The Battle of Neighborhoods in Shanghai

Author: Jane W.J. Goh
Date: 01 November 2020

Introduction

After moving across 8 different cities(/towns) in different countries in the past 20 years, I have come to appreciate a neighborhood that has local flavor, convenient access to healthy living, as well as foreign touch that reminds me of home- Los Angeles. However, with every move, the search for a good base that meets every criterion remains difficult, especially so when all one has is Google maps and websites targeting expats and charging agency fees- is it a fair price or overcharged? Is this a foreigner-friendly neighborhood? Is it convenient to all the daily necessities? Moving to a new city can be a daunting experience, especially when you 1. don't know anyone, 2. are not familiar with the landscape, and 3. don't speak the language.

Shanghai is home to 200,000 expats, the largest expat population in China mainland. With housing information available largely in Chinese, some work can be done to close the information asymmetry. This project explores and clusters the neighborhoods in Shanghai in order to find a suitable community for a new expat in town.

There are 3 parts to the project:

1. Importing and cleaning the Shanghai neighborhoods data

2. Calling Foursquare API to find each neighborhood's characteristics- by most common venue

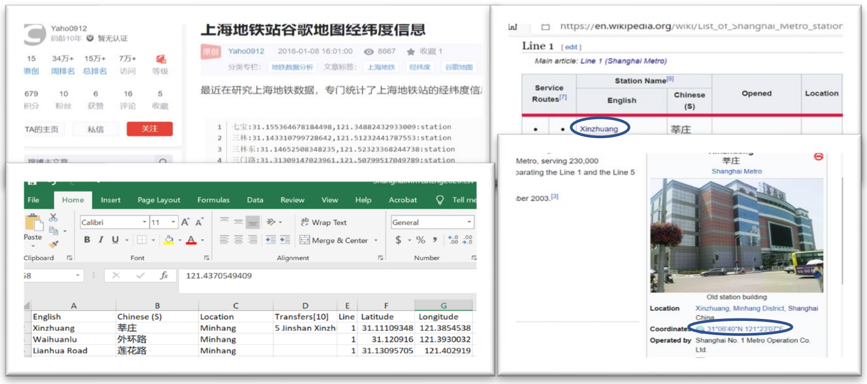
3. Using k-means to cluster the neighborhoods & analysis

Data

Neighborhood here is defined as within 400 meter/ 5-minute walking distance of a metro station- the main form of transport between home and office. Neighborhood characteristics is defined by the type of venues available from the 400 meter/ 5-minute walking distance of the metro station.

This notebook makes use of two main sources of data 1. CSV file containing Shanghai's 423 metro stations in English and Chinese names, locations, latitude, longitude data and 2. Foursquare API which provides venues data for each latitude, longitude data points.

The ShanghaiMRTLatLng.csv file data is sourced from a 2016 data available on https://blog.csdn.net/a364572/article/details/50483568. However, the data source is available in mandarin and not up to date in 2020 as there have been 60+ new stations added since then, found from wikitable search from https://en.wikipedia.org/wiki/List_of_Shanghai_Metro_stations. I extracted the full list of metro stations from wikitables, merged the latitude longitude data with the 2016 files, and updated manually the missing data points and the data is now available as csv in the repository.



上海地铁站谷歌地图经纬度信息

Yaho0912 2016-01-08 16:01:00 8667 收藏 1

分类专栏： 地铁数据分析 文章标签： 上海地铁 经纬度 谷歌地图

最近在研究上海地铁数据，专门统计了上海地铁站的经纬度信

```
1  七宝:31.155364678184498,121.34882432933009:station
2  三林:31.143310799728642,121.51232441787553:station
3  三林东:31.14652508348235,121.52323368244738:station
4  三门路:31.31309147023961,121.50799517049789:station
```

121.4370549409

A	B	C	D	E	F	G
English	Chinese (S)	Location	Transfers[10]	Line	Latitude	Longitude
Xinzhuang	莘庄	Minhang	5 Jinshan Xinzh	1	31.11109348	121.3854538
Waihuanlu	外环路	Minhang		1	31.120916	121.3930032
Lianhua Road	莲花路	Minhang		1	31.13095705	121.402919

https://en.wikipedia.org/wiki/List_of_Shanghai_Metro_station

Line 1 [edit]

Main article: Line 1 (Shanghai Metro)

Service Routes[7]		Station Name[8]		Opened	Location
		English	Chinese (S)		
•	•	Xinzhuang	莘庄		

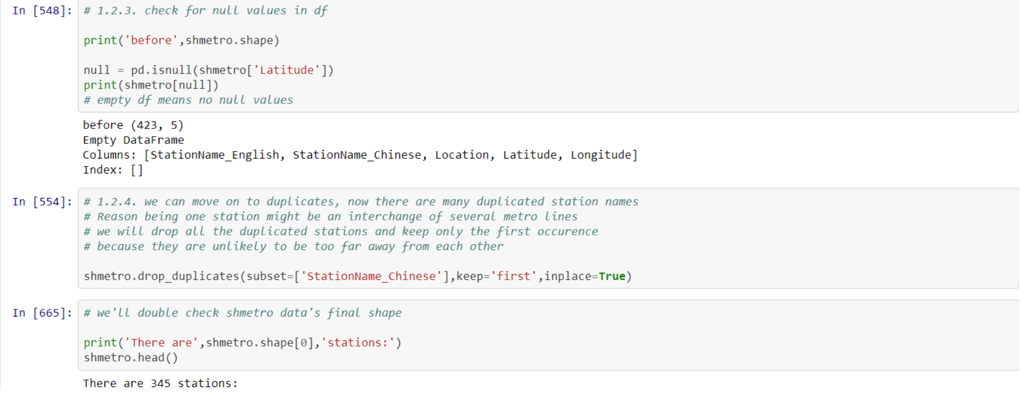
Metro, serving 230,000
parating the Line 1 and the Line 5
ber 2003.[3]

莘庄

Location	Xinzhuang, Minhang District, Shanghai China
Coordinates	31°06′40″N 121°23′07″E
Operated by	Shanghai No. 1 Metro Operation Co. Ltd.

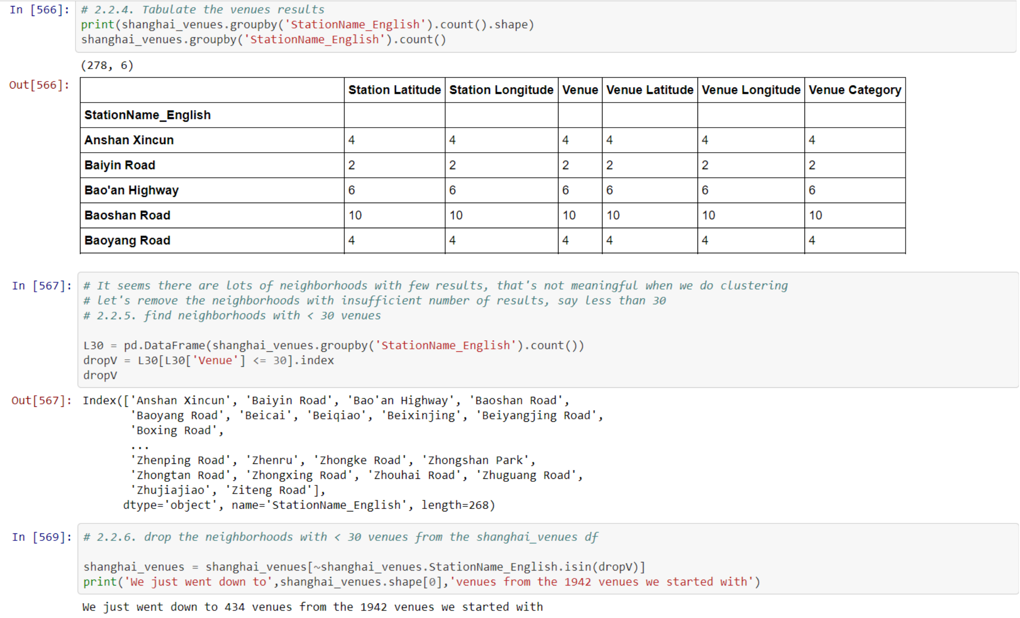
Methodology

In preparing the Shanghai neighborhoods data, duplicated station names were removed. Reason being one station might be an interchange of several metro lines, all the duplicated stations were dropped and keep only the first occurrence because the same station names are unlikely to be too far away from each other.



```
In [548]: # 1.2.3. check for null values in df

          print('before',shmetro.shape)

          null = pd.isnull(shmetro['Latitude'])
          print(shmetro[null])
          # empty df means no null values

          before (423, 5)
          Empty DataFrame
          Columns: [StationName_English, StationName_Chinese, Location, Latitude, Longitude]
          Index: []

In [554]: # 1.2.4. we can move on to duplicates, now there are many duplicated station names
          # Reason being one station might be an interchange of several metro lines
          # we will drop all the duplicated stations and keep only the first occurence
          # because they are unlikely to be too far away from each other

          shmetro.drop_duplicates(subset=['StationName_Chinese'],keep='first',inplace=True)

In [665]: # we'll double check shmetro data's final shape

          print('There are',shmetro.shape[0],'stations:')
          shmetro.head()

          There are 345 stations:
```

After merging the data from Shanghai neighborhoods and Foursquare data, I realized that there are insufficient data in a lot of locations, so I have removed them from consideration in the notebook steps 2.2.5 and 2.2.6.

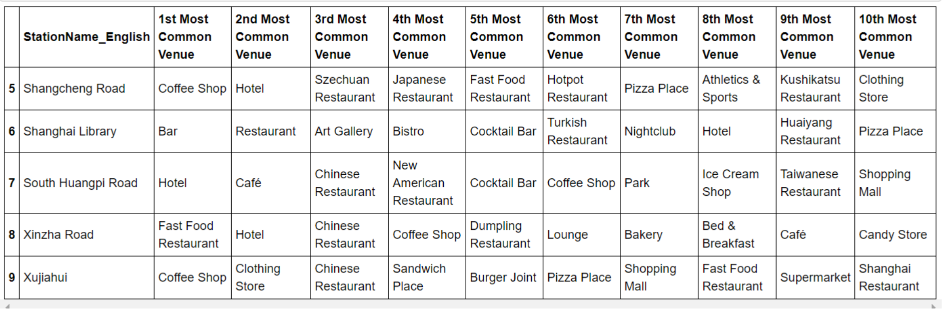


```
In [566]: # 2.2.4. Tabulate the venues results
          print(shanghai_venues.groupby('StationName_English').count().shape)
          shanghai_venues.groupby('StationName_English').count()

          (278, 6)

Out[566]:
```

	Station Latitude	Station Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
StationName_English						
Anshan Xincun	4	4	4	4	4	4
Baiyin Road	2	2	2	2	2	2
Bao'an Highway	6	6	6	6	6	6
Baoshan Road	10	10	10	10	10	10
Baoyang Road	4	4	4	4	4	4

```
In [567]: # It seems there are lots of neighborhoods with few results, that's not meaningful when we do clustering
          # let's remove the neighborhoods with insufficient number of results, say less than 30
          # 2.2.5. find neighborhoods with < 30 venues

          L30 = pd.DataFrame(shanghai_venues.groupby('StationName_English').count())
          dropV = L30[L30['Venue'] <= 30].index
          dropV

Out[567]: Index(['Anshan Xincun', 'Baiyin Road', 'Bao'an Highway', 'Baoshan Road',
                 'Baoyang Road', 'Beicai', 'Beiqiao', 'Beixinjing', 'Beiyangjing Road',
                 'Boxing Road',
                 ...
                 'Zhenping Road', 'Zhenru', 'Zhongke Road', 'Zhongshan Park',
                 'Zhongtan Road', 'Zhongxing Road', 'Zhouhai Road', 'Zhuguang Road',
                 'Zhujiajiao', 'Ziteng Road'],
                dtype='object', name='StationName_English', length=268)

In [569]: # 2.2.6. drop the neighborhoods with < 30 venues from the shanghai_venues df

          shanghai_venues = shanghai_venues[~shanghai_venues.StationName_English.isin(dropV)]
          print('We just went down to',shanghai_venues.shape[0],'venues from the 1942 venues we started with')

          We just went down to 434 venues from the 1942 venues we started with
```

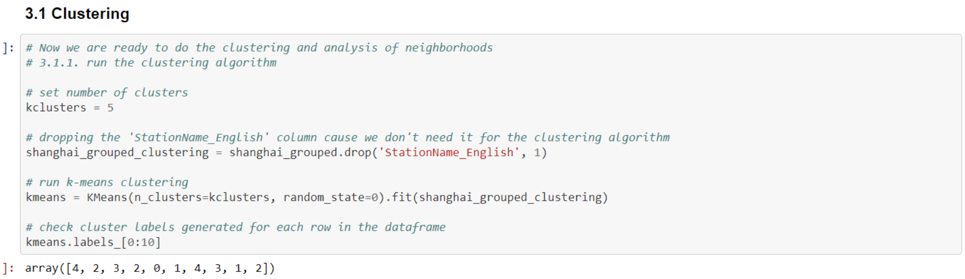
Next, self-defined functions are used to find the neighborhoods' characteristics, and this is the resulting look.



	StationName_English	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
5	Shangcheng Road	Coffee Shop	Hotel	Szechuan Restaurant	Japanese Restaurant	Fast Food Restaurant	Hotpot Restaurant	Pizza Place	Athletics & Sports	Kushikatsu Restaurant	Clothing Store
6	Shanghai Library	Bar	Restaurant	Art Gallery	Bistro	Cocktail Bar	Turkish Restaurant	Nightclub	Hotel	Huaiyang Restaurant	Pizza Place
7	South Huangpi Road	Hotel	Café	Chinese Restaurant	New American Restaurant	Cocktail Bar	Coffee Shop	Park	Ice Cream Shop	Taiwanese Restaurant	Shopping Mall
8	Xinzha Road	Fast Food Restaurant	Hotel	Chinese Restaurant	Coffee Shop	Dumpling Restaurant	Lounge	Bakery	Bed & Breakfast	Café	Candy Store
9	Xujiahui	Coffee Shop	Clothing Store	Chinese Restaurant	Sandwich Place	Burger Joint	Pizza Place	Shopping Mall	Fast Food Restaurant	Supermarket	Shanghai Restaurant

Now, It may be good enough to know what is popular in each neighborhood, however, we'll take it a step further and find which neighborhoods are more similar in spirit through clustering analysis.

In order to find similar neighborhoods, K-Means is chosen to learn from the data and cluster the neighborhoods unsupervised. K-Means is chosen as it is able to find similar and dissimilar groups in unlabeled data, and it is an algorithm that is accessible to beginners.



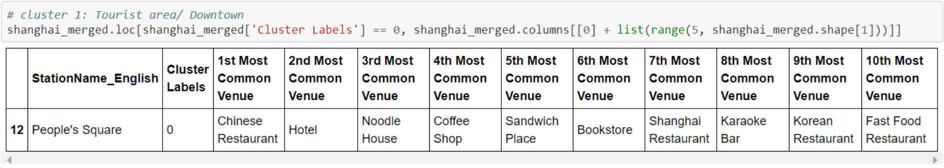
3.1 Clustering

```
]: # Now we are ready to do the clustering and analysis of neighborhoods
   # 3.1.1. run the clustering algorithm

   # set number of clusters
   kclusters = 5

   # dropping the 'StationName_English' column cause we don't need it for the clustering algorithm
   shanghai_grouped_clustering = shanghai_grouped.drop('StationName_English', 1)

   # run k-means clustering
   kmeans = KMeans(n_clusters=kclusters, random_state=0).fit(shanghai_grouped_clustering)

   # check cluster labels generated for each row in the dataframe
   kmeans.labels_[0:10]
]: array([4, 2, 3, 2, 0, 1, 4, 3, 1, 2])
```

Results

Upon examining the resulting clusters, one can infer a characteristic of different neighborhoods in town:

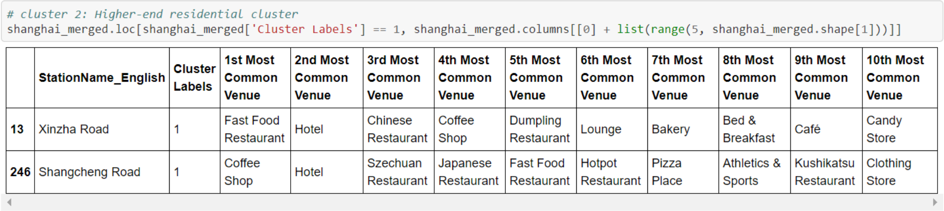
Cluster 1: People's square station is filled with variety of Asian cuisine restaurants, hotels, and karaoke bar- indicating that this might be a very bustling place, suitable for someone who prefers a busy environment with easy access to food and entertainment



```
# cluster 1: Tourist area/ Downtown
shanghai_merged.loc[shanghai_merged['Cluster Labels'] == 0, shanghai_merged.columns[[0] + list(range(5, shanghai_merged.shape[1]))]]
```

	StationName_English	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
12	People's Square	0	Chinese Restaurant	Hotel	Noodle House	Coffee Shop	Sandwich Place	Bookstore	Shanghai Restaurant	Karaoke Bar	Korean Restaurant	Fast Food Restaurant

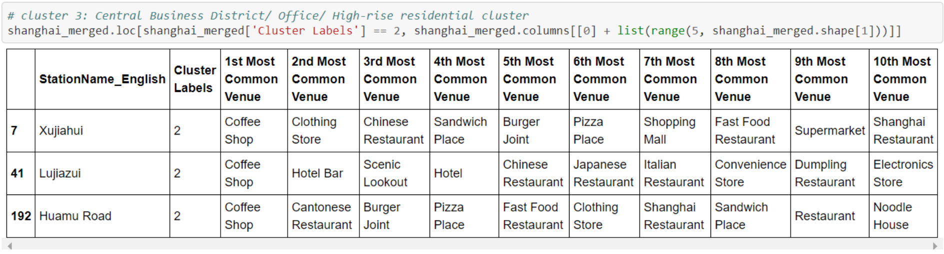
Cluster 2: Xinzha Road and Shangcheng Road stations are concentrated in largely Asian/some Western restaurants and cafes, hotels and b&b's, and shopping (sports & clothes)- an indication that it could be an area that is convenient for tourist access.



```
# cluster 2: Higher-end residential cluster
shanghai_merged.loc[shanghai_merged['Cluster Labels'] == 1, shanghai_merged.columns[[0] + list(range(5, shanghai_merged.shape[1]))]]
```

	StationName_English	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	Xinzha Road	1	Fast Food Restaurant	Hotel	Chinese Restaurant	Coffee Shop	Dumpling Restaurant	Lounge	Bakery	Bed & Breakfast	Café	Candy Store
246	Shangcheng Road	1	Coffee Shop	Hotel	Szechuan Restaurant	Japanese Restaurant	Fast Food Restaurant	Hotpot Restaurant	Pizza Place	Athletics & Sports	Kushikatsu Restaurant	Clothing Store

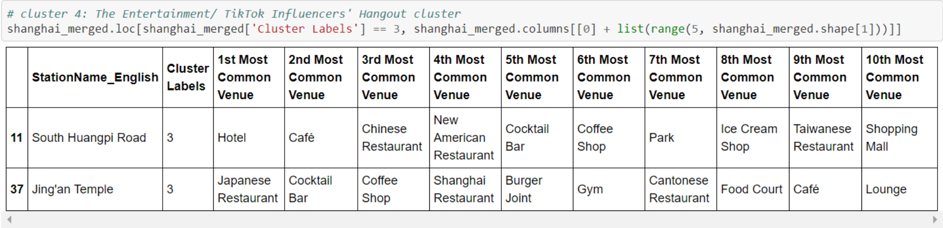
Cluster 3: Xujiahui, Lujiazhui and Huamu Road stations are first and foremost about coffee shops, followed by a mix of Asian/Western restaurants, and access to shopping malls/ convenience stores/ supermarket, these are indications of the convenient city lifestyle



```
# cluster 3: Central Business District/ Office/ High-rise residential cluster
shanghai_merged.loc[shanghai_merged['Cluster Labels'] == 2, shanghai_merged.columns[[0] + list(range(5, shanghai_merged.shape[1]))]]
```

	StationName_English	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
7	Xujiahui	2	Coffee Shop	Clothing Store	Chinese Restaurant	Sandwich Place	Burger Joint	Pizza Place	Shopping Mall	Fast Food Restaurant	Supermarket	Shanghai Restaurant
41	Lujiazui	2	Coffee Shop	Hotel Bar	Scenic Lookout	Hotel	Chinese Restaurant	Japanese Restaurant	Italian Restaurant	Convenience Store	Dumpling Restaurant	Electronics Store
192	Huamu Road	2	Coffee Shop	Cantonese Restaurant	Burger Joint	Pizza Place	Fast Food Restaurant	Clothing Store	Shanghai Restaurant	Sandwich Place	Restaurant	Noodle House

Cluster 4: South Huangpi Road and Jian'an Temple stations are the first clusters where we see gym and park making it to the top 10. Along with a mix of Asian/Western restaurants and cocktail bars, this cluster looks like a good base for work/life balance.



```
# cluster 4: The Entertainment/ TikTok Influencers' Hangout cluster
shanghai_merged.loc[shanghai_merged['Cluster Labels'] == 3, shanghai_merged.columns[[0] + list(range(5, shanghai_merged.shape[1]))]]
```

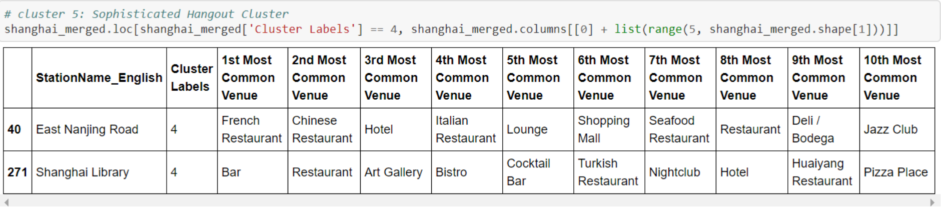
	StationName_English	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
11	South Huangpi Road	3	Hotel	Café	Chinese Restaurant	New American Restaurant	Cocktail Bar	Coffee Shop	Park	Ice Cream Shop	Taiwanese Restaurant	Shopping Mall
37	Jing'an Temple	3	Japanese Restaurant	Cocktail Bar	Coffee Shop	Shanghai Restaurant	Burger Joint	Gym	Cantonese Restaurant	Food Court	Café	Lounge

Cluster 5: East Nanjing Road and Shanghai Library stations are defined by its lounge/bistro/deli, largely Western restaurants. And the art gallery and jazz club? This cluster looks like one fine lifestyle neighborhood.

Discussion

This project could be further improved with the following:

In part 1: Introduce a web crawler and more comprehensive data cleaning codes.



```
# cluster 5: Sophisticated Hangout Cluster
shanghai_merged.loc[shanghai_merged['Cluster Labels'] == 4, shanghai_merged.columns[[0] + list(range(5, shanghai_merged.shape[1]))]]
```

	StationName_English	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
40	East Nanjing Road	4	French Restaurant	Chinese Restaurant	Hotel	Italian Restaurant	Lounge	Shopping Mall	Seafood Restaurant	Restaurant	Deli / Bodega	Jazz Club
271	Shanghai Library	4	Bar	Restaurant	Art Gallery	Bistro	Cocktail Bar	Turkish Restaurant	Nightclub	Hotel	Huaiyang Restaurant	Pizza Place

In part 1, 2: Can include other potential data sources such as average property price, surround building types, and residential demographic to make neighborhood characteristics identification even more meaningful.

In part 3: Instead of K-Means, maybe can explore DBSCAN density-based clustering.

Conclusion

We have made a headway into exploring of different neighborhoods in Shanghai, a different cluster for everyone with different lifestyles. For people who are looking to a new place, hope you find a place to call home. For my fellow classmates, Happy Learning!