Capstone_Project_Report

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Project: Segmenting and Clustering Neighborhoods in Zürich, CH
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1 Introduction

This Report contains the capstone project of the IBM Data Science Professional Certificate offer through Coursera. This submission corresponds to the whole project solution from defining the problem or task that is to be solved by means of Foursquare location data and Machine Learning Algorithms. All the required tasks to accomplish the project goals are part of this final report.

Since the goal of the project is segmenting places in the city of Zürich, Switzerland, let's begin by exploring some interesting facts about the beautiful city of Zürich:

Zürich or Zurich (/zjrk/ ZEWR-ik) is the largest city in Switzerland and the capital of the canton of Zürich. It is located in north-central Switzerland at the northwestern tip of Lake Zürich. The municipality has approximately 409,000 inhabitants. Zürich is a hub for railways, roads, and air traffic. Both Zurich Airport and railway station are the largest and busiest in the country.

Zürich is a leading global city and among the world's largest financial centres despite having a relatively small population. The city is home to a large number of financial institutions and banking companies. Most of Switzerland's research and development centres are concentrated in Zürich and the low tax rates attract overseas companies to set up their headquarters there. Info taken from: Zürich

1.1 Problem Definition

The main goal of this project is to provide business intelligence for an international company that is willing to open a new restaurant supply shop in Zürich. The target market for this kind of business is limited to those within the culinary community. This includes: restaurants, culinary schools, cafeterias(including medical and schools), bars, caterers, bakeries and coffee shops. Therefore, it is of major importance clustering places around the city and find out which ones of those concentrate venues which belong to the target market. This information will help decision makers choosing the right place for opening shops, planning logistics, calculating costs and designing better marketing campaigns.

1.2 Project Details

Main tasks in this project are as follows: 1. Gathering data 2. Assessing and cleaning data 3. Creating Visualizations 4. Using the Foursquare API to gather venues information. 5. Clustering. 6. Results analysis and giving recommedations.

1.3 Data Source

The whole data for this project is gathered from the web and from Foursquare location data service using their API. The idea is to create a dataset containing the different neighborhoods in the city of Zürich according to their respective postal codes, then add the geographical coordinates and venues information and location in each neighborhood. The final resulting dataset is used for creating clusters with different venues and find out which clusters constitute important segments to direct marketing campaigns.

1. **Zurich - postal codes**

All the information regarding postal codes for the different neighborhoods in the city of Zürich will be gathered from the website geonames_postalcodes_CH performing web scraping with the help of BeatifulSoup and then converting the data into a pandas DataFrame for further analysis.

2. **Additional Data via the Foursquare API**

All the data related to venues will be gathered from Foursquare location data using their API. Foursquare

2 Data Wrangling

Data wrangling, which consists of the following tasks: 1. Gathering data 2. Assessing data 3. Cleaning data 4. Storing, analyzing, and visualizing the wrangled data

[1]:
```
import numpy as np # library to handle data in a vectorized manner

import pandas as pd # library for data analsysis
pd.set_option('display.max_columns', None)
pd.set_option('display.max_rows', None)

import json # library to handle JSON files

# uncomment this line if you haven't completed the Foursquare API lab
#!conda install -c conda-forge geopy --yes
from geopy.geocoders import Nominatim # convert an address into latitude and␣
 ↪longitude values

import requests # library to handle requests
```

```
from pandas.io.json import json_normalize # tranform JSON file into a pandas␣
 ↪dataframe

# Matplotlib and associated plotting modules
import matplotlib.cm as cm
import matplotlib.colors as colors
import matplotlib.pyplot as plt
import seaborn as sns
# import k-means from clustering stage
from sklearn.cluster import KMeans

# for webscraping import Beautiful Soup
from bs4 import BeautifulSoup

import xml
# uncomment this line if you haven't completed the Foursquare API lab
#!conda install -c conda-forge folium=0.5.0 --yes
import folium # map rendering library

import pickle

print('Libraries imported.')
```

```
Libraries imported.
```

2.1 Gathering Data

Scraping the web to obtain the postal codes data for the Neighborhoods in Zürich All the information regarding postal codes for the different neighborhoods in the city of Zürich will be gathered from the website geonames_postalcodes_CH performing web scraping with the help of BeatifulSoup and then converting the data into a pandas DataFrame for further analysis.

[2]:
```
#Zurich
#Web_pages containing the required data
link1='https://www.geonames.org/postal-codes/CH/ZH/zurich.html'
link2='http://www.all-about-switzerland.info/systematics-swiss-postal-zip-codes.
 ↪html'
url = requests.get(link1).text
soup = BeautifulSoup(url,'html.parser')
```

2.2 Transforming Data

Data gathered fom the web come in the form of **JSON** data, so additional efforts are required to convert the needed data into a pandas DataFrame to perform further analysis. **Transforming the data into a pandas dataframe** The dataframe will consist of six columns: `Postalcode`,`Kanton`,`Borough`,`Place`,`Latitute` and `Longitude`

[4]:
```
#Finding the right table and getting the data from the HTML script
My_table = soup.find('table',{'class':'restable'})
fields = My_table.find_all('td')
#Getting the data into a python list
data_fields=[]
for field in fields:
    data_fields.append(field.text.strip())
#Extracting the required data
place=[]
postcode = []
Kanton = []
Bezirk = []
GeoCoords= []
for i in range(0, len(data_fields), 9):#every field has 9 elements
    if i <=1791: #last row with complete data
        place.append(data_fields[i+1])
        postcode.append(data_fields[i+2])
        Kanton.append(data_fields[i+4])
        Bezirk.append(data_fields[i+5])
        GeoCoords.append(data_fields[i+8])
#Creating the DataFrame using the data gethered from the web
df_Zurich = pd.DataFrame(data=[postcode,Kanton,Bezirk,place,GeoCoords]).
 ↪transpose()
df_Zurich.columns = ['Postalcode', 'Kanton', 'Borough','Place','Location']
#Checking the resulted df
print(df_Zurich.shape)
df_Zurich.head()
```

```
(200, 5)
```

[4]:

	Postalcode	Kanton	Borough	Place	Location
0	8001	Kanton Zürich	Bezirk Zürich	Zürich	47.367/8.55
1	8002	Kanton Zürich	Bezirk Zürich	Zürich	47.367/8.55
2	8003	Kanton Zürich	Bezirk Zürich	Zürich	47.367/8.55
3	8004	Kanton Zürich	Bezirk Zürich	Zürich	47.367/8.55
4	8005	Kanton Zürich	Bezirk Zürich	Zürich	47.367/8.55

It is necessary to split the coordinates into Latitute and Longitude.

[6]:
```
df_Zurich['Latitude'] = df_Zurich['Location'].apply(lambda x:float(x.split("/
 ↪")[0]))
df_Zurich['Longitude'] = df_Zurich['Location'].apply(lambda x:float(x.split("/
 ↪")[1]))
#Location column is not needed anymore
df_Zurich.drop('Location',axis=1,inplace=True)
```

[7]:
```
#Checking the final resulting DataFrame
df_Zurich.head()
```

[7]:

	Postalcode	Kanton	Borough	Place	Latitude	Longitude
0	8001	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55
1	8002	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55
2	8003	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55
3	8004	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55
4	8005	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55

[8]:
```
# @hidden_cell
#Saving the dfgroup for later use
file_Name = "df_Zurich.pkl"

# open the file for writing
fileObject = open(file_Name,'wb')

# this writes the object df to the
# file named "dfgroup.pkl"
pickle.dump(df_Zurich,fileObject)

# closing the fileObject
fileObject.close()
```

[9]:
```
# @hidden_cell
#Opening the pickled df
zurich_data = pd.read_pickle("df_Zurich.pkl")
zurich_data.head() #continue using the pickled df
```

[9]:

	Postalcode	Kanton	Borough	Place	Latitude	Longitude
0	8001	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55
1	8002	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55
2	8003	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55
3	8004	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55
4	8005	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55

3 Methodology

In this project, I will apply unsupervised learning techniques to identify clusters of venues in the city of Zürich, Switzerland and then create city segments based on the venues belonging to each cluster. These segments can then be used by the investors to make better business decisions like for instance directing marketing campaigns towards audiences that will have the highest expected rate of returns. Since the main task consist in clustering, I will apply k-means clustering to the dataset and use the average within-cluster distances from each point to their assigned cluster's centroid to decide on a number of clusters to keep.

3.1 Data Analysis and Clustering

Before aplying machine learning algorithms it is necessary to gather the venues data using the Foursquare API, perform some exploratory data analysis and preprocess the

data and get it ready for KMeans clustering.

3.2 Creating some Visualizations

Creating a map of Zurich with neighborhoods superimposed on top.

[10]:
```
address = 'Zurich, Switzerland'

geolocator = Nominatim(user_agent="ny_explorer")
location = geolocator.geocode(address)
latitude = location.latitude
longitude = location.longitude
print('The geograpical coordinates of Zurich, Switzerland are {}, {}.'.
 ↪format(latitude, longitude))
```

```
The geograpical coordinates of Zurich, Switzerland are 47.3723941, 8.5423328.
```

[11]:
```
# create map of Zurich using latitude and longitude values
map_Zurich = folium.Map(location=[latitude, longitude], zoom_start=10)

# add markers to map
for lat, lng, borough, neighborhood in zip(zurich_data['Latitude'],␣
 ↪zurich_data['Longitude'], zurich_data['Borough'], zurich_data['Place']):
    label = '{}, {}'.format(neighborhood, borough)
    label = folium.Popup(label, parse_html=True)
    folium.CircleMarker(
        [lat, lng],
        radius=5,
        popup=label,
        color='blue',
        fill=True,
        fill_color='#3186cc',
        fill_opacity=0.7,
        parse_html=False).add_to(map_Zurich)

map_Zurich
```

[11]:
```
<folium.folium.Map at 0x26bd76da898>
```

3.3 Foursquare API

3.3.1 Using the Foursquare API to explore the neighborhoods and segment them.

Defining Foursquare Credentials and Version.

[1]:
```
# @hidden_cell
CLIENT_ID = 'Your Client_ID' # your Foursquare ID
CLIENT_SECRET = 'Your Client_SECRET' # your Foursquare Secret
VERSION = '20180604' # Foursquare API version
```

```
#LIMIT = 30
print('Your credentails:')
print('CLIENT_ID: ' + CLIENT_ID)
print('CLIENT_SECRET:' + CLIENT_SECRET)
```

```
Your credentails:
CLIENT_ID: Your Client_ID
CLIENT_SECRET:Your Client_SECRET
```

Exploring the first neighborhood in the dataframe.

[51]:
```
#zurich_data.loc[0, 'Place']
```

[14]:
```
neighborhood_latitude = zurich_data.loc[0, 'Latitude'] # neighborhood latitude␣
 ↪value
neighborhood_longitude = zurich_data.loc[0, 'Longitude'] # neighborhood␣
 ↪longitude value

neighborhood_name = zurich_data.loc[0, 'Place'] # neighborhood name

print('Latitude and longitude values of {} are {}, {}.'.
 ↪format(neighborhood_name,
                                                        ␣
 ↪neighborhood_latitude,
                                                        ␣
 ↪neighborhood_longitude))
```

```
Latitude and longitude values of Zürich are 47.367, 8.55.
```

Now, let's get the top 100 venues that are in Rouge, Malvern within a radius of 1000 meters.
First, let's create the GET request URL. Name your URL **url**.

[52]:
```
LIMIT = 100 # limit of number of venues returned by Foursquare API
radius = 1000 # define radius
# create URL
url = 'https://api.foursquare.com/v2/venues/explore?
 ↪&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
    CLIENT_ID,
    CLIENT_SECRET,
    VERSION,
    neighborhood_latitude,
    neighborhood_longitude,
    radius,
    LIMIT)
#url # display URL
```

[53]:
```
#Sending the GET request and examining the results
results = requests.get(url).json()
#results
```

[17]:
```
# function that extracts the category of the venue
def get_category_type(row):
    try:
        categories_list = row['categories']
    except:
        categories_list = row['venue.categories']

    if len(categories_list) == 0:
        return None
    else:
        return categories_list[0]['name']
```

[18]:
```
venues = results['response']['groups'][0]['items']

nearby_venues = json_normalize(venues) # flatten JSON

# filter columns
filtered_columns = ['venue.name', 'venue.categories', 'venue.location.lat',␣
 ↪'venue.location.lng']
nearby_venues =nearby_venues.loc[:, filtered_columns]

# filter the category for each row
nearby_venues['venue.categories'] = nearby_venues.apply(get_category_type,␣
 ↪axis=1)

# clean columns
nearby_venues.columns = [col.split(".")[-1] for col in nearby_venues.columns]

nearby_venues.head()
```

[18]:

	name	categories	lat	lng
0	John Baker Ltd	Bakery	47.367208	8.547293
1	ViCAFE - Barista Espresso Bar	Coffee Shop	47.366784	8.546093
2	Mövenpick Ice Cream Boutique	Ice Cream Shop	47.366129	8.546777
3	Tibits	Vegetarian / Vegan Restaurant	47.365086	8.547895
4	Arthouse Le Paris	Indie Movie Theater	47.366359	8.547593

[19]:
```
#Number of venues returned by Foursquare
print('{} venues were returned by Foursquare.'.format(nearby_venues.shape[0]))
```

```
100 venues were returned by Foursquare.
```

Using a function to repeat the same process to all the neighborhoods in Zurich

[57]:
```
def getNearbyVenues(names, latitudes, longitudes, radius=500):

    venues_list=[]
    for name, lat, lng in zip(names, latitudes, longitudes):
        print(name)

        # create the API request URL
        url = 'https://api.foursquare.com/v2/venues/explore?
↪&client_id={}&client_secret={}&v={}&ll={},{}&radius={}&limit={}'.format(
            CLIENT_ID,
            CLIENT_SECRET,
            VERSION,
            lat,
            lng,
            radius,
            LIMIT)

        # make the GET request
        results = requests.get(url).json()["response"]['groups'][0]['items']

        # return only relevant information for each nearby venue
        venues_list.append([(
            name,
            lat,
            lng,
            v['venue']['name'],
            v['venue']['location']['lat'],
            v['venue']['location']['lng'],
            v['venue']['categories'][0]['name']) for v in results])

    nearby_venues = pd.DataFrame([item for venue_list in venues_list for item␣
↪in venue_list])
    nearby_venues.columns = ['Neighborhood',
                  'Neighborhood Latitude',
                  'Neighborhood Longitude',
                  'Venue',
                  'Venue Latitude',
                  'Venue Longitude',
                  'Venue Category']

    return(nearby_venues)
```

Creating a new dataframe called *zurich_venues*.

[59]:
```
#zurich_venues = getNearbyVenues(names=zurich_data['Place'],
#                                 latitudes=zurich_data['Latitude'],
 #                                longitudes=zurich_data['Longitude']);
```

Let's check the size of the resulting dataframe

[54]:
```
#print(zurich_venues.shape)
#zurich_venues.head()
```

[60]:
```
#Let's check how many venues were returned for each neighborhood
#zurich_venues.groupby('Neighborhood').count()
```

Let's find out how many unique categories can be curated from all the returned venues

[24]:
```
print('There are {} uniques categories.'.format(len(zurich_venues['Venue␣
 ↪Category'].unique())))
```

```
There are 179 uniques categories.
```

3.4 Exploring Neighborhoods

[ ]:
```
# one hot encoding
zurich_onehot = pd.get_dummies(zurich_venues[['Venue Category']], prefix="",␣
 ↪prefix_sep="")

# add neighborhood column back to dataframe
zurich_onehot['Neighborhood'] = zurich_venues['Neighborhood']

# move neighborhood column to the first column
fixed_columns = [zurich_onehot.columns[-1]] + list(zurich_onehot.columns[:-1])
toronto_onehot = zurich_onehot[fixed_columns]

zurich_onehot.head()
```

[26]:
```
zurich_onehot.shape
```

[26]:
```
(2939, 180)
```

Next, let's group rows by neighborhood and by taking the mean of the frequency of occurrence of each category

[ ]:
```
zurich_grouped = zurich_onehot.groupby('Neighborhood').mean().reset_index()
#zurich_grouped.head()
```

[28]:
```
# Let's confirm the new size
zurich_grouped.shape
```

[28]:
```
(162, 180)
```

[29]:
```
#Checking missig data
zurich_grouped.isnull().any().any()
```

[29]:
```
False
```

Let's print each neighborhood along with the top 5 most common venues

[61]:
```
num_top_venues = 5

for hood in zurich_grouped['Neighborhood']:
```

```
    #print("----"+hood+"----")
    temp = zurich_grouped[zurich_grouped['Neighborhood'] == hood].T.
↪reset_index()
    temp.columns = ['venue','freq']
    temp = temp.iloc[1:]
    temp['freq'] = temp['freq'].astype(float)
    temp = temp.round({'freq': 2})
    #print(temp.sort_values('freq', ascending=False).reset_index(drop=True).
↪head(num_top_venues))
    #print('\n')
```

Let's put that into a *pandas* dataframe First, let's write a function to sort the venues in descending order.

[31]:
```
def return_most_common_venues(row, num_top_venues):
    row_categories = row.iloc[1:]
    row_categories_sorted = row_categories.sort_values(ascending=False)

    return row_categories_sorted.index.values[0:num_top_venues]
```

Now let's create the new dataframe and display the top 10 venues for each neighborhood.

[32]:
```
num_top_venues = 10

indicators = ['st', 'nd', 'rd']

# create columns according to number of top venues
columns = ['Neighborhood']
for ind in np.arange(num_top_venues):
    try:
        columns.append('{}{} Most Common Venue'.format(ind+1, indicators[ind]))
    except:
        columns.append('{}th Most Common Venue'.format(ind+1))

# create a new dataframe
neighborhoods_venues_sorted = pd.DataFrame(columns=columns)
neighborhoods_venues_sorted['Neighborhood'] = zurich_grouped['Neighborhood']

for ind in np.arange(zurich_grouped.shape[0]):
    neighborhoods_venues_sorted.iloc[ind, 1:] =␣
↪return_most_common_venues(zurich_grouped.iloc[ind, :], num_top_venues)

neighborhoods_venues_sorted.head()
```

[32]:

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	\
0	Adetswil	Italian Restaurant	Zoo Exhibit	
1	Adliswil	Supermarket	Light Rail Station	
2	Aeugst am Albis	Mountain	Zoo Exhibit	
3	Affoltern am Albis	Restaurant	Grocery Store	
4	Andelfingen	Home Service	Italian Restaurant	

```
  3rd Most Common Venue 4th Most Common Venue 5th Most Common Venue  \
0               Factory            Food Court     Food & Drink Shop
1          Snack Place  Fast Food Restaurant   Arts & Crafts Store
2    Falafel Restaurant            Food Court     Food & Drink Shop
3                Plaza    Italian Restaurant         Train Station
4           Restaurant         Train Station                   Gym

  6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
0                  Food           Flower Shop                 Field
1           Bus Station            Restaurant    Falafel Restaurant
2                  Food           Flower Shop                 Field
3      Tapas Restaurant     Electronics Store           Zoo Exhibit
4         Grocery Store           Zoo Exhibit         Event Service

  9th Most Common Venue 10th Most Common Venue
0  Fast Food Restaurant         Farmers Market
1               Factory            Flower Shop
2  Fast Food Restaurant         Farmers Market
3               Factory            Flower Shop
4           Flower Shop                  Field
```

3.5 Clustering

3.5.1 Cluster Neighborhoods

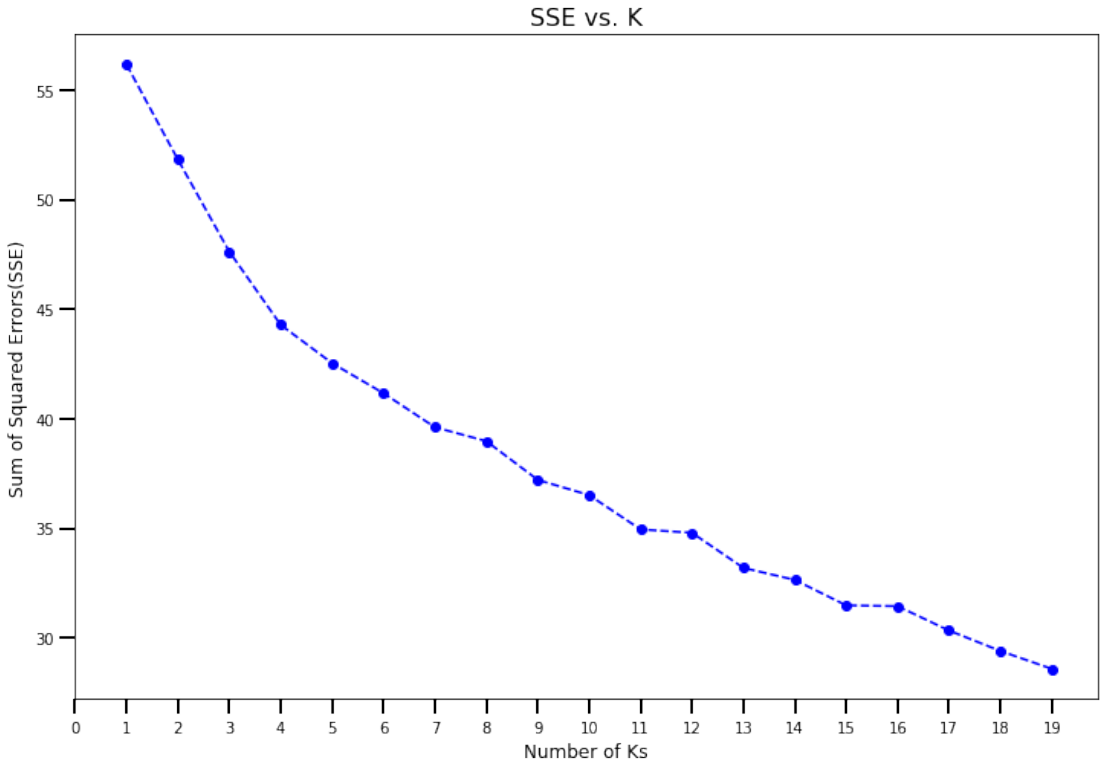
In this substep, I will apply k-means clustering to the pre-processed dataset and use the average within-cluster distances from each point to their assigned cluster's centroid to decide on a number of clusters to keep. To help choosing the right k for clustering, I use a function that gets the Sum Squared of Errors for each number of clusters and then plot the errors for different values o ks. The final k has to show a significant reduction in error and should not be too large in order to be used properly.

[33]:
```
#Creating the final dataset for KMeans
zurich_grouped_clustering = zurich_grouped.drop('Neighborhood', 1)
```

[34]:
```
# Creating a function that helps finding the right number of clusters
def kmeans_score(data, k):
    '''
    returns the kmeans score regarding SSE(Sum Square of Errors) for points to␣
 ↪centers
    INPUT:
        data - the dataset you want to fit kmeans to
        k - the number of centers you want (the k value)
    OUTPUT:
        score - the SSE score for the kmeans model fit to the data
    '''
    #instantiate kmeans
```

```
    kmeans = KMeans(init="k-means++", n_clusters= k, random_state=0)

    # Then fit the model to your data using the fit method
    model = kmeans.fit(data)

    # Obtain a score related to the model fit
    score = np.abs(model.score(data))

    return score
```

[35]:
```
scores = []
#testing for cluster counts through 20 clusters
ks=20
k_values = list(range(1,ks))

for k in k_values:
    scores.append(kmeans_score(zurich_grouped_clustering , k))

plt.figure(figsize=(12, 8))
ax = plt.subplot(111)
ax.plot(k_values, scores, linestyle='--', marker='o', color='b');
ax.xaxis.set_tick_params(width=2, length=10)
ax.yaxis.set_tick_params(width=2, length=10)
plt.xlabel('Number of Ks',fontsize=12)
plt.ylabel('Sum of Squared Errors(SSE)',fontsize=12)
plt.xticks(np.arange(0, ks, 1))
plt.title('SSE vs. K',fontsize=16)
plt.show()
```



3.6 Selecting k

Using the elbow method to determine the optimal number of clusters for k-means clustering, it can be noticed from the plot, that the errors (SSE) continue falling with increasing number of clusters. However, since the goal of clustering is to identify segments to be used for directing marketing campaigns towards audiences that will have the highest expeted rate of returns, creating a high number of clusters might not be so beneficial and doesn't make much sense if the marketing campaigns will only be directed to some specific clusters and the others might just be discarded, meaning that after some point each additional cluster provides even a smaller net benefit. Considering that, and based on the SSE vs. k curve besides the practical application of the created cluster, I would suggest a k = 9 to be a proper value that satisfies the two conditions of not being to large to make marketing results analysis and application too complex, and also showing a significant reduction in error (SSE).

[36]:
```
# set number of clusters
kclusters = 9
# run k-means clustering
kmeans = KMeans(n_clusters=kclusters, random_state=0).
 ↪fit(zurich_grouped_clustering)

# check cluster labels generated for each row in the dataframe
kmeans.labels_[0:10]
```

[36]:
```
array([5, 8, 7, 8, 8, 8, 1, 8, 2, 8])
```

Let's create a new dataframe that includes the cluster as well as the top 10 venues for each neighborhood.

[37]:
```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels', kmeans.labels_)

zurich_data.rename(index=str, columns={'Place':'Neighborhood'},inplace=True)

zurich_merged = zurich_data

# merge zurich_grouped with toronto_data to add latitude/longitude for each␣
 ↪neighborhood
zurich_merged = zurich_merged.join(neighborhoods_venues_sorted.
 ↪set_index('Neighborhood'), on='Neighborhood')

zurich_merged.head() # check the last columns!
```

[37]:

	Postalcode	Kanton	Borough	Neighborhood	Latitude	Longitude	\
0	8001	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55	
1	8002	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55	
2	8003	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55	
3	8004	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55	
4	8005	Kanton Zürich	Bezirk Zürich	Zürich	47.367	8.55	

	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	\
0	8.0	Hotel	Italian Restaurant	
1	8.0	Hotel	Italian Restaurant	
2	8.0	Hotel	Italian Restaurant	
3	8.0	Hotel	Italian Restaurant	
4	8.0	Hotel	Italian Restaurant	

	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	\
0	Café	Swiss Restaurant	Bar	
1	Café	Swiss Restaurant	Bar	
2	Café	Swiss Restaurant	Bar	
3	Café	Swiss Restaurant	Bar	
4	Café	Swiss Restaurant	Bar	

	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	\
0	Plaza	Coffee Shop	Lounge	
1	Plaza	Coffee Shop	Lounge	
2	Plaza	Coffee Shop	Lounge	
3	Plaza	Coffee Shop	Lounge	
4	Plaza	Coffee Shop	Lounge	

	9th Most Common Venue	10th Most Common Venue
0	Supermarket	Opera House

```
1           Supermarket             Opera House
2           Supermarket             Opera House
3           Supermarket             Opera House
4           Supermarket             Opera House
```

[62]:
```
#print(zurich_merged.shape)
#zurich_merged.dropna(inplace=True)
#zurich_merged.isnull().sum()
```

[63]:
```
#zurich_merged['Cluster Labels'] = zurich_merged['Cluster Labels'].
 ↪astype('int64')
#zurich_merged.info()
```

4 Results

Finally, let's visualize the resulting clusters

[40]:
```
# create map
map_clusters = folium.Map(location=[latitude, longitude], zoom_start=11)

# set color scheme for the clusters
x = np.arange(kclusters)
ys = [i + x + (i*x)**2 for i in range(kclusters)]
colors_array = cm.rainbow(np.linspace(0, 1, len(ys)))
rainbow = [colors.rgb2hex(i) for i in colors_array]

# add markers to the map
markers_colors = []
for lat, lon, poi, cluster in zip(zurich_merged['Latitude'],␣
 ↪zurich_merged['Longitude'], zurich_merged['Neighborhood'],␣
 ↪zurich_merged['Cluster Labels']):
    label = folium.Popup(str(poi) + ' Cluster ' + str(cluster), parse_html=True)
    folium.CircleMarker(
        [lat, lon],
        radius=5,
        popup=label,
        color=rainbow[cluster-1],
        fill=True,
        fill_color=rainbow[cluster-1],
        fill_opacity=0.7).add_to(map_clusters)
    #print(cluster+1,color)

map_clusters
```

[40]:
```
<folium.folium.Map at 0x26bd9ba61d0>
```

4.1 Examine Clusters

Now,we can examine each cluster and determine the discriminating venue categories that distinguish each cluster. Based on the defining categories, we can then select the most interesting clusters.

4.1.1 Cluster 1

[41]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 0, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[41]:

	Kanton	Longitude	Cluster Labels	1st Most Common Venue	\
40	Kanton Zürich	8.691	0	Gym	
50	Kanton Zürich	8.669	0	Hotel	
60	Kanton Zürich	8.391	0	Brewery	
61	Kanton Zürich	8.627	0	Sporting Goods Shop	
68	Kanton Zürich	8.576	0	Swiss Restaurant	
73	Kanton Zürich	8.502	0	Construction & Landscaping	
75	Kanton Zürich	8.554	0	Swiss Restaurant	
76	Kanton Zürich	8.502	0	Swiss Restaurant	
77	Kanton Zürich	8.521	0	Café	
81	Kanton Zürich	8.633	0	IT Services	
83	Kanton Zürich	8.649	0	Soccer Field	
91	Kanton Zürich	8.665	0	Convenience Store	
94	Kanton Zürich	8.594	0	Shopping Mall	
107	Kanton Zürich	8.689	0	Swiss Restaurant	
108	Kanton Zürich	8.681	0	Swiss Restaurant	
110	Kanton Zürich	8.742	0	Hotel	
111	Kanton Zürich	8.720	0	Motorcycle Shop	
112	Kanton Zürich	8.720	0	Swiss Restaurant	
119	Kanton Zürich	8.584	0	Hotel	
122	Kanton Zürich	8.679	0	Convenience Store	
134	Kanton Zürich	8.463	0	Swiss Restaurant	
137	Kanton Zürich	8.600	0	Yoga Studio	
139	Kanton Zürich	8.437	0	Supermarket	
147	Kanton Zürich	8.548	0	Supermarket	
148	Kanton Zürich	8.457	0	Café	
149	Kanton Zürich	8.487	0	Trail	
151	Kanton Zürich	8.499	0	Swiss Restaurant	
162	Kanton Zürich	8.704	0	Gas Station	
193	Kanton Zürich	8.443	0	Wine Shop	
195	Kanton Zürich	8.497	0	Café	
199	Kanton Zürich	8.527	0	Swiss Restaurant	

	2nd Most Common Venue	3rd Most Common Venue	\
40	Hotel	Swiss Restaurant	
50	Supermarket	Swiss Restaurant	
60	Swiss Restaurant	Bakery	

61	Swiss Restaurant	Factory	
68	Pool	Bus Station	
73	Swiss Restaurant	Italian Restaurant	
75	American Restaurant	Flower Shop	
76	Market	Convenience Store	
77	Dessert Shop	Bistro	
81	Snack Place	Shopping Mall	
83	Swiss Restaurant	Miscellaneous Shop	
91	Swiss Restaurant	Falafel Restaurant	
94	Food & Drink Shop	Swiss Restaurant	
107	Train Station	Trail	
108	Shopping Mall	Furniture / Home Store	
110	Zoo Exhibit	Factory	
111	Swiss Restaurant	Shopping Mall	
112	Italian Restaurant	Bus Station	
119	Swiss Restaurant	Bakery	
122	Supermarket	Swiss Restaurant	
134	Recycling Facility	Restaurant	
137	Plaza	Swiss Restaurant	
139	Swiss Restaurant	Food	
147	Swiss Restaurant	Flower Shop	
148	Swiss Restaurant	Beer Garden	
149	Swiss Restaurant	Outdoor Sculpture	
151	Flower Shop	Bus Station	
162	Swiss Restaurant	Rest Area	
193	Food & Drink Shop	Diner	
195	Swiss Restaurant	Factory	
199	Discount Store	Zoo Exhibit	

	4th Most Common Venue	5th Most Common Venue	\
40	Factory	Food & Drink Shop	
50	Restaurant	Food Court	
60	Grocery Store	Food Truck	
61	Food & Drink Shop	Food	
68	Zoo Exhibit	Factory	
73	Bakery	Falafel Restaurant	
75	Gastropub	Zoo Exhibit	
76	Gastropub	Bus Stop	
77	Swiss Restaurant	Beach	
81	Discount Store	Italian Restaurant	
83	Bakery	Zoo Exhibit	
91	Food Court	Food & Drink Shop	
94	Bus Station	Falafel Restaurant	
107	Gym	Zoo Exhibit	
108	Train Station	Palace	
110	Food & Drink Shop	Food	
111	Farmers Market	Zoo Exhibit	

```
112                 Event Service           Zoo Exhibit
119  Paper / Office Supplies Store         Grocery Store
122             Italian Restaurant           Zoo Exhibit
134                  Train Station     Electronics Store
137                     Restaurant           Zoo Exhibit
139             Miscellaneous Shop           Zoo Exhibit
147                         Bakery    Light Rail Station
148                         Bakery                  Farm
149                 Scenic Lookout                 Hotel
151                    Zoo Exhibit    Falafel Restaurant
162                          Café           Zoo Exhibit
193                   Pizza Place      Swiss Restaurant
195              Food & Drink Shop                  Food
199             Falafel Restaurant            Food Court

    6th Most Common Venue 7th Most Common Venue 8th Most Common Venue  \
40                   Food           Flower Shop                 Field
50                Factory                  Food           Flower Shop
60             Food Court     Food & Drink Shop                  Food
61             Flower Shop                 Field  Fast Food Restaurant
68                   Food           Flower Shop                 Field
73      Food & Drink Shop                  Food           Flower Shop
75     Falafel Restaurant     Food & Drink Shop                  Food
76             Zoo Exhibit                  Food           Flower Shop
77                   Farm            Food Court     Food & Drink Shop
81       Swiss Restaurant           Bus Station                Bakery
83                   Farm     Food & Drink Shop                  Food
91                   Food           Flower Shop                 Field
94                   Food           Flower Shop                 Field
107         Event Service                  Food           Flower Shop
108                   Gym           Zoo Exhibit                Factory
110           Flower Shop                 Field  Fast Food Restaurant
111            Food Truck     Food & Drink Shop                  Food
112   Falafel Restaurant     Food & Drink Shop                  Food
119                   Gym              Pharmacy         Train Station
122   Falafel Restaurant     Food & Drink Shop                  Food
134          Zoo Exhibit         Event Service           Flower Shop
137              Factory                  Food           Flower Shop
139            Food Truck     Food & Drink Shop           Flower Shop
147          Zoo Exhibit    Falafel Restaurant     Food & Drink Shop
148            Food Court     Food & Drink Shop                  Food
149   Light Rail Station              Mountain             Hotel Bar
151     Food & Drink Shop                  Food                  Field
162              Factory                  Food           Flower Shop
193               Bakery           Bus Station           Zoo Exhibit
195           Flower Shop                 Field  Fast Food Restaurant
199     Food & Drink Shop                  Food           Flower Shop
```

```
    9th Most Common Venue 10th Most Common Venue
40   Fast Food Restaurant         Farmers Market
50                  Field   Fast Food Restaurant
60            Flower Shop                  Field
61          Farmers Market                   Farm
68   Fast Food Restaurant         Farmers Market
73                  Field   Fast Food Restaurant
75                  Field   Fast Food Restaurant
76                  Field   Fast Food Restaurant
77                   Food           Flower Shop
81             Zoo Exhibit         Farmers Market
83            Flower Shop                  Field
91   Fast Food Restaurant         Farmers Market
94   Fast Food Restaurant         Farmers Market
107                 Field   Fast Food Restaurant
108                 Field   Fast Food Restaurant
110         Farmers Market                   Farm
111           Flower Shop                  Field
112           Flower Shop                  Field
119    Italian Restaurant           Supermarket
122           Flower Shop                  Field
134                 Field   Fast Food Restaurant
137                 Field   Fast Food Restaurant
139                 Field   Fast Food Restaurant
147                  Food                  Field
148           Flower Shop                  Field
149         Discount Store                   Farm
151  Fast Food Restaurant         Farmers Market
162                 Field   Fast Food Restaurant
193                  Farm                  Food
195         Farmers Market                   Farm
199                 Field   Fast Food Restaurant
```

4.1.2 Cluster 2

[42]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 1, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[42]:
```
            Kanton  Longitude  Cluster Labels 1st Most Common Venue  \
138  Kanton Zürich      8.436               1            Restaurant
165  Kanton Zürich      8.807               1            Restaurant
166  Kanton Zürich      8.775               1            Restaurant
171  Kanton Zürich      8.594               1            Restaurant
176  Kanton Zürich      8.654               1            Restaurant
177  Kanton Zürich      8.689               1      Swiss Restaurant
180  Kanton Zürich      8.728               1            Restaurant
```

```
187  Kanton Zürich      8.718              1            Restaurant
192  Kanton Zürich      8.667              1      Swiss Restaurant
194  Kanton Zürich      8.431              1                Tunnel

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
138      Swiss Restaurant          Zoo Exhibit         Event Service
165           Zoo Exhibit              Factory     Food & Drink Shop
166           Zoo Exhibit              Factory     Food & Drink Shop
171         Shopping Mall     Business Service           Zoo Exhibit
176           Zoo Exhibit              Factory     Food & Drink Shop
177            Restaurant          Zoo Exhibit         Event Service
180         Train Station          Zoo Exhibit         Event Service
187               Brewery          Bus Station           Zoo Exhibit
192            Restaurant          Zoo Exhibit         Event Service
194            Restaurant          Zoo Exhibit         Event Service

    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
138                  Food          Flower Shop                 Field
165                  Food          Flower Shop                 Field
166                  Food          Flower Shop                 Field
171               Factory                Food           Flower Shop
176                  Food          Flower Shop                 Field
177                  Food          Flower Shop                 Field
180                  Food          Flower Shop                 Field
187    Falafel Restaurant    Food & Drink Shop                  Food
192                  Food          Flower Shop                 Field
194                  Food          Flower Shop                 Field

    8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
138  Fast Food Restaurant        Farmers Market                    Farm
165  Fast Food Restaurant        Farmers Market                    Farm
166  Fast Food Restaurant        Farmers Market                    Farm
171                 Field  Fast Food Restaurant         Farmers Market
176  Fast Food Restaurant        Farmers Market                    Farm
177  Fast Food Restaurant        Farmers Market                    Farm
180  Fast Food Restaurant        Farmers Market                    Farm
187           Flower Shop                 Field   Fast Food Restaurant
192  Fast Food Restaurant        Farmers Market                    Farm
194  Fast Food Restaurant        Farmers Market                    Farm
```

4.1.3 Cluster 3

[43]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 2, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[43]:
```
            Kanton  Longitude  Cluster Labels 1st Most Common Venue  \
71   Kanton Zürich      8.452               2      Swiss Restaurant
```

```
152  Kanton Zürich      8.439                2      Swiss Restaurant
160  Kanton Zürich      8.508                2      Swiss Restaurant

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
71             Zoo Exhibit    Falafel Restaurant            Food Court
152            Zoo Exhibit    Falafel Restaurant            Food Court
160            Zoo Exhibit    Falafel Restaurant            Food Court

    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
71      Food & Drink Shop                  Food           Flower Shop
152     Food & Drink Shop                  Food           Flower Shop
160     Food & Drink Shop                  Food           Flower Shop

    8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
71                  Field  Fast Food Restaurant         Farmers Market
152                 Field  Fast Food Restaurant         Farmers Market
160                 Field  Fast Food Restaurant         Farmers Market
```

4.1.4 Cluster 4

[44]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 3, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[44]:
```
             Kanton  Longitude  Cluster Labels       1st Most Common Venue  \
24   Kanton Zürich      8.530                3                Pizza Place
31   Kanton Zürich      8.751                3          Convenience Store
39   Kanton Zürich      8.657                3              Train Station
48   Kanton Zürich      8.697                3                 Print Shop
72   Kanton Zürich      8.377                3               Soccer Field
78   Kanton Zürich      8.543                3                Flower Shop
79   Kanton Zürich      8.644                3                      River
80   Kanton Zürich      8.630                3             Cosmetics Shop
82   Kanton Zürich      8.721                3              Grocery Store
88   Kanton Zürich      8.856                3                       Café
89   Kanton Zürich      8.865                3                 Print Shop
93   Kanton Zürich      8.642                3                       Café
97   Kanton Zürich      8.618                3                       Café
101  Kanton Zürich      8.732                3              Grocery Store
103  Kanton Zürich      8.846                3  Construction & Landscaping
104  Kanton Zürich      8.845                3  Construction & Landscaping
120  Kanton Zürich      8.574                3              Grocery Store
124  Kanton Zürich      8.545                3                Supermarket
127  Kanton Zürich      8.682                3          Food & Drink Shop
130  Kanton Zürich      8.448                3  Construction & Landscaping
153  Kanton Zürich      8.418                3                     Brewery
154  Kanton Zürich      8.407                3              Train Station
172  Kanton Zürich      8.682                3               Home Service
```

```
175  Kanton Zürich      8.648                3                Concert Hall
182  Kanton Zürich      8.822                3                  Playground
183  Kanton Zürich      8.853                3                Cheese Shop

    2nd Most Common Venue   3rd Most Common Venue   4th Most Common Venue  \
24       Airport Terminal       Convenience Store        Swiss Restaurant
31      Food & Drink Shop             Art Gallery           Train Station
39                  Café      Italian Restaurant             Zoo Exhibit
48          Grocery Store               Bus Stop           Train Station
72       Swiss Restaurant           Train Station                   Café
78     Miscellaneous Shop              Restaurant           Train Station
79         Hardware Store           Train Station                    Pier
80          Train Station       Food & Drink Shop              Food Truck
82             Playground             Pizza Place        Swiss Restaurant
88                Theater                 Factory       Food & Drink Shop
89      Convenience Store  Furniture / Home Store           Train Station
93              Gastropub           Train Station                 Factory
97          Grocery Store                   Beach      Miscellaneous Shop
101     Convenience Store      Italian Restaurant           Train Station
103         Train Station       Electronics Store                   Hotel
104         Train Station                   Café  Thrift / Vintage Store
120           Yoga Studio       Convenience Store                   Field
124             Gastropub           Train Station                   Café
127              Bus Stop           Train Station             Zoo Exhibit
130                Bakery           Train Station      Falafel Restaurant
153      Swiss Restaurant           Train Station             Zoo Exhibit
154           Zoo Exhibit                 Factory              Food Court
172         Train Station          Hardware Store             Zoo Exhibit
175         Train Station                Bus Stop             Zoo Exhibit
182         Train Station             Zoo Exhibit                 Factory
183         Event Service              Restaurant           Train Station

    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
24          Train Station          Zoo Exhibit               Factory
31                Bakery    Falafel Restaurant            Food Court
39     Food & Drink Shop                  Food           Flower Shop
48            Cheese Shop                  Food           Flower Shop
72             Zoo Exhibit               Factory                  Food
78             Zoo Exhibit               Factory     Food & Drink Shop
79             Zoo Exhibit         Event Service                  Food
80            Dessert Shop                  Farm            Food Court
82          Train Station                 Café         Event Service
88                   Food           Flower Shop                 Field
89                Factory                  Food           Flower Shop
93     Food & Drink Shop                  Food           Flower Shop
97          Train Station     Food & Drink Shop                  Food
101           Zoo Exhibit               Factory                  Food
```

103	Deli / Bodega	Falafel Restaurant	Food & Drink Shop
104	Department Store	Dessert Shop	Food
120	Swiss Restaurant	Beach	Train Station
124	Zoo Exhibit	Factory	Food
127	Factory	Food	Flower Shop
130	Food Court	Food & Drink Shop	Food
153	Falafel Restaurant	Food & Drink Shop	Food
154	Food & Drink Shop	Food	Flower Shop
172	Factory	Food & Drink Shop	Food
175	Falafel Restaurant	Food & Drink Shop	Food
182	Food & Drink Shop	Food	Flower Shop
183	Food	Flower Shop	Field

	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
24	Food	Flower Shop	Field
31	Food	Flower Shop	Field
39	Field	Fast Food Restaurant	Farmers Market
48	Field	Fast Food Restaurant	Farmers Market
72	Flower Shop	Field	Fast Food Restaurant
78	Food	Field	Fast Food Restaurant
79	Flower Shop	Field	Fast Food Restaurant
80	Deli / Bodega	Food	Flower Shop
82	Flower Shop	Field	Fast Food Restaurant
88	Fast Food Restaurant	Farmers Market	Farm
89	Field	Fast Food Restaurant	Farmers Market
93	Field	Fast Food Restaurant	Farmers Market
97	Flower Shop	Field	Fast Food Restaurant
101	Flower Shop	Field	Fast Food Restaurant
103	Food	Flower Shop	Field
104	Flower Shop	Field	Fast Food Restaurant
120	Zoo Exhibit	Food	Flower Shop
124	Flower Shop	Field	Fast Food Restaurant
127	Field	Fast Food Restaurant	Farmers Market
130	Flower Shop	Field	Fast Food Restaurant
153	Flower Shop	Field	Fast Food Restaurant
154	Field	Fast Food Restaurant	Farmers Market
172	Flower Shop	Field	Fast Food Restaurant
175	Flower Shop	Field	Fast Food Restaurant
182	Field	Fast Food Restaurant	Farmers Market
183	Fast Food Restaurant	Farmers Market	Farm

4.1.5 Cluster 5

[45]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 4, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[45]:
```
            Kanton  Longitude  Cluster Labels 1st Most Common Venue  \
135  Kanton Zürich      8.427               4           Bus Station
143  Kanton Zürich      8.637               4           Bus Station
158  Kanton Zürich      8.433               4           Bus Station
161  Kanton Zürich      8.635               4           Bus Station
190  Kanton Zürich      8.783               4           Bus Station
197  Kanton Zürich      8.533               4           Bus Station

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
135          Zoo Exhibit           Food Truck     Food & Drink Shop
143        Grocery Store          Zoo Exhibit    Falafel Restaurant
158          Zoo Exhibit           Food Truck     Food & Drink Shop
161          Zoo Exhibit           Food Truck     Food & Drink Shop
190          Zoo Exhibit           Food Truck     Food & Drink Shop
197        Grocery Store          Zoo Exhibit    Falafel Restaurant

    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
135                  Food          Flower Shop                 Field
143    Food & Drink Shop                 Food           Flower Shop
158                  Food          Flower Shop                 Field
161                  Food          Flower Shop                 Field
190                  Food          Flower Shop                 Field
197    Food & Drink Shop                 Food           Flower Shop

    8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
135  Fast Food Restaurant        Farmers Market                   Farm
143                 Field  Fast Food Restaurant         Farmers Market
158  Fast Food Restaurant        Farmers Market                   Farm
161  Fast Food Restaurant        Farmers Market                   Farm
190  Fast Food Restaurant        Farmers Market                   Farm
197                 Field  Fast Food Restaurant         Farmers Market
```

4.1.6 Cluster 6

[46]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 5, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[46]:
```
            Kanton  Longitude  Cluster Labels 1st Most Common Venue  \
63   Kanton Zürich      8.668               5    Italian Restaurant
150  Kanton Zürich      8.490               5    Italian Restaurant
168  Kanton Zürich      8.840               5    Italian Restaurant

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
63             Restaurant          Zoo Exhibit                Factory
150          Zoo Exhibit              Factory           Food Court
168          Zoo Exhibit              Factory           Food Court
```

```
    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
63      Food & Drink Shop                  Food           Flower Shop
150     Food & Drink Shop                  Food           Flower Shop
168     Food & Drink Shop                  Food           Flower Shop

    8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
63                  Field  Fast Food Restaurant         Farmers Market
150                 Field  Fast Food Restaurant         Farmers Market
168                 Field  Fast Food Restaurant         Farmers Market
```

4.1.7 Cluster 7

[47]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 6, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[47]:
```
            Kanton  Longitude  Cluster Labels 1st Most Common Venue  \
115  Kanton Zürich      8.856               6  Gym / Fitness Center
167  Kanton Zürich      8.865               6  Gym / Fitness Center

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
115        Hardware Store     Convenience Store      Department Store
167            Food Truck     Food & Drink Shop                  Food

    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
115          Dessert Shop     Food & Drink Shop                  Food
167           Flower Shop                 Field  Fast Food Restaurant

    8th Most Common Venue 9th Most Common Venue 10th Most Common Venue
115           Flower Shop                 Field   Fast Food Restaurant
167        Farmers Market                  Farm     Falafel Restaurant
```

4.1.8 Cluster 8

[48]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 7, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[48]:
```
            Kanton  Longitude  Cluster Labels 1st Most Common Venue  \
114  Kanton Zürich       8.75               7              Mountain
196  Kanton Zürich       8.49               7              Mountain

    2nd Most Common Venue 3rd Most Common Venue 4th Most Common Venue  \
114         Garden Center           Zoo Exhibit    Falafel Restaurant
196           Zoo Exhibit    Falafel Restaurant            Food Court

    5th Most Common Venue 6th Most Common Venue 7th Most Common Venue  \
114     Food & Drink Shop                  Food           Flower Shop
196     Food & Drink Shop                  Food           Flower Shop
```

	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
114	Field	Fast Food Restaurant	Farmers Market
196	Field	Fast Food Restaurant	Farmers Market

4.1.9 Cluster 9

[49]:
```
zurich_merged.loc[zurich_merged['Cluster Labels'] == 8, zurich_merged.
↪columns[[1] + list(range(5, zurich_merged.shape[1]))]]
```

[49]:

	Kanton	Longitude	Cluster Labels	1st Most Common Venue	\
0	Kanton Zürich	8.550	8	Hotel	
1	Kanton Zürich	8.550	8	Hotel	
2	Kanton Zürich	8.550	8	Hotel	
3	Kanton Zürich	8.550	8	Hotel	
4	Kanton Zürich	8.550	8	Hotel	
5	Kanton Zürich	8.550	8	Hotel	
6	Kanton Zürich	8.550	8	Hotel	
7	Kanton Zürich	8.550	8	Hotel	
8	Kanton Zürich	8.550	8	Hotel	
9	Kanton Zürich	8.550	8	Hotel	
10	Kanton Zürich	8.550	8	Hotel	
11	Kanton Zürich	8.550	8	Hotel	
12	Kanton Zürich	8.550	8	Hotel	
13	Kanton Zürich	8.550	8	Hotel	
14	Kanton Zürich	8.550	8	Hotel	
15	Kanton Zürich	8.550	8	Hotel	
16	Kanton Zürich	8.550	8	Hotel	
17	Kanton Zürich	8.550	8	Hotel	
18	Kanton Zürich	8.550	8	Hotel	
19	Kanton Zürich	8.550	8	Hotel	
20	Kanton Zürich	8.550	8	Hotel	
21	Kanton Zürich	8.469	8	Sporting Goods Shop	
22	Kanton Zürich	8.525	8	Supermarket	
23	Kanton Zürich	8.563	8	Italian Restaurant	
25	Kanton Zürich	8.540	8	Italian Restaurant	
26	Kanton Zürich	8.585	8	Hotel	
27	Kanton Zürich	8.629	8	Shopping Mall	
28	Kanton Zürich	8.597	8	Platform	
29	Kanton Zürich	8.619	8	Bus Station	
30	Kanton Zürich	8.691	8	Supermarket	
32	Kanton Zürich	8.844	8	Farm	
33	Kanton Zürich	8.724	8	Hotel	
34	Kanton Zürich	8.724	8	Hotel	
35	Kanton Zürich	8.724	8	Hotel	
36	Kanton Zürich	8.724	8	Hotel	
37	Kanton Zürich	8.724	8	Hotel	

38	Kanton Zürich	8.619	8	Convenience Store
41	Kanton Zürich	8.721	8	Italian Restaurant
42	Kanton Zürich	8.772	8	Supermarket
43	Kanton Zürich	8.646	8	Soccer Field
44	Kanton Zürich	8.699	8	Boat or Ferry
45	Kanton Zürich	8.723	8	Supermarket
46	Kanton Zürich	8.564	8	Hotel
47	Kanton Zürich	8.551	8	Convenience Store
49	Kanton Zürich	8.598	8	Hotel
51	Kanton Zürich	8.426	8	Grocery Store
52	Kanton Zürich	8.448	8	Italian Restaurant
53	Kanton Zürich	8.400	8	Supermarket
54	Kanton Zürich	8.550	8	Hotel
55	Kanton Zürich	8.550	8	Hotel
56	Kanton Zürich	8.550	8	Hotel
57	Kanton Zürich	8.448	8	Chinese Restaurant
59	Kanton Zürich	8.440	8	Home Service
62	Kanton Zürich	8.640	8	Supermarket
64	Kanton Zürich	8.601	8	Convenience Store
65	Kanton Zürich	8.623	8	Salon / Barbershop
66	Kanton Zürich	8.643	8	Light Rail Station
67	Kanton Zürich	8.541	8	Convenience Store
69	Kanton Zürich	8.486	8	Supermarket
70	Kanton Zürich	8.459	8	Hotel
74	Kanton Zürich	8.546	8	Gym
84	Kanton Zürich	8.674	8	Food
85	Kanton Zürich	8.673	8	Auto Dealership
86	Kanton Zürich	8.792	8	Track
90	Kanton Zürich	8.724	8	Hotel
92	Kanton Zürich	8.606	8	Wine Bar
95	Kanton Zürich	8.576	8	Italian Restaurant
98	Kanton Zürich	8.678	8	Home Service
99	Kanton Zürich	8.653	8	Hobby Shop
100	Kanton Zürich	8.603	8	Bar
102	Kanton Zürich	8.768	8	IT Services
105	Kanton Zürich	8.879	8	Advertising Agency
106	Kanton Zürich	8.790	8	Convenience Store
109	Kanton Zürich	8.818	8	Construction & Landscaping
113	Kanton Zürich	8.758	8	Supermarket
116	Kanton Zürich	8.850	8	Health Food Store
117	Kanton Zürich	8.842	8	Recreation Center
118	Kanton Zürich	8.914	8	Supermarket
121	Kanton Zürich	8.615	8	Construction & Landscaping
123	Kanton Zürich	8.757	8	Movie Theater
125	Kanton Zürich	8.644	8	Grocery Store
126	Kanton Zürich	8.600	8	Factory
128	Kanton Zürich	8.468	8	Office

131	Kanton Zürich	8.451	8	Restaurant
132	Kanton Zürich	8.422	8	Convenience Store
133	Kanton Zürich	8.404	8	Pub
136	Kanton Zürich	8.411	8	Hotel
140	Kanton Zürich	8.406	8	Art Gallery
141	Kanton Zürich	8.639	8	Café
144	Kanton Zürich	8.683	8	Italian Restaurant
145	Kanton Zürich	8.683	8	Italian Restaurant
146	Kanton Zürich	8.710	8	Real Estate Office
155	Kanton Zürich	8.471	8	Italian Restaurant
157	Kanton Zürich	8.516	8	Convenience Store
163	Kanton Zürich	8.676	8	Bus Stop
164	Kanton Zürich	8.792	8	Home Service
169	Kanton Zürich	8.633	8	Construction & Landscaping
170	Kanton Zürich	8.618	8	Farmers Market
173	Kanton Zürich	8.684	8	Convenience Store
174	Kanton Zürich	8.670	8	Racetrack
181	Kanton Zürich	8.783	8	Construction & Landscaping
184	Kanton Zürich	8.903	8	Music Venue
185	Kanton Zürich	8.921	8	Comfort Food Restaurant
186	Kanton Zürich	8.823	8	Mediterranean Restaurant
188	Kanton Zürich	8.713	8	Construction & Landscaping
189	Kanton Zürich	8.798	8	Supermarket
191	Kanton Zürich	8.929	8	Bakery

	2nd Most Common Venue	3rd Most Common Venue	\
0	Italian Restaurant	Café	
1	Italian Restaurant	Café	
2	Italian Restaurant	Café	
3	Italian Restaurant	Café	
4	Italian Restaurant	Café	
5	Italian Restaurant	Café	
6	Italian Restaurant	Café	
7	Italian Restaurant	Café	
8	Italian Restaurant	Café	
9	Italian Restaurant	Café	
10	Italian Restaurant	Café	
11	Italian Restaurant	Café	
12	Italian Restaurant	Café	
13	Italian Restaurant	Café	
14	Italian Restaurant	Café	
15	Italian Restaurant	Café	
16	Italian Restaurant	Café	
17	Italian Restaurant	Café	
18	Italian Restaurant	Café	
19	Italian Restaurant	Café	
20	Italian Restaurant	Café	

21	Restaurant	Supermarket
22	Light Rail Station	Snack Place
23	Chinese Restaurant	Hotel
25	Bakery	Pub
26	Italian Restaurant	Swiss Restaurant
27	Pizza Place	Art Gallery
28	Supermarket	Food & Drink Shop
29	Train Station	Men's Store
30	Platform	Department Store
32	Shipping Store	Zoo Exhibit
33	Italian Restaurant	Bistro
34	Italian Restaurant	Bistro
35	Italian Restaurant	Bistro
36	Italian Restaurant	Bistro
37	Italian Restaurant	Bistro
38	Supermarket	Plaza
41	Irish Pub	Gym
42	Frame Store	Playground
43	Pool	Grocery Store
44	Pool	Food & Drink Shop
45	Bus Station	Train Station
46	Train Station	Board Shop
47	Hotel	Italian Restaurant
49	Grocery Store	Ice Cream Shop
51	Zoo Exhibit	Italian Restaurant
52	Bus Stop	Supermarket
53	Hookah Bar	Swiss Restaurant
54	Italian Restaurant	Café
55	Italian Restaurant	Café
56	Italian Restaurant	Café
57	Hobby Shop	River
59	Shopping Mall	Pizza Place
62	Bus Station	Greek Restaurant
64	Light Rail Station	Thai Restaurant
65	Hotel	Convenience Store
66	Italian Restaurant	Train Station
67	Train Station	Flower Shop
69	Pizza Place	Italian Restaurant
70	Train Station	Paper / Office Supplies Store
74	Supermarket	Department Store
84	Mediterranean Restaurant	Zoo Exhibit
85	Shopping Mall	Automotive Shop
86	Bus Stop	Notary
90	Italian Restaurant	Bistro
92	Deli / Bodega	Restaurant
95	Furniture / Home Store	Comfort Food Restaurant
98	Italian Restaurant	Restaurant

99	Zoo Exhibit	Factory
100	Zoo Exhibit	Falafel Restaurant
102	Supermarket	Golf Course
105	Food & Drink Shop	Food
106	Plaza	Restaurant
109	Bridal Shop	Café
113	Bus Station	Bar
116	Shoe Store	Thai Restaurant
117	Pizza Place	Zoo Exhibit
118	Restaurant	Gas Station
121	Yoga Studio	Soccer Field
123	Food	Burger Joint
125	Wine Shop	Pub
126	Stables	Playground
128	Home Service	Plaza
131	Grocery Store	Plaza
132	Pool	Bakery
133	Auto Workshop	Falafel Restaurant
136	Café	Supermarket
140	Grocery Store	Zoo Exhibit
141	Food Truck	Supermarket
144	Farmers Market	Light Rail Station
145	Farmers Market	Light Rail Station
146	Health & Beauty Service	Event Service
155	Pizza Place	Bakery
157	Zoo Exhibit	Food Court
163	Italian Restaurant	Tennis Court
164	Zoo Exhibit	Factory
169	Convenience Store	Food Court
170	Business Service	Zoo Exhibit
173	Bakery	Trail
174	Food Truck	Food & Drink Shop
181	Motorcycle Shop	Falafel Restaurant
184	Mountain	Gastropub
185	Zoo Exhibit	Factory
186	Zoo Exhibit	Falafel Restaurant
188	Gas Station	History Museum
189	Irish Pub	Italian Restaurant
191	Bus Stop	Zoo Exhibit

	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	\
0	Swiss Restaurant	Bar	Plaza	
1	Swiss Restaurant	Bar	Plaza	
2	Swiss Restaurant	Bar	Plaza	
3	Swiss Restaurant	Bar	Plaza	
4	Swiss Restaurant	Bar	Plaza	
5	Swiss Restaurant	Bar	Plaza	

6	Swiss Restaurant	Bar	Plaza
7	Swiss Restaurant	Bar	Plaza
8	Swiss Restaurant	Bar	Plaza
9	Swiss Restaurant	Bar	Plaza
10	Swiss Restaurant	Bar	Plaza
11	Swiss Restaurant	Bar	Plaza
12	Swiss Restaurant	Bar	Plaza
13	Swiss Restaurant	Bar	Plaza
14	Swiss Restaurant	Bar	Plaza
15	Swiss Restaurant	Bar	Plaza
16	Swiss Restaurant	Bar	Plaza
17	Swiss Restaurant	Bar	Plaza
18	Swiss Restaurant	Bar	Plaza
19	Swiss Restaurant	Bar	Plaza
20	Swiss Restaurant	Bar	Plaza
21	Gym / Fitness Center	Pizza Place	Shopping Mall
22	Fast Food Restaurant	Arts & Crafts Store	Bus Station
23	Supermarket	Thai Restaurant	Train Station
25	Lounge	Shopping Mall	Grocery Store
26	Pizza Place	Asian Restaurant	Bus Station
27	Convenience Store	Steakhouse	Supermarket
28	Shopping Mall	Wine Bar	Pool
29	Café	Food & Drink Shop	Grocery Store
30	Shopping Mall	Restaurant	Train Station
32	Food Truck	Food & Drink Shop	Food
33	Bar	Pizza Place	Gym / Fitness Center
34	Bar	Pizza Place	Gym / Fitness Center
35	Bar	Pizza Place	Gym / Fitness Center
36	Bar	Pizza Place	Gym / Fitness Center
37	Bar	Pizza Place	Gym / Fitness Center
38	Gym	Cable Car	Swiss Restaurant
41	Fast Food Restaurant	Japanese Restaurant	Train Station
42	Bus Station	Zoo Exhibit	Falafel Restaurant
43	Miscellaneous Shop	Train Station	Bakery
44	Tailor Shop	Bus Stop	Falafel Restaurant
45	Cheese Shop	Zoo Exhibit	Factory
46	Mexican Restaurant	Bus Station	Swiss Restaurant
47	Bus Station	Train Station	Athletics & Sports
49	Train Station	Fast Food Restaurant	Supermarket
51	Bus Stop	Swiss Restaurant	Kebab Restaurant
52	Hotel	Train Station	Pizza Place
53	Drugstore	Park	Bus Stop
54	Swiss Restaurant	Bar	Plaza
55	Swiss Restaurant	Bar	Plaza
56	Swiss Restaurant	Bar	Plaza
57	Bus Stop	Factory	Food
59	Pilates Studio	Thai Restaurant	Event Service

62	Grocery Store	Zoo Exhibit	Food Court
64	Supermarket	Miscellaneous Shop	Italian Restaurant
65	Italian Restaurant	Swiss Restaurant	Gym / Fitness Center
66	Scenic Lookout	Event Service	Food
67	Supermarket	Swiss Restaurant	Gas Station
69	Train Station	Bakery	Outdoors & Recreation
70	Flower Shop	Shopping Mall	Bakery
74	Shopping Mall	Trattoria/Osteria	Hardware Store
84	Falafel Restaurant	Food Court	Food & Drink Shop
85	Gym	Food Truck	Food & Drink Shop
86	Department Store	Dessert Shop	Food & Drink Shop
90	Bar	Pizza Place	Gym / Fitness Center
92	Zoo Exhibit	Event Service	Food
95	Supermarket	Bistro	Swiss Restaurant
98	Train Station	Gym	Grocery Store
99	Food & Drink Shop	Food	Flower Shop
100	Food Court	Food & Drink Shop	Food
102	Food Truck	Food & Drink Shop	Food
105	Shop & Service	Food Truck	Flower Shop
106	Bakery	Factory	Food & Drink Shop
109	Dessert Shop	Farm	Food & Drink Shop
113	Bakery	Zoo Exhibit	Farmers Market
116	Pharmacy	Zoo Exhibit	Factory
117	Event Service	Food	Flower Shop
118	Bakery	Zoo Exhibit	Falafel Restaurant
121	Restaurant	Event Service	Food
123	History Museum	Train Station	Seafood Restaurant
125	Eastern European Restaurant	Liquor Store	Zoo Exhibit
126	Food & Drink Shop	Food	Flower Shop
128	Bakery	Zoo Exhibit	Falafel Restaurant
131	Italian Restaurant	Train Station	Tapas Restaurant
132	Laser Tag	Falafel Restaurant	Food & Drink Shop
133	Food Court	Food & Drink Shop	Food
136	Italian Restaurant	Athletics & Sports	Bus Stop
140	Factory	Food & Drink Shop	Food
141	Discount Store	Kebab Restaurant	Bus Station
144	Science Museum	Zoo Exhibit	Factory
145	Science Museum	Zoo Exhibit	Factory
146	Food & Drink Shop	Food	Flower Shop
155	Photography Studio	Zoo Exhibit	Falafel Restaurant
157	Food & Drink Shop	Food	Flower Shop
163	Zoo Exhibit	Falafel Restaurant	Food & Drink Shop
164	Food & Drink Shop	Food	Flower Shop
169	Food & Drink Shop	Food	Flower Shop
170	Food Truck	Food & Drink Shop	Food
173	Grocery Store	Zoo Exhibit	Falafel Restaurant
174	Food	Flower Shop	Field

181	Food Court	Food & Drink Shop	Food	
184	Falafel Restaurant	Food & Drink Shop	Food	
185	Food & Drink Shop	Food	Flower Shop	
186	Food Court	Food & Drink Shop	Food	
188	Clothing Store	Factory	Food	
189	Restaurant	Gym / Fitness Center	Grocery Store	
191	Farm	Food Court	Food & Drink Shop	

	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	\
0	Coffee Shop	Lounge	Supermarket	
1	Coffee Shop	Lounge	Supermarket	
2	Coffee Shop	Lounge	Supermarket	
3	Coffee Shop	Lounge	Supermarket	
4	Coffee Shop	Lounge	Supermarket	
5	Coffee Shop	Lounge	Supermarket	
6	Coffee Shop	Lounge	Supermarket	
7	Coffee Shop	Lounge	Supermarket	
8	Coffee Shop	Lounge	Supermarket	
9	Coffee Shop	Lounge	Supermarket	
10	Coffee Shop	Lounge	Supermarket	
11	Coffee Shop	Lounge	Supermarket	
12	Coffee Shop	Lounge	Supermarket	
13	Coffee Shop	Lounge	Supermarket	
14	Coffee Shop	Lounge	Supermarket	
15	Coffee Shop	Lounge	Supermarket	
16	Coffee Shop	Lounge	Supermarket	
17	Coffee Shop	Lounge	Supermarket	
18	Coffee Shop	Lounge	Supermarket	
19	Coffee Shop	Lounge	Supermarket	
20	Coffee Shop	Lounge	Supermarket	
21	Bookstore	Gas Station	Thai Restaurant	
22	Restaurant	Falafel Restaurant	Factory	
23	Japanese Restaurant	Gas Station	Kebab Restaurant	
25	Gym / Fitness Center	Train Station	Mobile Phone Shop	
26	Steakhouse	Supermarket	Bakery	
27	Italian Restaurant	Swiss Restaurant	Lake	
28	Train Station	Italian Restaurant	Bakery	
29	Gas Station	Electronics Store	Bakery	
30	Zoo Exhibit	Factory	Flower Shop	
32	Flower Shop	Field	Fast Food Restaurant	
33	Indian Restaurant	Discount Store	Farmers Market	
34	Indian Restaurant	Discount Store	Farmers Market	
35	Indian Restaurant	Discount Store	Farmers Market	
36	Indian Restaurant	Discount Store	Farmers Market	
37	Indian Restaurant	Discount Store	Farmers Market	
38	Chinese Restaurant	Bar	Bakery	
41	Snack Place	Coffee Shop	Argentinian Restaurant	

42	Food	Flower Shop	Field
43	Asian Restaurant	Pizza Place	Convenience Store
44	Food	Flower Shop	Field
45	Food	Flower Shop	Field
46	Falafel Restaurant	Restaurant	Grocery Store
47	Swiss Restaurant	Restaurant	Grocery Store
49	Café	Restaurant	Asian Restaurant
51	Post Office	Health & Beauty Service	Event Service
52	Restaurant	Tennis Stadium	Austrian Restaurant
53	Burrito Place	Movie Theater	Sushi Restaurant
54	Coffee Shop	Lounge	Supermarket
55	Coffee Shop	Lounge	Supermarket
56	Coffee Shop	Lounge	Supermarket
57	Flower Shop	Field	Fast Food Restaurant
59	Zoo Exhibit	Factory	Flower Shop
62	Food	Flower Shop	Field
64	Bakery	Gourmet Shop	Food
65	Light Rail Station	Golf Course	Event Service
66	Flower Shop	Field	Fast Food Restaurant
67	Tennis Stadium	Light Rail Station	Indian Restaurant
69	Zoo Exhibit	Falafel Restaurant	Food
70	Bookstore	Convenience Store	Food
74	Electronics Store	Factory	Flower Shop
84	Flower Shop	Field	Fast Food Restaurant
85	Food	Flower Shop	Field
86	Food	Flower Shop	Field
90	Indian Restaurant	Discount Store	Farmers Market
92	Flower Shop	Field	Fast Food Restaurant
95	Farm	Food & Drink Shop	Food
98	Zoo Exhibit	Event Service	Flower Shop
99	Field	Fast Food Restaurant	Farmers Market
100	Flower Shop	Field	Fast Food Restaurant
102	Flower Shop	Field	Fast Food Restaurant
105	Field	Fast Food Restaurant	Farmers Market
106	Food	Flower Shop	Field
109	Department Store	Food	Flower Shop
113	Food Court	Food & Drink Shop	Food
116	Food	Flower Shop	Field
117	Field	Fast Food Restaurant	Farmers Market
118	Food	Flower Shop	Field
121	Flower Shop	Field	Fast Food Restaurant
123	Factory	Flower Shop	Field
125	Food	Flower Shop	Field
126	Field	Fast Food Restaurant	Farmers Market
128	Food	Flower Shop	Field
131	Electronics Store	Zoo Exhibit	Factory
132	Food	Flower Shop	Field

133	Flower Shop		Field	Fast Food Restaurant
136	Food & Drink Shop		Food	Flower Shop
140	Flower Shop		Field	Fast Food Restaurant
141	Grocery Store		Speakeasy	Market
144	Food & Drink Shop		Food	Flower Shop
145	Food & Drink Shop		Food	Flower Shop
146	Field	Fast Food Restaurant		Farmers Market
155	Food & Drink Shop		Food	Flower Shop
157	Field	Fast Food Restaurant		Farmers Market
163	Food	Flower Shop		Field
164	Field	Fast Food Restaurant		Farmers Market
169	Field	Fast Food Restaurant		Farmers Market
170	Flower Shop		Field	Fast Food Restaurant
173	Food & Drink Shop		Food	Flower Shop
174	Fast Food Restaurant	Farmers Market		Farm
181	Flower Shop		Field	Fast Food Restaurant
184	Flower Shop		Field	Fast Food Restaurant
185	Field	Fast Food Restaurant		Farmers Market
186	Flower Shop		Field	Fast Food Restaurant
188	Flower Shop		Field	Fast Food Restaurant
189	Zoo Exhibit	Event Service		Flower Shop
191	Food	Flower Shop		Field

	10th Most Common Venue
0	Opera House
1	Opera House
2	Opera House
3	Opera House
4	Opera House
5	Opera House
6	Opera House
7	Opera House
8	Opera House
9	Opera House
10	Opera House
11	Opera House
12	Opera House
13	Opera House
14	Opera House
15	Opera House
16	Opera House
17	Opera House
18	Opera House
19	Opera House
20	Opera House
21	Hotel
22	Flower Shop

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23                  Café
25     Indie Movie Theater
26        Department Store
27      Falafel Restaurant
28                 Factory
29             Supermarket
30                   Field
32          Farmers Market
33       Food & Drink Shop
34       Food & Drink Shop
35       Food & Drink Shop
36       Food & Drink Shop
37       Food & Drink Shop
38            Gourmet Shop
41      Chinese Restaurant
42    Fast Food Restaurant
43                  Café
44    Fast Food Restaurant
45    Fast Food Restaurant
46        Asian Restaurant
47                 Factory
49                     Gym
51                   Field
52       Convenience Store
53              Playground
54             Opera House
55             Opera House
56             Opera House
57          Farmers Market
59                   Field
62    Fast Food Restaurant
64             Flower Shop
65                   Field
66          Farmers Market
67          Discount Store
69             Flower Shop
70           Home Service
74                   Field
84          Farmers Market
85    Fast Food Restaurant
86    Fast Food Restaurant
90       Food & Drink Shop
92          Farmers Market
95             Flower Shop
98                   Field
99                    Farm
100         Farmers Market
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102         Farmers Market
105                   Farm
106   Fast Food Restaurant
109                  Field
113             Flower Shop
116   Fast Food Restaurant
117                   Farm
118   Fast Food Restaurant
121         Farmers Market
123   Fast Food Restaurant
125   Fast Food Restaurant
126                   Farm
128   Fast Food Restaurant
131             Flower Shop
132   Fast Food Restaurant
133         Farmers Market
136                  Field
140         Farmers Market
141                   Farm
144                  Field
145                  Field
146                   Farm
155                  Field
157                   Farm
163   Fast Food Restaurant
164                   Farm
169                   Farm
170                   Farm
173                  Field
174     Falafel Restaurant
181         Farmers Market
184         Farmers Market
185                   Farm
186         Farmers Market
188         Farmers Market
189                  Field
191   Fast Food Restaurant
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4.2 Discussion

Keeping in mind that the main business application consists in opening a new restaurant supply shop and that the target market for this kind of business includes: restaurants, culinary schools, cafeterias(including medical and schools), bars, caterers, bakeries and coffee shops. Based on the clustering results, cluster 1 and mainly cluster 4 are the ones grouping a high proportion of venues which are part of the target market. This is valuable information that will help decision makers choosing the right place for opening the shop, planning logistics, calculating costs and designing better marketing

campaigns.

4.3 Conclusion

Combining location data with unsupervised learning techniques, it was possible to segment places in the city of Zürich and create clusters that agglomerate venues considered the target audience for the proposed business case, namely restaurants, hotels, bars, coffe shops, bistros, hotels on others related to the culinary community. For this specific project, clusters 1 and 4 are the most relevant ones to further analyze and consider when making business decisions.

5 References

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