Capstone Project

THE BATTLE OF NEIGHBORHOODS IN BEIJING: RESTAURANTS

Introduction

- Beijing: one of the most popular city to travel in the world
- Long history creates various culture and plenty food
- Beijing has 16 districts with more than 20 million population.
- Travel to such a huge city with too much information online
- Hard to make decision
- Using the online data and location data to help travellers to find a better district to visit with more restaurants.

Data Resource

- Wikipedia Website: https://en.wikipedia.org/wiki/List_of_counties_in_China

List of counties in China

From Wikipedia, the free encyclopedia

Further information: List of cities in China and List of prefectures in the People's Republic of China

Main article: Counties of China

This is a list of all counties (including Autonomous counties, Autonomous banners, and Banners) along with County-level cities (Chinese: 县级

List [edit]

Name	Prefecture	Province	Type	Population Census 2010
Yaohai	Hefei	Anhui	District	902,830
Luyang	Hefei	Anhui	District	609,239
Shushan	Hefei	Anhui	District	1,022,321
Baohe	Hefei	Anhui	District	817,686
Changfeng	Hefei	Anhui	County	629,535
Feidong	Hefei	Anhui	County	861,960
Feixi	Hefei	Anhui	County	858,895
Lujiang	Hefei	Anhui	County	973,850
Chaohu	Hefei	Anhui	City	780,700

FOURSQUARE

FIND YOUR PLACE

- Foursquare APIs

Data Preparation

- Scrap all the counties in China from a Wikipedia Website

```
source = requests.get("https://en.wikipedia.org/wiki/List_of_counties_in_China")
soup = BeautifulSoup(source, "html.parser")

table = soup.find("table",{'class':"wikitable"})
# Dataframe with 3 columns

df = pd.read_html(str(table))
df = pd.DataFrame(df[0])
df.head()
```

	Name	Prefecture	Province	Type	Population Census 2010
0	Yaohai	Hefei	Anhui	District	902830
1	Luyang	Hefei	Anhui	District	609239
2	Shushan	Hefei	Anhui	District	1022321
3	Baohe	Hefei	Anhui	District	817686
4	Changfeng	Hefei	Anhui	County	629535

Data Preparation

- Keep all the districts in Beijing which has a more than 1,000,000 population

```
df = df[df['Province'] == 'Beijing']
df = df.drop(df.index[[-1,-2]])
df['Population Census 2010']=pd.to_numeric(df['Population Census 2010'] )
df = df[df['Population Census 2010'] > 1000000]
df
```

	Name	Prefecture	Province	Type	Population Census 2010
107	Xicheng	Directly administered	Beijing	District	1243000
108	Chaoyang	Directly administered	Beijing	District	3545000
109	Haidian	Directly administered	Beijing	District	3281000
110	Fengtai	Directly administered	Beijing	District	2112000
112	Tongzhou	Directly administered	Beijing	District	1184000
114	Changping	Directly administered	Beijing	District	1661000
115	Daxing	Directly administered	Beijing	District	1365000

Data Preparation

- Add the coordinates information into the data frame by using the CSV

```
df_geo_coor = pd.read_csv('Coor.csv')
df_geo_coor
```

	District	Latitude	Longitude
0	Xicheng	39.9123	116.3659
1	Chaoyang	39.9215	116.4431
2	Haidian	39.9600	116.2983
3	Fengtai	39.8584	116.2871
4	Tongzhou	39.9099	116.6564
5	Changping	40.2207	116.2312
6	Daxing	39.7269	116.3414

Data Preparation: final data frame

```
df = pd.merge(df, df_geo_coor, how='left', left_on = 'Name', right_on = 'District')
# remove the "District" column
df.drop("District", axis=1, inplace=True)
df
```

	Name	Prefecture	Province	Type	Population Census 2010	Latitude	Longitude
0	Xicheng	Directly administered	Beijing	District	1243000	39.9123	116.3659
1	Chaoyang	Directly administered	Beijing	District	3545000	39.9215	116.4431
2	Haidian	Directly administered	Beijing	District	3281000	39.9600	116.2983
3	Fengtai	Directly administered	Beijing	District	2112000	39.8584	116.2871
4	Tongzhou	Directly administered	Beijing	District	1184000	39.9099	116.6564
5	Changping	Directly administered	Beijing	District	1661000	40.2207	116.2312
6	Daxing	Directly administered	Beijing	District	1365000	39.7269	116.3414

Data Preparation

- Visualize the geographic details of the 7 main districts in Beijing

```
# create map of Beijing using latitude and longitude values
map_Beijing = folium.Map(location=[latitude, longitude], zoom_start=10)

 # add markers to map
for lat, lng, label in zip(df['Latitude'], df['Longitude'], df['Name']):
    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_Beijing)

map_Beijing
```

Exploratory Data Analysis

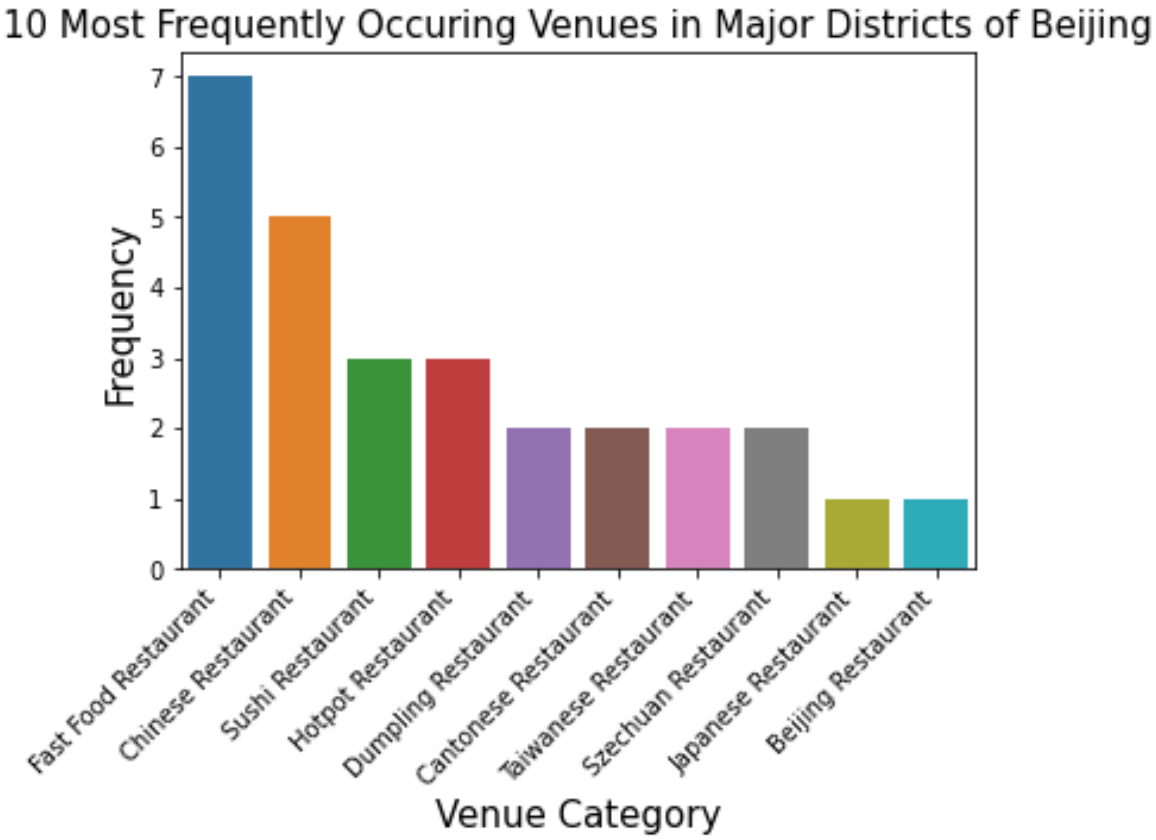
- The overall neighborhoods in the 7 main districts of Beijing

```
Neighborhood
Changping      1
Chaoyang      16
Fengtai        3
Tongzhou       2
Xicheng       10
Name: Venue Category, dtype: int64
```

	Venue_Category	Frequency
0	Fast Food Restaurant	7
1	Chinese Restaurant	5
2	Sushi Restaurant	3
3	Hotpot Restaurant	3
4	Dumpling Restaurant	2
5	Cantonese Restaurant	2
6	Taiwanese Restaurant	2
7	Szechuan Restaurant	2
8	Japanese Restaurant	1
9	Beijing Restaurant	1

Exploratory Data Analysis

- Visualize the result:



Exploratory Data Analysis

- Create one-hot data frame for restaurants in each 7 main districts.

```
# one hot encoding
Beijing_onehot = pd.get_dummies(Beijing_Venues_only_restaurant[['Venue Category']], prefix="", prefix_sep="")

# add neighborhood column back to dataframe
Beijing_onehot['Neighborhood'] = Beijing_Venues_only_restaurant['Neighborhood']

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

Beijing_onehot.head()
```

	Neighborhood	Asian Restaurant	Beijing Restaurant	Cantonese Restaurant	Chinese Restaurant	Comfort Food Restaurant	Dumpling Restaurant	Fast Food Restaurant	Hotpot Restaurant	Italian Restaurant	Japanese Restaurant	Korean Restaurant	N Americ Restaur
1	Xicheng	0	0	0	0	0	1	0	0	0	0	0	
2	Xicheng	0	0	0	0	0	0	0	1	0	0	0	
3	Xicheng	0	0	0	0	0	0	0	0	0	0	0	
4	Xicheng	0	0	0	0	0	0	0	0	0	0	0	
5	Xicheng	0	0	0	0	0	0	0	0	0	0	0	

Exploratory Data Analysis

- Group rows by neighborhoods and taking the mean of frequency of occurrence in each category

```
# group rows by neighborhood and by taking the mean of the frequency of occurrence of each category
Beijing_grouped = Beijing_onehot.groupby('Neighborhood').mean().reset_index()
Beijing_grouped
```

	Neighborhood	Asian Restaurant	Beijing Restaurant	Cantonese Restaurant	Chinese Restaurant	Comfort Food Restaurant	Dumpling Restaurant	Fast Food Restaurant	Hotpot Restaurant	Italian Restaurant	Japanese Restaurant	Korean Restaurant	N Americ Restaur
0	Changping	0.0	0.0000	0.0000	0.000000	0.000000	0.0000	1.0000	0.0	0.0000	0.000	0.0000	0.0(
1	Chaoyang	0.0	0.0625	0.0625	0.125000	0.000000	0.0625	0.1875	0.0	0.0625	0.125	0.0625	0.06
2	Fengtai	0.0	0.0000	0.0000	0.666667	0.333333	0.0000	0.0000	0.0	0.0000	0.000	0.0000	0.0(
3	Tongzhou	0.0	0.0000	0.0000	0.500000	0.000000	0.0000	0.5000	0.0	0.0000	0.000	0.0000	0.0(
4	Xicheng	0.1	0.0000	0.1000	0.000000	0.000000	0.1000	0.2000	0.1	0.0000	0.000	0.0000	0.0(

Exploratory Data Analysis

- Print the result for each district with top 5 common restaurants

----Changping----

	venue	freq
0	Fast Food Restaurant	1.0
1	Asian Restaurant	0.0
2	Beijing Restaurant	0.0
3	Cantonese Restaurant	0.0
4	Chinese Restaurant	0.0

----Chaoyang----

	venue	freq
0	Fast Food Restaurant	0.19
1	Chinese Restaurant	0.12
2	Japanese Restaurant	0.12
3	Sushi Restaurant	0.12
4	Beijing Restaurant	0.06

----Fengtai----

	venue	freq
0	Chinese Restaurant	0.67
1	Comfort Food Restaurant	0.33
2	Asian Restaurant	0.00
3	Beijing Restaurant	0.00
4	Cantonese Restaurant	0.00

----Tongzhou----

	venue	freq
0	Chinese Restaurant	0.5
1	Fast Food Restaurant	0.5
2	Asian Restaurant	0.0
3	Beijing Restaurant	0.0
4	Cantonese Restaurant	0.0

----Xicheng----

	venue	freq
0	Fast Food Restaurant	0.2
1	Szechuan Restaurant	0.2
2	Asian Restaurant	0.1
3	Cantonese Restaurant	0.1
4	Dumpling Restaurant	0.1

Exploratory Data Analysis

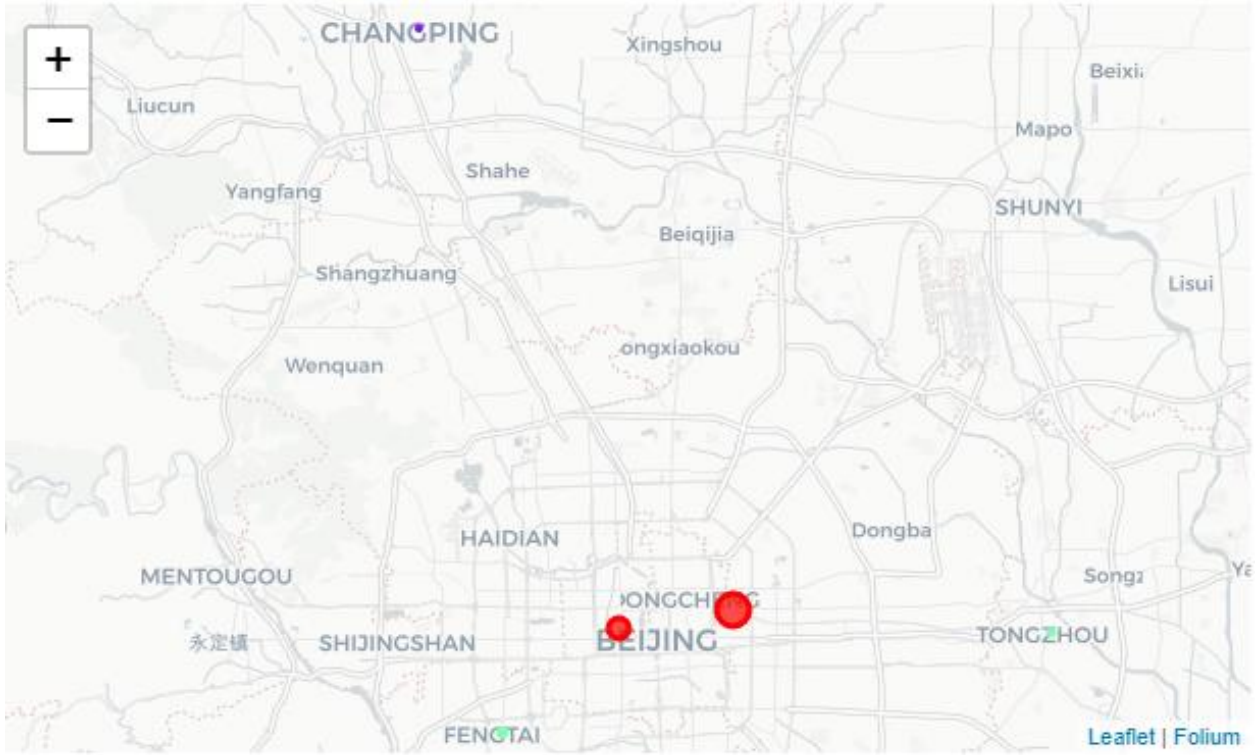
- Cluster analysis by using the K-Means

```
# add clustering labels
neighborhoods_venues_sorted.insert(0, 'Cluster Labels2', kmeans.labels_)

Beijing_merged = df.drop([2,6])

Beijing_merged.rename(columns={'Name':'Neighborhood'}, inplace=True)

# merge Beijing_grouped with data to add latitude/longitude for each neighborhood
Beijing_merged = Beijing_merged.join(neighborhoods_venues_sorted.set_index('Neighborhood'), on='Neighborhood')

Beijing_merged # check columns
```

	Neighborhood	Prefecture	Province	Type	Population Census 2010	Latitude	Longitude	Cluster Labels2	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue
0	Xicheng	Directly administered	Beijing	District	1243000	39.9123	116.3659	0	Szechuan Restaurant	Fast Food Restaurant	Taiwanese Restaurant	Ramen Restaurant	Hotpot Restaurant	Dumpling Restaurant
1	Chaoyang	Directly administered	Beijing	District	3545000	39.9215	116.4431	0	Fast Food Restaurant	Sushi Restaurant	Japanese Restaurant	Chinese Restaurant	Ramen Restaurant	New American Restaurant
3	Fengtai	Directly administered	Beijing	District	2112000	39.8584	116.2871	2	Chinese Restaurant	Comfort Food Restaurant	Taiwanese Restaurant	Szechuan Restaurant	Sushi Restaurant	Ramen Restaurant
4	Tongzhou	Directly administered	Beijing	District	1184000	39.9099	116.6564	2	Fast Food Restaurant	Chinese Restaurant	Taiwanese Restaurant	Szechuan Restaurant	Sushi Restaurant	Ramen Restaurant
5	Changping	Directly administered	Beijing	District	1661000	40.2207	116.2312	1	Fast Food Restaurant	Taiwanese Restaurant	Szechuan Restaurant	Sushi Restaurant	Ramen Restaurant	New American Restaurant

Exploratory Data Analysis

- Visualize the K-Means Clusters



Result

- The most restaurant in the main districts of Beijing is the Fast-Food restaurants.
- Chaoyang and Xicheng Have the greatest number of restaurants.
- There is no efficient information of restaurants in Haidian and Daxing.
- This report analyzes the overview distribution of restaurants in the main districts in Beijing by using the Foursquare Location Data and K-Means algorithm.

Conclusion and Future Direction

- Build a clustering model to help travelers to locate more restaurants.
- **More Data in :**
- Location
- Scores in social media
- Transportation information