Final Assignment

A trip to Singapore

1. Introduction

Singapore is one of my next travel destinations and therefore an interesting study subject for this capstone project. Therefore, the goal of this project is to search deeper for nice places and locations. I'll use the Foursquare API to analyze venue recommendations as learned in the foregoing projects in New York and Toronto.

For this demonstration, this notebook will make use of the following data:

- Singapore Median Rental Prices by town
- Popular Food venues in the neighborhood

This information will help to organize my trip to Singapore.

This project will be structured as follows:

1. Introduction
2. Data
3. Procedure
4. Segmenting & Clustering
5. Exploring Neighborhoods in Singapore
6. Analysis of Neighborhoods
7. Analysis of most popular venues
8. Clustering of Neighborhoods
9. Discussion

2. Data

In this notebook I'll use the following sources:

Singapore Towns and median residential rental prices.

Data will retrieved from Singapore open dataset from [median rent by town and flattype](https://data.gov.sg) from https://data.gov.sg website.

The original data source contains median rental prices of Singapore HDB units from 2005 up to 2nd quarter of 2018. To demonstrate this, I will simplify the analysis by using the average rental prices of all available flat type.

Singapore Towns location data retrieved using Google maps API.

Data coordinates of Town Venues will be retrieved using google API.

Singapore Top Venue Recommendations from FourSquare API

(FourSquare website: www.foursquare.com)

I will use the FourSquare API to explore neighborhoods in Singapore. I'll retrieve the following information:

- Venue ID
- Venue Name
- Coordinates : Latitude and Longitude
- Category Name

In another query I'll search for venue ratings for each location. Note that rating information is a paid service from FourSquare and we are limited to only 50 queries per day. With this constraint, we limit the category analysis with only one type for this project.

3. Procedure

The source data contains median rental prices of Singapore HDB units from 2005 up to 2nd quarter of 2018. I will retrive the most recent recorded rental prices from this data source (Q2 2018) being the most relevant price available at this time. For this demonstration, I will simplify the analysis by using the average rental prices of all available flat type.

The result tables will need some cleaning and regrouping. Thus, the following tasks will be performed:

- Drop/ignore cells with missing data
- Use most current data record
- Fix data types

The retrieved table contains some un-wanted entries and needs some cleanup. The following tasks will be performed:

- Drop/ignore cells with missing data
- Use most current data record
- Fix data types
- The Google API will be used to get the coordinates (latitude and longitude) of each town center. Therefore, the MRT stations will be used as the center points of each evaluated towns.

4. Segmenting and Clustering

Using the Foursquare API, the **explore** API function was be used to get the most common venue categories in each neighborhood, afterwards using this feature to group the neighborhoods into clusters. The *k*-means clustering algorithm was used for the analysis. The, the Folium library is used to visualize the recommended neighborhoods and their resulting clusters.

Using the function **getNearbyVenues**, the following information for the dataframe is extracted:

- Venue ID
- Venue Name
- Coordinates : Latitude and Longitude
- Category Name

5. Exploring Neighborhoods in Singapore

5.1 Using the following foursquare api query url, search venues on all boroughs in selected Singapore towns

`https://api.foursquare.com/v2/venues/`**search**`?client_id=`**CLIENT_ID**`&client_sec`
`ret=`**CLIENT_SECRET**`&ll=`**LATITUDE, LONGITUDE**`&v=`**VERSION**`&query=`**QUERY**
`&radius=`**RADIUS**`&limit=`**LIMIT**

Using the function **getNearbyVenues**, the following information for the dataframe is extracted:

- Venue ID
- Venue Name
- Coordinates : Latitude and Longitude
- Category Name

The function **getVenuesByCategory** performs the following:

1. **category** based venue search to simulate user venue searches based on certain places of interest. This search extracts the following information:
    - Venue ID
    - Venue Name
    - Coordinates : Latitude and Longitude
    - Category Name
2. For each retrieved **venueID**, retrive the venues category rating.

To demonstrate user selection of places of interest, We will use this Food Venues category in our further analysis.

- This Foursquare search is expected to collect venues in the following category:
    - category
    - Food Courts
    - Coffee Shops
    - Restaurants
    - Cafés
    - Other food venues

6. Analysis of Neighborhoods

A selection of data out of the venue analysis:

	Town	American Restaurants	Asian Restaurants	BBQ Joints	Bakeries	Bars	Bistros	Breakfast Spots	Breweries	Bubble Tea Shops	Buffets	Burger Joints	
0	ANG MO KIO	0.000000	0.000000	0.0	0.029412	0.0	0.000000	0.029412	0.0	0.029412	0.0	0.029412	
1	BEDOK	0.034483	0.034483	0.0	0.000000	0.0	0.000000	0.000000	0.0	0.000000	0.0	0.034483	
2	BISHAN	0.027778	0.000000	0.0	0.000000	0.0	0.000000	0.000000	0.0	0.055556	0.0	0.000000	
3	BUKIT BATOK	0.000000	0.045455	0.0	0.000000	0.0	0.000000	0.000000	0.0	0.000000	0.0	0.000000	
4	BUKIT MERAH	0.000000	0.000000	0.0	0.000000	0.0	0.111111	0.000000	0.0	0.000000	0.0	0.000000	

7. Analysis of most popular venues

```
# Town=< ANG MO KIO >
                    venue  freq
0             Food Courts  0.18
1   Fast Food Restaurants  0.12
2    Japanese Restaurants  0.06
3           Dessert Shops  0.06
4       Sushi Restaurants  0.06
5                   Cafés  0.06
6            Snack Places  0.03
7           Noodle Houses  0.03
8       Ramen Restaurants  0.03
9             Restaurants  0.03


# Town=< BEDOK >
                     venue  freq
0             Coffee Shops  0.21
1              Food Courts  0.10
2        Sushi Restaurants  0.07
3     Japanese Restaurants  0.07
4    Fast Food Restaurants  0.07
5      American Restaurants  0.03
6       Chinese Restaurants  0.03
7          Sandwich Places  0.03
8   Indonesian Restaurants  0.03
9        Indian Restaurants  0.03


# Town=< BISHAN >
                    venue  freq
0             Coffee Shops  0.14
1     Japanese Restaurants  0.11
2      Chinese Restaurants  0.11
3              Food Courts  0.08
4    Fast Food Restaurants  0.08
5                    Cafés  0.08
```

```
6          Bubble Tea Shops  0.06
7     American Restaurants  0.03
8         Sandwich Places  0.03
9      Italian Restaurants  0.03


# Town=< BUKIT BATOK >
                   venue  freq
0            Food Courts  0.27
1            Coffee Shops  0.14
2     Chinese Restaurants  0.14
3   Fast Food Restaurants  0.14
4    Japanese Restaurants  0.05
5         Sandwich Places  0.05
6         Ice Cream Shops  0.05
7     Italian Restaurants  0.05
8        Thai Restaurants  0.05
9       Asian Restaurants  0.05


# Town=< BUKIT MERAH >
                            venue  freq
0             Chinese Restaurants  0.44
1                    Coffee Shops  0.22
2                     Food Courts  0.11
3                         Bistros  0.11
4                           Cafés  0.11
5                Malay Restaurants  0.00
6                   Noodle Houses  0.00
7   Modern European Restaurants  0.00
8             Miscellaneous Shops  0.00
9             Mexican Restaurants  0.00


# Town=< BUKIT PANJANG >
                     venue  freq
0     Chinese Restaurants  0.20
1      Indian Restaurants  0.13
2        Thai Restaurants  0.13
3             Food Courts  0.13
4           Burger Joints  0.07
5     Seafood Restaurants  0.07
6  Vietnamese Restaurants  0.07
7       Asian Restaurants  0.07
8           Noodle Houses  0.07
9                   Cafés  0.07


# Town=< CENTRAL >
                   venue  freq
0                   Cafés  0.09
1     Chinese Restaurants  0.09
2            Coffee Shops  0.07
3       Ramen Restaurants  0.07
4             Food Courts  0.07
5                  Diners  0.04
6    Japanese Restaurants  0.04
7      Hotpot Restaurants  0.04
8           Noodle Houses  0.04
9   Fast Food Restaurants  0.04


# Town=< CHOA CHU KANG >
```

```
                    venue  freq
0   Fast Food Restaurants  0.15
1            Food Courts  0.11
2            Coffee Shops  0.11
3           Noodle Houses  0.11
4       Asian Restaurants  0.07
5           Dessert Shops  0.04
6           Burger Joints  0.04
7  Portuguese Restaurants  0.04
8         Sandwich Places  0.04
9                   Cafés  0.04


# Town=< CLEMENTI >
                   venue  freq
0            Food Courts  0.24
1  Fast Food Restaurants  0.09
2           Coffee Shops  0.09
3     Dim Sum Restaurants  0.06
4    Japanese Restaurants  0.06
5        Thai Restaurants  0.06
6       Asian Restaurants  0.06
7     Chinese Restaurants  0.06
8    Fried Chicken Joints  0.06
9                   Cafés  0.03


# Town=< GEYLANG >
                              venue  freq
0              Chinese Restaurants  0.24
1              Dim Sum Restaurants  0.12
2                      Food Courts  0.08
3  Vegetarian / Vegan Restaurants  0.08
4                     Coffee Shops  0.08
5                    Noodle Houses  0.08
6             Seafood Restaurants  0.08
7                       BBQ Joints  0.04
8            Fast Food Restaurants  0.04
9                Asian Restaurants  0.04


# Town=< HOUGANG >
                   venue  freq
0            Food Courts  0.19
1  Fast Food Restaurants  0.15
2           Coffee Shops  0.12
3       Asian Restaurants  0.08
4     Chinese Restaurants  0.08
5           Dessert Shops  0.04
6                   Cafés  0.04
7     Fish & Chips Shops  0.04
8         Sandwich Places  0.04
9          Shopping Malls  0.04


# Town=< JURONG EAST >
                    venue  freq
0            Food Courts  0.13
1   Japanese Restaurants  0.13
2     Chinese Restaurants  0.10
3  Fast Food Restaurants  0.08
4                   Cafés  0.08
5            Coffee Shops  0.05
```

```
6                    Diners  0.03
7  Chinese Breakfast Places  0.03
8         Ramen Restaurants  0.03
9            Noodle Houses  0.03


# Town=< JURONG WEST >
                     venue  freq
0   Fast Food Restaurants  0.16
1     Chinese Restaurants  0.13
2       Asian Restaurants  0.10
3    Japanese Restaurants  0.10
4            Food Courts  0.10
5                  Cafés  0.06
6          Wings Joints  0.03
7        Sandwich Places  0.03
8  Hong Kong Restaurants  0.03
9  Indonesian Restaurants  0.03


# Town=< KALLANG/WHAMPOA >
                   venue  freq
0           Food Courts  0.20
1         Noodle Houses  0.13
2          Snack Places  0.13
3            BBQ Joints  0.13
4   Chinese Restaurants  0.13
5   Seafood Restaurants  0.07
6           Soup Places  0.07
7       Thai Restaurants  0.07
8     Indian Restaurants  0.07
9    Italian Restaurants  0.00


# Town=< MARINE PARADE >
                   venue  freq
0         Noodle Houses  0.29
1   Chinese Restaurants  0.14
2   Seafood Restaurants  0.10
3     Asian Restaurants  0.10
4            BBQ Joints  0.05
5                  Bars  0.05
6  Dim Sum Restaurants  0.05
7      Thai Restaurants  0.05
8         Dessert Shops  0.05
9           Coffee Shops  0.05


# Town=< PASIR RIS >
                     venue  freq
0   Fast Food Restaurants  0.18
1            Food Courts  0.18
2           Coffee Shops  0.12
3        Sandwich Places  0.06
4  Hong Kong Restaurants  0.06
5               Bakeries  0.06
6      Asian Restaurants  0.06
7     Italian Restaurants  0.06
8      Sushi Restaurants  0.06
9            Restaurants  0.06


# Town=< PUNGGOL >
```

```
                       venue  freq
0           Food Courts  0.16
1     Seafood Restaurants  0.08
2   Fast Food Restaurants  0.08
3                  Cafés  0.08
4            Soup Places  0.04
5      Ramen Restaurants  0.04
6        Sandwich Places  0.04
7  Comfort Food Restaurants  0.04
8            Coffee Shops  0.04
9      Chinese Restaurants  0.04


# Town=< QUEENSTOWN >
                          venue  freq
0          Chinese Restaurants  0.38
1                  Food Courts  0.25
2             Thai Restaurants  0.12
3          Italian Restaurants  0.12
4            Malay Restaurants  0.12
5         American Restaurants  0.00
6         Macanese Restaurants  0.00
7  Modern European Restaurants  0.00
8          Miscellaneous Shops  0.00
9          Mexican Restaurants  0.00


# Town=< SEMBAWANG >
                     venue  freq
0           Food Courts  0.28
1          Coffee Shops  0.17
2      Asian Restaurants  0.11
3  Fast Food Restaurants  0.11
4    Italian Restaurants  0.06
5                Bistros  0.06
6   Japanese Restaurants  0.06
7      Sushi Restaurants  0.06
8    Chinese Restaurants  0.06
9                  Cafés  0.06


# Town=< SENGKANG >
                     venue  freq
0           Food Courts  0.18
1          Coffee Shops  0.18
2  Fast Food Restaurants  0.18
3                  Cafés  0.18
4    English Restaurants  0.06
5    Chinese Restaurants  0.06
6            Restaurants  0.06
7      Sushi Restaurants  0.06
8        Sandwich Places  0.06
9    Mexican Restaurants  0.00


# Town=< SERANGOON >
                     venue  freq
0  Fast Food Restaurants  0.14
1          Coffee Shops  0.10
2   Japanese Restaurants  0.10
3     Indian Restaurants  0.05
4                  Cafés  0.05
5            Steakhouses  0.05
```

```
6          Sushi Restaurants  0.05
7        Chinese Restaurants  0.05
8                Food Courts  0.05
9           Thai Restaurants  0.05


# Town=< TAMPINES >
                    venue  freq
0             Food Courts  0.20
1             Coffee Shops  0.16
2   Fast Food Restaurants  0.12
3      Italian Restaurants  0.08
4     Japanese Restaurants  0.08
5     American Restaurants  0.04
6      Seafood Restaurants  0.04
7     Fried Chicken Joints  0.04
8     Dumpling Restaurants  0.04
9             Pizza Places  0.04


# Town=< TOA PAYOH >
                    venue  freq
0             Coffee Shops  0.18
1   Fast Food Restaurants  0.12
2             Food Courts  0.12
3     Chinese Restaurants  0.12
4            Snack Places  0.06
5                   Cafés  0.06
6            Burger Joints  0.03
7          Sandwich Places  0.03
8      Italian Restaurants  0.03
9        Asian Restaurants  0.03


# Town=< WOODLANDS >
                    venue  freq
0             Food Courts  0.16
1     Japanese Restaurants  0.13
2                   Cafés  0.10
3   Fast Food Restaurants  0.10
4             Coffee Shops  0.10
5     Chinese Restaurants  0.10
6     American Restaurants  0.06
7      Italian Restaurants  0.03
8     Fried Chicken Joints  0.03
9             Pizza Places  0.03


# Town=< YISHUN >
                    venue  freq
0             Food Courts  0.28
1       Hainan Restaurants  0.06
2    Hong Kong Restaurants  0.06
3        Halal Restaurants  0.06
4         Thai Restaurants  0.06
5   Fast Food Restaurants  0.06
6        Sushi Restaurants  0.06
7         Bubble Tea Shops  0.06
8       Fish & Chips Shops  0.06
9            Burger Joints  0.06
```

8. Clustering Neighborhoods

In order to cluster the Neighborhoods into 5 clusters, I use the *k*-means.

	Town	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
0	ANG MO KIO	Food Courts	Fast Food Restaurants	Dessert Shops	Japanese Restaurants	Sushi Restaurants	Cafés	Ramen Restaurants	Hong Kong Restaurants	Halal Restaurants
1	BEDOK	Coffee Shops	Food Courts	Sushi Restaurants	Japanese Restaurants	Fast Food Restaurants	Wings Joints	Fried Chicken Joints	Indian Restaurants	Ice Cream Shops
2	BISHAN	Coffee Shops	Japanese Restaurants	Chinese Restaurants	Fast Food Restaurants	Food Courts	Cafés	Bubble Tea Shops	American Restaurants	Portuguese Restaurants
3	BUKIT BATOK	Food Courts	Coffee Shops	Fast Food Restaurants	Chinese Restaurants	Asian Restaurants	Thai Restaurants	Pizza Places	Ice Cream Shops	Japanese Restaurants
4	BUKIT MERAH	Chinese Restaurants	Coffee Shops	Food Courts	Bistros	Cafés	Dongbei Restaurants	Comfort Food Restaurants	Dessert Shops	Dim Sum Restaurants

9. Discussion

Singapore is a very interesting town full of attractions, among them restaurants and other food venues. The research in this notebook provides useful information in addition to the classical tourist guides. Furthermore, recommendations for recreation areas can be found, too. So we have a nice combination of lovely places in different Towns to visit in this town. For me to say: I'm prepared for my trip to Singapore.

To retrieve data for finding useful recommendations. I used the Foursquare API. The list of venues is not exhaustive, as the API has its limitations. Additionally, not all places in the recommendations are rated, thus there are some big gaps. To close them, some efforts must be put in the collection of missing data.

The generated clusters from the results shows that there are some excellent and interesting places located in areas where the median rents are cheaper. This kind of results may be very interesting for travelers who are also on budget constraints. Result shows that most popular food venue among Singaporeans, residents and visitors are Food Courts, Coffee Shops and Fast Food Restaurants. The highest rated Food Courts are located in Marine Parade, and in Central Areas.

Definitely places I'll visit.