
| 5  | Keles            | 0.000000          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 6  | Kestel           | 0.035714          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.035714 | 0.000000 | 0.035714            |
| 7  | Mudanya          | 0.000000          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.055556             | 0.000000           | 0.000000    | 0.055556  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 8  | Mustafakemalpaşa | 0.000000          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.166667            |
| 9  | Nilüfer          | 0.000000          | 0.000000         | 0.011111 | 0.000000    | 0.000000            | 0.000000             | 0.022222           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 10 | Orhaneli         | 0.000000          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 11 | Orhangazi        | 0.000000          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.000000             | 0.133333           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 12 | Osmangazi        | 0.000000          | 0.000000         | 0.000000 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 13 | Yenişehir        | 0.000000          | 0.011364         | 0.034091 | 0.000000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 14 | Yıldırım         | 0.000000          | 0.000000         | 0.020000 | 0.000000    | 0.010000            | 0.000000             | 0.010000           | 0.000000    | 0.000000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 15 | İnegöl           | 0.000000          | 0.000000         | 0.030000 | 0.010000    | 0.000000            | 0.000000             | 0.000000           | 0.000000    | 0.010000  | ... | 0.000000           | 0.000000 | 0.000000 | 0.000000            |
| 16 | İznik            | 0.000000          | 0.000000         | 0.000000 | 0.042254    | 0.014085            | 0.000000             | 0.000000           | 0.000000    | 0.000000  | ... | 0.014085           | 0.000000 | 0.000000 | 0.000000            |



# Clustering

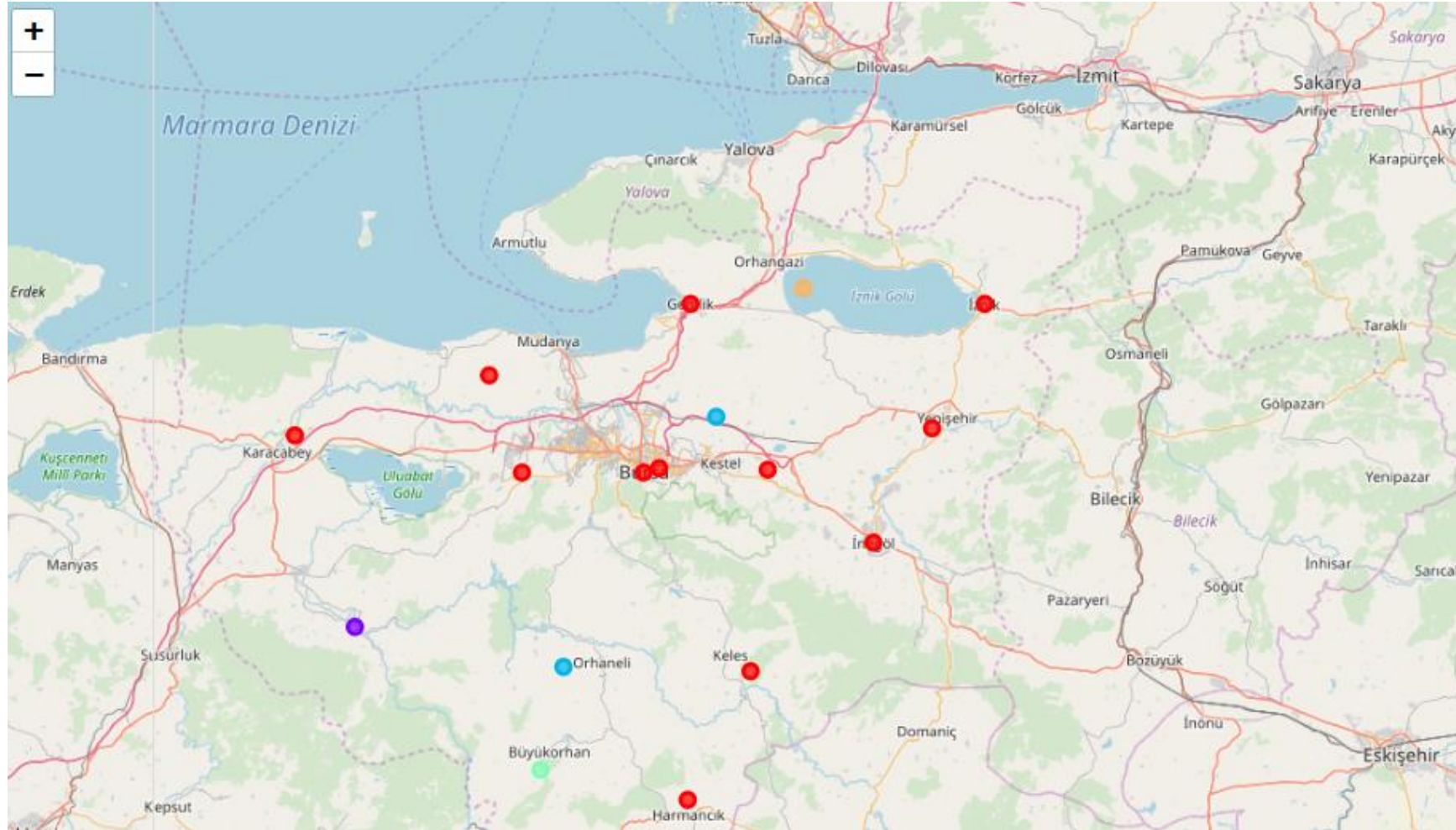
- ▶ And now our data is ready to use in clustering algorithm. I have set 5 clusters for this project. KMeans algorithm from sklearn library is used to find out clusters. Let's check the data frame after clustering algorithm.

|   | City  | Borough    | Neighborhood | Latitude  | Longitude | Cluster Labels | 1st Most Common Venue | 2nd Most Common Venue | 3rd Most Common Venue |
|---|-------|------------|--------------|-----------|-----------|----------------|-----------------------|-----------------------|-----------------------|
| 0 | Bursa | Büyükorhan | Büyükorhan   | 39.744199 | 28.870146 | 3              | Scenic Lookout        | Food Truck            | Forest                |
| 1 | Bursa | Gemlik     | Gemlik       | 40.430165 | 29.157070 | 0              | Café                  | Seafood Restaurant    | Convenience Store     |
| 2 | Bursa | Gürsu      | Gürsu        | 40.264367 | 29.206952 | 2              | Mountain              | Forest                | Tree                  |
| 3 | Bursa | Harmancık  | Harmancık    | 39.699869 | 29.151777 | 0              | Café                  | Campground            | Mountain              |
| 4 | Bursa | İnegöl     | İnegöl       | 40.080014 | 29.509645 | 0              | Café                  | Restaurant            | Kofte Place           |

- ▶ Now, lets draw a map to see the distribution of our clusters. Each color represent another cluster. Red ones represent the Cluster #1, Purple represents Cluster #2, Blue ones are Cluster #3, Green one is the Cluster #4 and the last one I mean the Yellow is the Cluster #5.



# Cluster's Distribution



# RESULTS & DISCUSSION

- The following slides will show you the boroughs in the clusters. You can see the detailed analysis at 'Conclusions' slides. Let's start with Cluster #1

|    |           |   |                    |                    |                   |                      |                      |                    |                    |                 |                  |                      |
|----|-----------|---|--------------------|--------------------|-------------------|----------------------|----------------------|--------------------|--------------------|-----------------|------------------|----------------------|
| 1  | Gemlik    | 0 | Café               | Seafood Restaurant | Convenience Store | Gym / Fitness Center | Coffee Shop          | Turkish Restaurant | Dessert Shop       | Restaurant      | Burger Joint     | Breakfast Spot       |
| 3  | Harmancık | 0 | Café               | Campground         | Mountain          | Forest               | Business Service     | Soccer Stadium     | Bus Station        | Cafeteria       | Tunnel           | Park                 |
| 4  | İnegöl    | 0 | Café               | Restaurant         | Kofte Place       | Gym / Fitness Center | Steakhouse           | Hotel              | Arcade             | Motorcycle Shop | Soup Place       | Bagel Shop           |
| 5  | İznik     | 0 | Café               | Hotel              | Art Gallery       | Beach                | Castle               | Restaurant         | Resort             | Scenic Lookout  | Kebab Restaurant | Turkish Restaurant   |
| 6  | Karacabey | 0 | Café               | Convenience Store  | Kofte Place       | Arcade               | Fast Food Restaurant | Soup Place         | Kebab Restaurant   | Nightclub       | Cigkofte Place   | Gym / Fitness Center |
| 7  | Keles     | 0 | Convenience Store  | Steakhouse         | Tea Room          | Pub                  | Mountain             | Bistro             | Bed & Breakfast    | Café            | Restaurant       | Clothing Store       |
| 8  | Kestel    | 0 | Beach              | Breakfast Spot     | Department Store  | Lake                 | Kofte Place          | Intersection       | Garden             | Rest Area       | Moving Target    | Knitting Store       |
| 9  | Mudanya   | 0 | Farm               | Café               | Lake              | Forest               | Beer Garden          | Beach              | Campground         | BBQ Joint       | Park             | Soccer Stadium       |
| 11 | Nilüfer   | 0 | Café               | Steakhouse         | Buffet            | Farm                 | Coffee Shop          | Pide Place         | Turkish Restaurant | Bakery          | Restaurant       | Soccer Field         |
| 14 | Osmangazi | 0 | Historic Site      | Café               | Bakery            | Seafood Restaurant   | Turkish Restaurant   | Cosmetics Shop     | Mosque             | Park            | History Museum   | Gym                  |
| 15 | Yenişehir | 0 | Café               | Restaurant         | Plaza             | Electronics Store    | Mobile Phone Shop    | Park               | Convenience Store  | Arcade          | Garden           | Tea Room             |
| 16 | Yıldırım  | 0 | Turkish Restaurant | Café               | Bakery            | Dessert Shop         | Seafood Restaurant   | Kebab Restaurant   | Mosque             | Cigkofte Place  | Kofte Place      | Sandwich Place       |

# Cluster # 2 and #3

|    | Borough          | 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 |
|----|------------------|----------------|----------------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|-----------------------|------------------------|
| 10 | Mustafakemalpaşa | 1              | Construction & Landscaping | Turkish Coffeehouse   | River                 | Plaza                 | Café                  | Indian Chinese Restaurant | Pier                  | Forest                | Nature Preserve       | Flea Market            |
|    | Borough          | 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  | Gürsu            | 2              | Mountain                   | Forest                | Tree                  | Tea Room              | Plaza                 | Kafenio                   | Convenience Store     | Moving Target         | Fast Food Restaurant  | Soccer Stadium         |
| 12 | Orhaneli         | 2              | Mountain                   | Hotel                 | Spa                   | River                 | Nature Preserve       | Campground                | Farm                  | Wings Joint           | Farmers Market        | Flower Shop            |

# Cluster # 4 and #5

|   | Borough    | 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 | Büyükorhan | 3              | Scenic Lookout        | Food Truck            | Forest                | Convenience Store     | Mediterranean Restaurant | Market                | Theme Park            | Café                  | Mountain              | Fish & Chips Shop      |

|    | Borough   | 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 |
|----|-----------|----------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|
| 13 | Orhangazi | 4              | Breakfast Spot        | Recreation Center     | Athletics & Sports    | Restaurant            | Lake                  | Farm                  | Seafood Restaurant    | Trail                 | Nature Preserve       | Park                   |

# CONCLUSIONS

- ▶ At this project we have analyzed the boroughs of Bursa according to the number and type of the venues in each borough. We started this project with finding the latitude and longitude values of each borough. Then we have used Foursquare API to find the venues at each borough. After that we have grouped this venues according to the categories and choosed the top 10 category for analysis. We have divided our data to the 5 clusters. Our major aim was answering the “What” to open at “Where” question.

# CONLUSIONS

- ▶ If you are planning to open a “Café” you can prefer Gemlik, Harmancık, Inegol, Iznik, Karacabey, Nilufer and Yenisehir boroughs as your primary borough and as your secondary you can choose Mudanya, Osmangazi and Yildirim.
- ▶ If you wish to open a “Convenience Store” you can prefer Keles borough which is the only borough has convenience store as first common. Even if Karacabey has “Café” as first common you still can try your chance to open a “Convenience Store” at there too.
- ▶ Kestel has “Beach” as the first most common venue. If you like sun, sea and sand trinity you can try your chance at Kestel.
- ▶ Mustafa Kemal Pasa is the only borough which has “Turkish Coffe House”. Name of this borough comes from the founder of the Turkish Republic Mustafa Kemal Ataturk. According to the historical data Mustafa Kemal loves coffe too much and now we can see that the people is at the Mustafa Kemal Pasa loves coffee too.

# CONCLUSIONS

- ▶ Gursu and Orhaneli are for the nature tourism. If you love nature I suggest you to open a hotel at the mountains of these two boroughs.
- ▶ Buyukorhan has both “Scenic lookout” and “Forest”. So the visitors are coming to see these two beauties. You can choose two 2<sup>nd</sup> most common venue which is “Food Truck” to sell somethings to visitors of the nature.
- ▶ Orhangazi is the most social borough I think. The people in there go for “Breakfast Spot” first then they visit “Recreation Center” and go to the “Athletics & Sports” to burn their calories to live a healthy life. I think you can try your chance with a “Breakfast Spot” too.
- ▶ Now we know the answer of the question. Now you can prefer your venue and your investment tool according to your budget.