IBM APPLIED DATA SCIENCE CAPSTONE PROJECT

INTRODUCTION

This report summarizes the findings in my IBM applied data science capstone project. The project's intention was to answer the following question:

> "Which city would be best to open up a restaurant and what type of restaurant should one open?"

METHODOLOGY

First stage of the project will focus on retrieving data from the data sources and clean the data so that they can be processed with Pandas data frame. Data was scrapped using BeautifulSoup4. Scrapped data usually contains unneeded characters and signs and should be cleaned.

Second stage of the project will focus on retrieving geolocation data from Foursquare and look for restaurants in the target city. The project will count the number of restaurants, broken down into categories. The project will determine a type of restaurant that is least present in the area.

Third stage of the project will seek for additional information that will reinforce the recommendation for a restaurant in the area from the above.

DATA SOURCES

- List of largest cities (https://en.wikipedia.org/wiki/List_of_largest_cities),
- List of cities by GDP (https://en.wikipedia.org/wiki/List_of_cities_by_GDP).

TARGET AUDIENCE

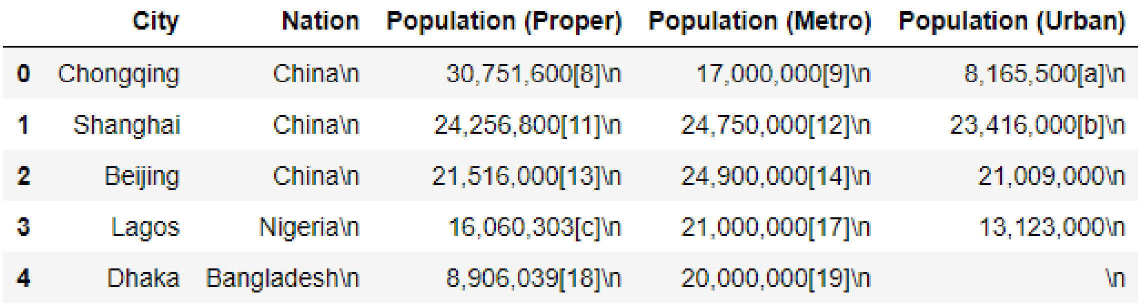
Someone looking to open up a restaurant globally.

DATA SOURCES

- Population, GDP of cities: Wikipedia
- Geolocation coordinate data: https://simplemaps.com/data/world-cities
- Place data: Foursquare

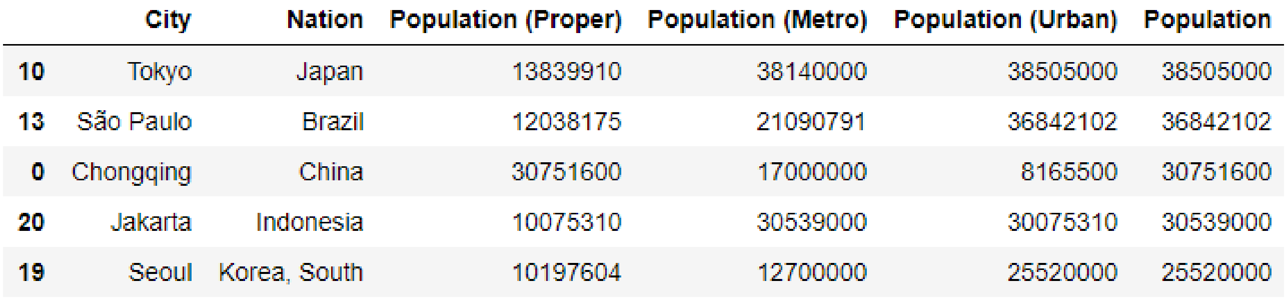
DATA RETRIEVAL AND CLEANING

1. Data for population initially scrapped from Wikipedia had many unnecessary data which interfered with mathematical calculation.
   The following table shows the uncleaned table



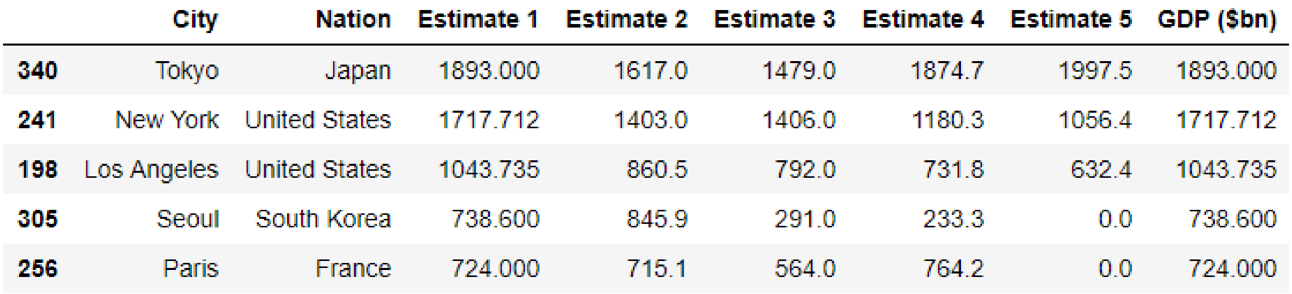
	City	Nation	Population (Proper)	Population (Metro)	Population (Urban)
0	Chongqing	China\n	30,751,600[8]\n	17,000,000[9]\n	8,165,500[a]\n
1	Shanghai	China\n	24,256,800[11]\n	24,750,000[12]\n	23,416,000[b]\n
2	Beijing	China\n	21,516,000[13]\n	24,900,000[14]\n	21,009,000\n
3	Lagos	Nigeria\n	16,060,303[c]\n	21,000,000[17]\n	13,123,000\n
4	Dhaka	Bangladesh\n	8,906,039[18]\n	20,000,000[19]\n	\n

2. String modifications were applied to the data frame to remove contents in the parenthesis. Also the \n signs were also removed
   After cleaning the data, notice that the columns that should have numbers, such as population data has been changed to type int.



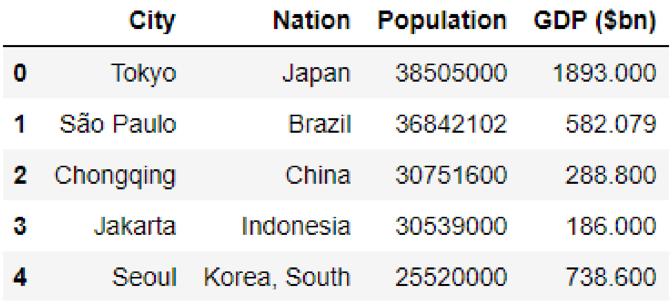
	City	Nation	Population (Proper)	Population (Metro)	Population (Urban)	Population
10	Tokyo	Japan	13839910	38140000	38505000	38505000
13	São Paulo	Brazil	12038175	21090791	36842102	36842102
0	Chongqing	China	30751600	17000000	8165500	30751600
20	Jakarta	Indonesia	10075310	30539000	30075310	30539000
19	Seoul	Korea, South	10197604	12700000	25520000	25520000

3. The same cleaning process was applied for the GDP data from Wikipedia.
   The table below shows the dataframe.head() for the GDP data retrieved for the major cities.
   Notice that there are multiple cities for a nation.



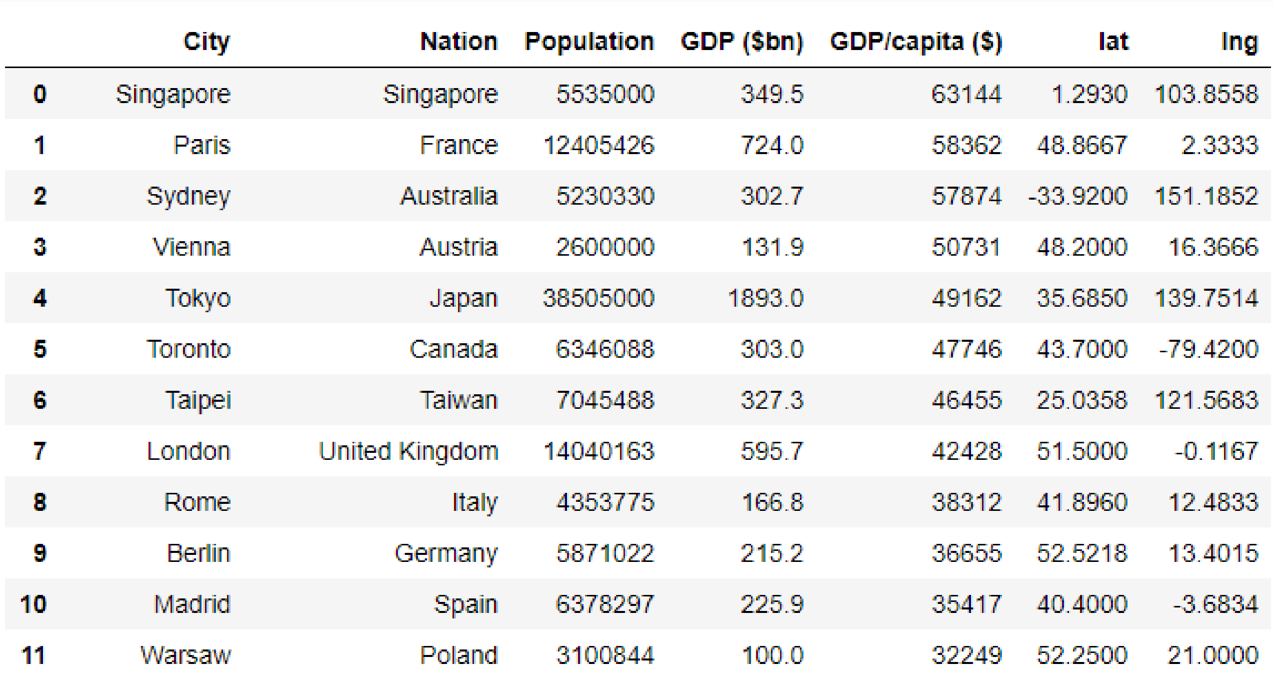
	City	Nation	Estimate 1	Estimate 2	Estimate 3	Estimate 4	Estimate 5	GDP ($bn)
340	Tokyo	Japan	1893.000	1617.0	1479.0	1874.7	1997.5	1893.000
241	New York	United States	1717.712	1403.0	1406.0	1180.3	1056.4	1717.712
198	Los Angeles	United States	1043.735	860.5	792.0	731.8	632.4	1043.735
305	Seoul	South Korea	738.600	845.9	291.0	233.3	0.0	738.600
256	Paris	France	724.000	715.1	564.0	764.2	0.0	724.000

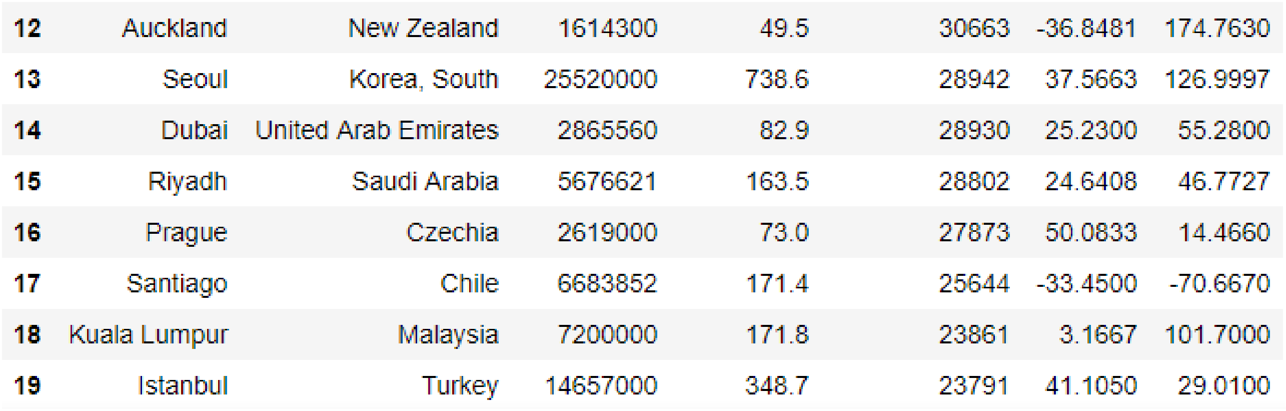
4. Before merging the data frame, city with the highest GDP was selected and the rest dropped from the data frame.
   The below shows data frame after merging.



	City	Nation	Population	GDP ($bn)
0	Tokyo	Japan	38505000	1893.000
1	São Paulo	Brazil	36842102	582.079
2	Chongqing	China	30751600	288.800
3	Jakarta	Indonesia	30539000	186.000
4	Seoul	Korea, South	25520000	738.600

5. In order to retrieve geospatial data, data was downloaded from https://simplemaps.com/data/world-cities due to problems with retrieving data from the Google platform. After merging data, columns lat and lng was added to the data frame for each of the major cities in the data frame.
The table below shows all the data retrieved (population, GDP, geospatial data) for the top 20 countries with the highest GDP/capita in US$.





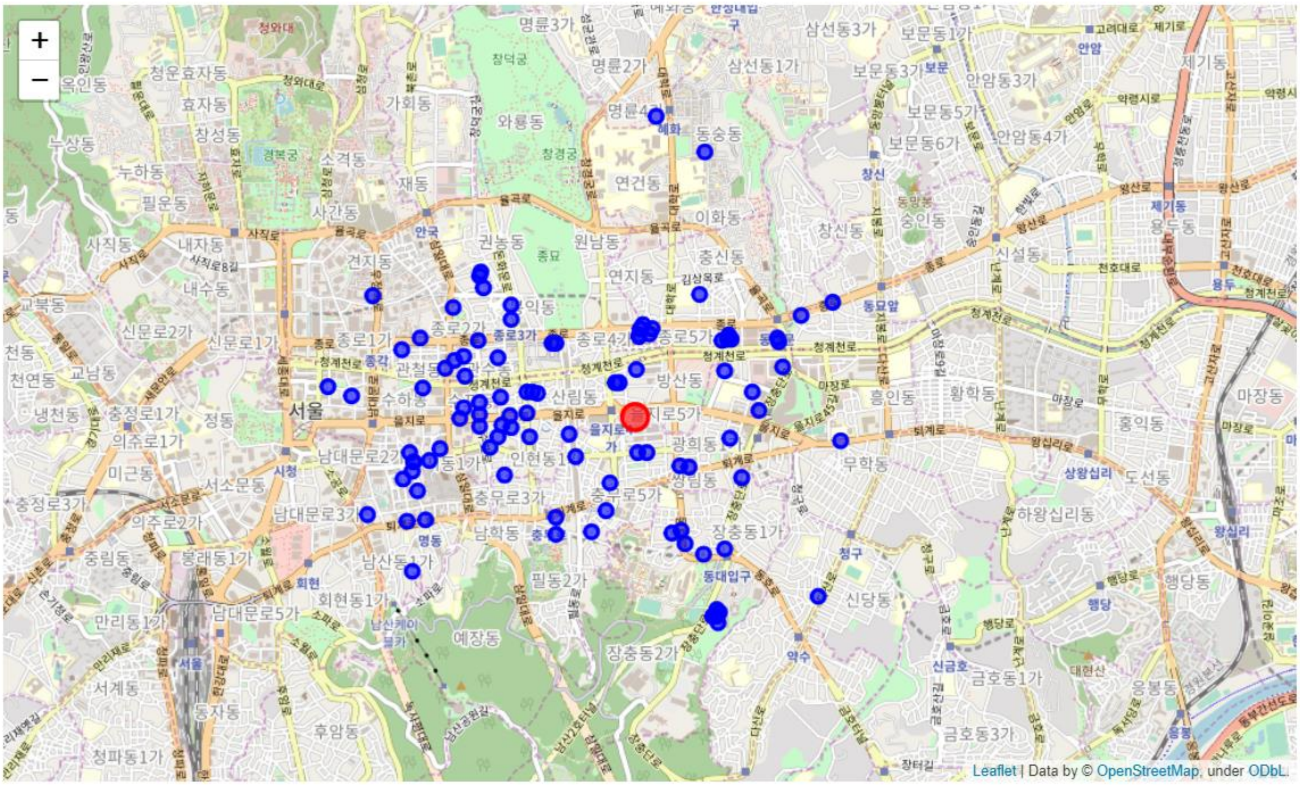
	City	Nation	Population	GDP ($bn)	GDP/capita ($)	lat	lng
0	Singapore	Singapore	5535000	349.5	63144	1.2930	103.8558
1	Paris	France	12405426	724.0	58362	48.8667	2.3333
2	Sydney	Australia	5230330	302.7	57874	-33.9200	151.1852
3	Vienna	Austria	2600000	131.9	50731	48.2000	16.3666
4	Tokyo	Japan	38505000	1893.0	49162	35.6850	139.7514
5	Toronto	Canada	6346088	303.0	47746	43.7000	-79.4200
6	Taipei	Taiwan	7045488	327.3	46455	25.0358	121.5683
7	London	United Kingdom	14040163	595.7	42428	51.5000	-0.1167
8	Rome	Italy	4353775	166.8	38312	41.8960	12.4833
9	Berlin	Germany	5871022	215.2	36655	52.5218	13.4015
10	Madrid	Spain	6378297	225.9	35417	40.4000	-3.6834
11	Warsaw	Poland	3100844	100.0	32249	52.2500	21.0000
12	Auckland	New Zealand	1614300	49.5	30663	-36.8481	174.7630
13	Seoul	Korea, South	25520000	738.6	28942	37.5663	126.9997
14	Dubai	United Arab Emirates	2865560	82.9	28930	25.2300	55.2800
15	Riyadh	Saudi Arabia	5676621	163.5	28802	24.6408	46.7727
16	Prague	Czechia	2619000	73.0	27873	50.0833	14.4660
17	Santiago	Chile	6683852	171.4	25644	-33.4500	-70.6670
18	Kuala Lumpur	Malaysia	7200000	171.8	23861	3.1667	101.7000
19	Istanbul	Turkey	14657000	348.7	23791	41.1050	29.0100

USING FOURSQUARE TO RETRIEVE VENUE INFORMATION FOR A LOCATION

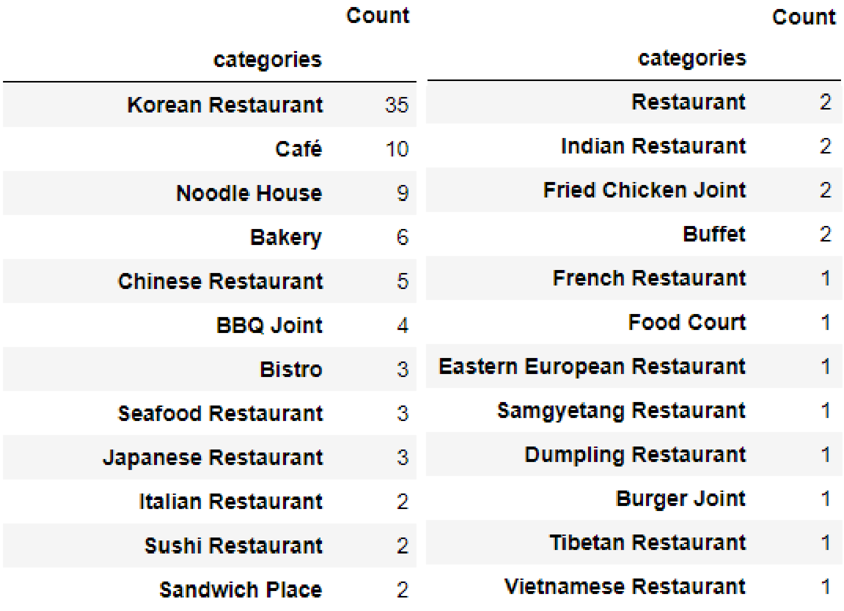
1. Seoul was selected arbitrary from the list of top 20 countries

2. Foursquare data retrieved for the Seoul coordinate of type “food”

3. The red circle depicts the coordinate passed onto Foursquare for retrieval. Due to restrictions, only around 50 venues are retrieved from each of Foursquare queries. The food venues retrieved from the query is marked as a blue circle in the map below.



4. The below shows the count of venues classified into type of restaurant.



categories	Count
Korean Restaurant	35
Café	10
Noodle House	9
Bakery	6
Chinese Restaurant	5
BBQ Joint	4
Bistro	3
Seafood Restaurant	3
Japanese Restaurant	3
Italian Restaurant	2
Sushi Restaurant	2
Sandwich Place	2

categories	Count
Restaurant	2
Indian Restaurant	2
Fried Chicken Joint	2
Buffet	2
French Restaurant	1
Food Court	1
Eastern European Restaurant	1
Samgyetang Restaurant	1
Dumpling Restaurant	1
Burger Joint	1
Tibetan Restaurant	1
Vietnamese Restaurant	1

INITIAL RESULT

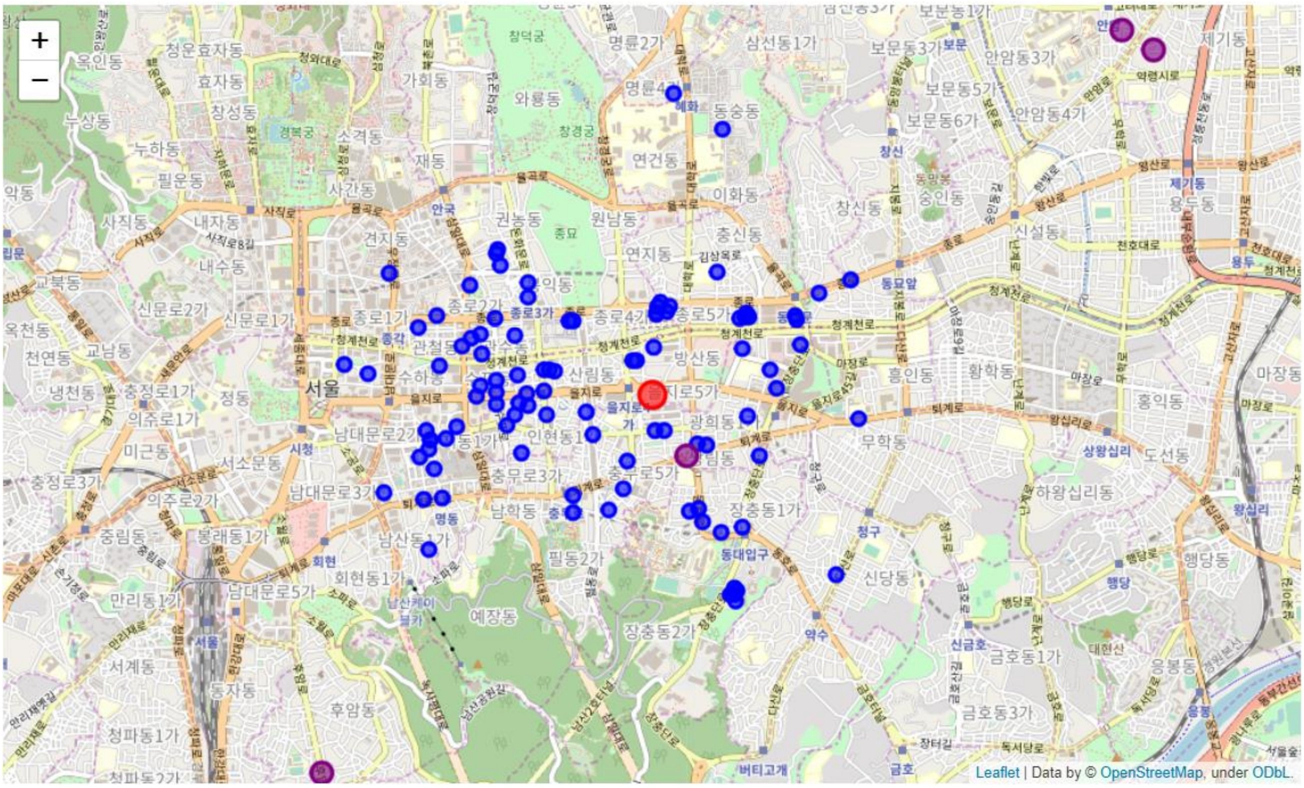
The initial thesis is that there are no restaurants related to Islam. The project makes the assumption that there should be demand for Halal foods if there are enough Islam population in the city. Research shows that there are around 100,000 Islams living within Seoul.

The idea is to see if there are Islam mosques in Seoul and locate them and see whether it would be feasible to have a Halal food restaurant within the target area.

RESULT DISCUSSION

Query for Islam mosques from Foursquare shows that there are two Mosques within the immediate vicinity of the initial search area. For the larger area around Seoul, there are a total of five mosques that are within 30 minutes' drive, which would be considered to be a feasible distance for customers.

The map below shows restaurants in blue circle and Islam mosques as purple dots. Red circle shows the central point for the search queries.



CONCLUSION

The project concludes that there is potential for prospective investors or entrepreneurs to open up a Halal food restaurant in Seoul in the norther district.