Exploring the neighborhoods in Doha,Qatar For starting a crepe shop.

Applied Data science Capstone project .

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Date 09th -June-2021

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Introduction

Doha is the capital and most populous city of Qatar. It has a population of **956,460** .

It is Qatar's fastest growing city, with over 80% of the nation's population living in Doha or its surrounding suburbs, and it is the economic centre of the country.

Having said the above , an existent business owner is interested in the idea of opening a new dessert shop '**Crepeaholic'** in Qatar ,Doha.

Crepeaholic, an upscale creperie, was founded in Amman, Jordan in the year 2013. Because of its booming success, it has expanded into an international franchise, and is now also in the glistening capitol of the UAE, Abu Dhabi.

Crepeaholic is known for its hot, freshly-baked savory and sweet crepes and waffles, which are crafted with top quality flour and naturalx homemade ingredients.

Business Problem

In this project we aim to explore the idea of opening a new Crepes&Waffles shop in Doha,Qatar .Followed by recommendation of the best location for it .

First , we would like to research the the demographics of Qatar and Doha in particular . IF possible ,pursued by analysis of market growth (Resturants/cafes count during time) .with intention to investigate the question of how many resturants/cafes were opened and closed in a short period of time .

Since there are lots of restaurants&cafes in Doha, we will try to detect locations that are not already crowded with restaurants/cafes but crowded with people. and as per the owner ; the focus shall be on family oriented areas and with a preference of a community aged between 16-35 years old . We are also particularly interested in areas with no or few desserts&Cafe shops in vicinity. We would also prefer locations as close to city center as possible, considering all other conditions are met .

Data Required

Based on definition of our business case, factors that will influence our decision are:

- Number of current restaurants/cafes in Doha and each Neighbourhood.
- A time series that shows the growth of restaurants/cafes In Doha and specifically the targeted kind of shops.
- Demographics of each neighbourhood .
- If available ,investigate the number of restaurants and cafes that were opened and closed in the period of 2017-2021.
- Distance of neighbourhood from city centre.
- Top 5 venue categories in each neighbourhood and its corresponded average customer review rates.

Data Needed :

- List of Doha's Neighbourhoods.
- Demographics tables about Doha .
- Foursquare API location data.
- If available , customer reviews and rates for each venue in Foursquare data.
- If available , foot traffic and check-ins details .

Data collection

Neighbourhoods ,Area and population Data

The data of the neighbourhoods and population in Doha was scraped from https://en.wikipedia.org/wiki/Zones_of_Qatar#Ad_Dawhah_Municipality.

The data is read into a pandas data frame using the read_html() method.

The top 10 rows of the Data-frame are shown in **Figure 1**

	Zone no.	Districts	Area (km²)	Population (2015)
0	1	Al Jasrah	0.4	240 (2010)[6]
1	2	Al Bidda	NaN	35 (2010)[6]
2	3	Fereej Mohamed Bin Jasim Mushayrib	NaN	4,886 (2010)[6]
3	4	Mushayrib	0.3	9791
4	5	Al Najada Barahat Al Jufairi Fereej Al Asmakh	0.2	2086
5	6	Old Al Ghanim	0.3	1124
6	7	Al Souq	0.3	297
7	10	Wadi Al Sail	NaN	8 (2010)[6]
8	11	Rumeilah	NaN	63 (2010)[6]
9	12	Al Bidda	NaN	1,067 (2010)[6]

Geographical coordinates Data

The data of geographical coordinates can be obtained from the **Geocoder Library**.

Using Geocoder ,we will bring the latitude and longitude for neighbourhood as below table for the head 20 neighbourhoods before data cleansing :

	Neighborhood	Latitude	Longitude
0	Ad Dawhah al Jadidah	25.2758	51.5336
1	Al Dafna Al Qassar	25.3122	51.5194
2	Al Hilal	25.2593	51.542
3	Al Khulaifat Ras Abu Aboud	25.2843	51.5545
4	Al Markhiya	25.3242	51.4891
5	Al Messila	25.3034	51.4881
6	Al Najada Barahat Al Jufairi Fereej Al Asmakh	25.2848	51.5336
7	Al Rufaa Old Al Hitmi	25.284	51.5478
8	Al Sadd	25.2816	51.5008
9	Al Sadd New Al Mirqab Fereej Al Nasr	25.2694	51.4962
10	Al Souq	25.2889	51.5373
11	Al Thumama	25.2288	51.5556
12	As Salatah Al Mirqab	25.2895	51.542
13	Doha International Airport	25.2572	51.5899
14	Duhail	25.3495	51.4669
15	Fereej Abdel Aziz	25.2763	51.5269
16	Fereej Bin Durham Al Mansoura	25.2704	51.5374
17	Fereej Bin Mahmoud	25.284	51.5145
18	Fereej Bin Omran New Al Hitmi Hamad Medical City	25.2957	51.5013
19	Fereej Kulaib	25.3154	51.4889

Venues' data

The venue data has been extracted using the **Foursquare API**. This data contains venue recommendations for all neighbourhoods in Doha and is used to study the popular venues of different neighbourhoods as well as build the unsupervised learning model to cluster neighbourhoods. The venue recommendations of all neighbourhoods were obtained with a limit of 200, that is, maximum of 200 venue recommendations per neighbourhood and a radius of 1 km around the neighbourhood's geographical coordinates. Figure 5 shows the top 5 rows depicting the results obtained after cleaning the data from Foursquare API

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Ad Dawhah al Jadidah	25.27583	51.53361	sealine beach	25.273369	51.530212	Beach
1	Ad Dawhah al Jadidah	25.27583	51.53361	Mashweyat Lamazani Kebab	25.279934	51.536991	BBQ Joint
2	Ad Dawhah al Jadidah	25.27583	51.53361	Meesh Me-Time Cafe	25.273987	51.541470	Café
3	Ad Dawhah al Jadidah	25.27583	51.53361	Kebab King	25.275301	51.539706	Indian Restaurant
4	Ad Dawhah al Jadidah	25.27583	51.53361	City Gym	25.275131	51.537954	Gym

Methodology

This section provides details for the methodology used in the project.

As we are constrained with the data provided and its limits . our aim in this study would be understanding the similarities between neighbourhoods based on # of venues , type of venues , number of dessert shops , population and population densities .we will be running an unsupervised machine learning technique called K means clustering to group the neighboorhoods based on the similarities . with conjunction with data visualization in graphs and maps , we will be able to reach our goal of this study to determine a location for our new dessert shop that we think will have more potential to succeed .

- In order to analyse the neighbourhoods and venues' surrounding , we need to cleanse the data and make sure our data is correct ,logical , readable with right formats and doesn't have duplicates .

Neighbourhoods

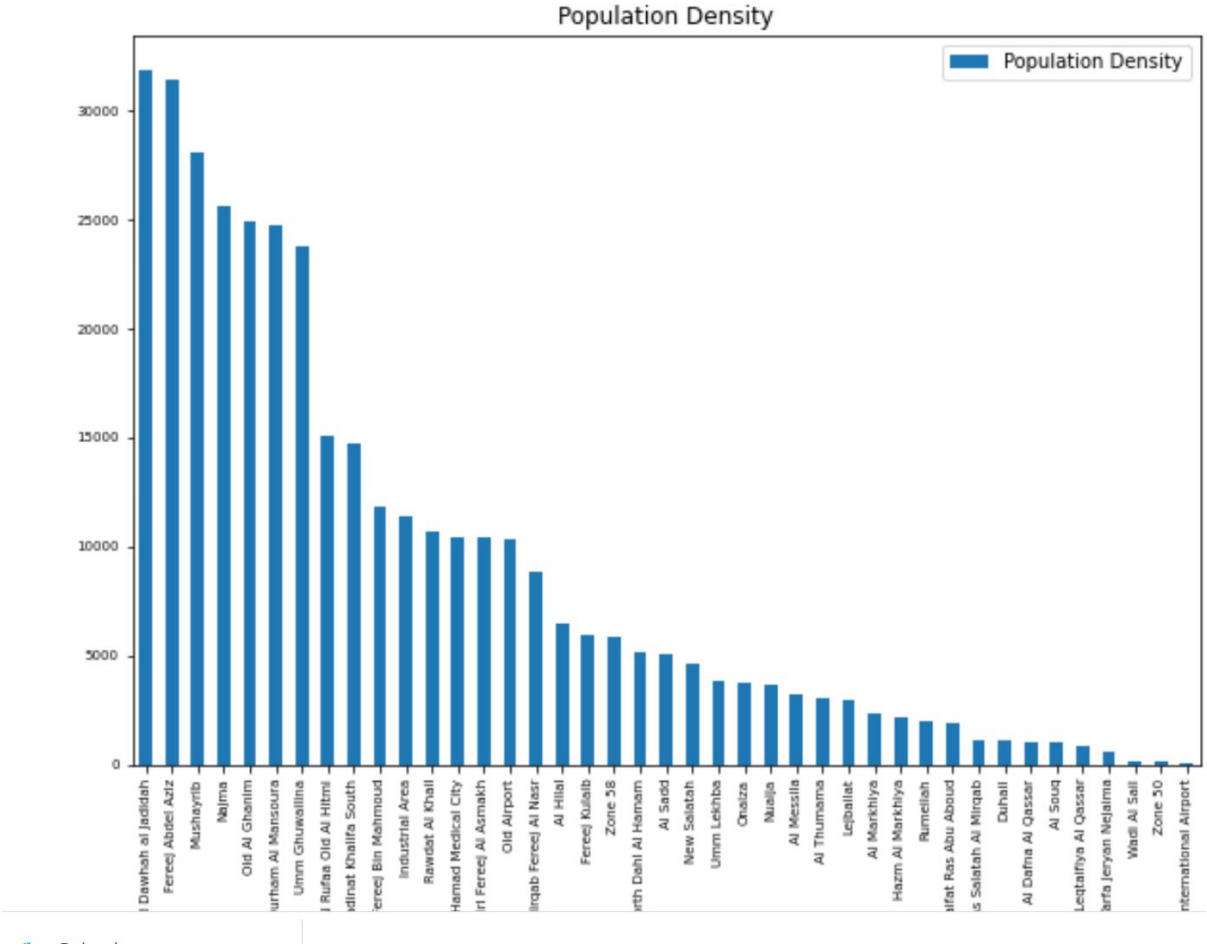
- After Examining the available raw data , these points were noticed :

- ✓ **The neighbourhoods data** consists of columns : Zone #, District or Neighbourhood, Area ,and corresponded Population.
- ✓ Data extracted from Wikipedia but the reference is a report from Ministry of development planning and statistics in Qatar.
- ✓ Data originally had 56 neighbourhoods/districts.
- ✓ Some population values are based on old report in 2010 .by observing these values , we can see they represent a very minimal out of total .Thus , we may remove these rows for the sake of our study .
- ✓ Last row represents the total for all Doha and we may drop it .
- ✓ some districts columns have more than one neighbourhood inside it.
- ✓ Population data type is String, we needed to change it to Integer.
- ✓ Population density was calculated by dividing the population by the area of neighbourhood .

- ✓ It was noticed that there are duplicates in the Neighbourhood column but it has different population and areas. We will assume that each row of them is a part of total , therefore we will group them based on Neighbourhoods .

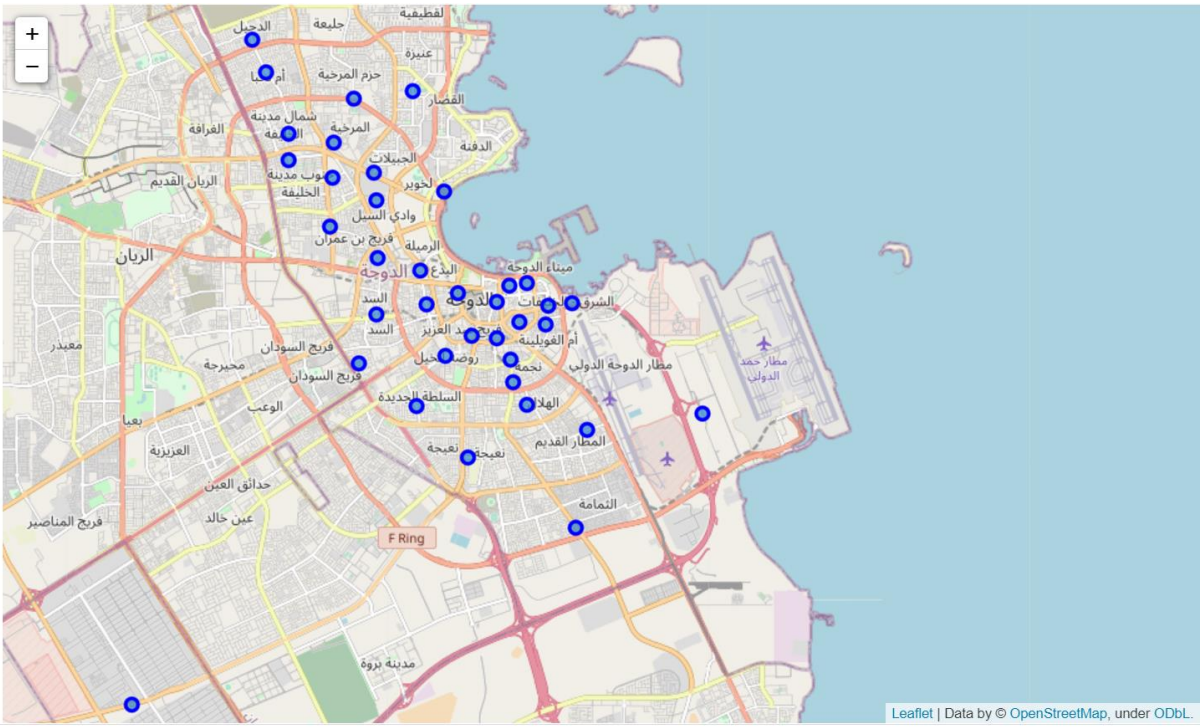
- ✓ After making the amendments on the neighbourhoods' data , the resultant table consists of 41 neighbourhood in Doha , Qatar .

- ✓ Plotting the population density Vs Neighbourhoods .



Geographical coordinates .

- ✓ After extracting the longitude and latitude for each neighbourhood , we Visualized and plotted them in maps :



- ✓ It was noticed that two neighbourhoods are having the same geographical coordinates (zone 50 and zone 58), the one with least population were eliminated from the list .

Venues

- One of the objectives included in the study was to determine how the dessert shops and restaurants/cafes in general were growing during time . Another objective was to detect how many dessert shops were opened and closed during the time between 2015 till today. Both information could have been used as a signal of venues growth and good /bad investing trend in each neighbourhood .
  Unfortunately , the data from the FOURSQUARE API doesn't provide historical info . thus , these questions were skipped in the study .

- As we have taken the exploration radius as 1 KM ,some neighbourhoods might interfere in each other area boundaries .
  Therefore , we have to remove the duplicates venues that appear in various neighbourhoods .

- We would like to examine the number of venues for each category , as below sample from the table :

	Venue Category
Café	129
Hotel	112
Middle Eastern Restaurant	83
Coffee Shop	57
Indian Restaurant	48
Restaurant	46
Fast Food Restaurant	41
Asian Restaurant	32
Pizza Place	26

- And more interestingly for the purpose of this study , we would like to see the number of desserts shops in each neighbourhood as below :

	Neighborhood	Dessert shops count
0	Onaiza Leqtaifiya Al Qassar	4
1	Hazm Al Markhiya	2
2	Zone 50	1
3	Old Airport	1
4	Zone 58	1
5	Al Dafna Al Qassar	1
6	Duhail	1
7	Al Souq	1
8	Fereej Abdel Aziz	1

Machine learning

- K-means unsupervised learning technique was used to cluster neighbourhoods based on the category of venues near neighbourhoods.

- We grouped the data obtained from the FOURSQUARE API to be based on neighbourhoods and converted to the numerical variables by using get_dummies method in pandas .

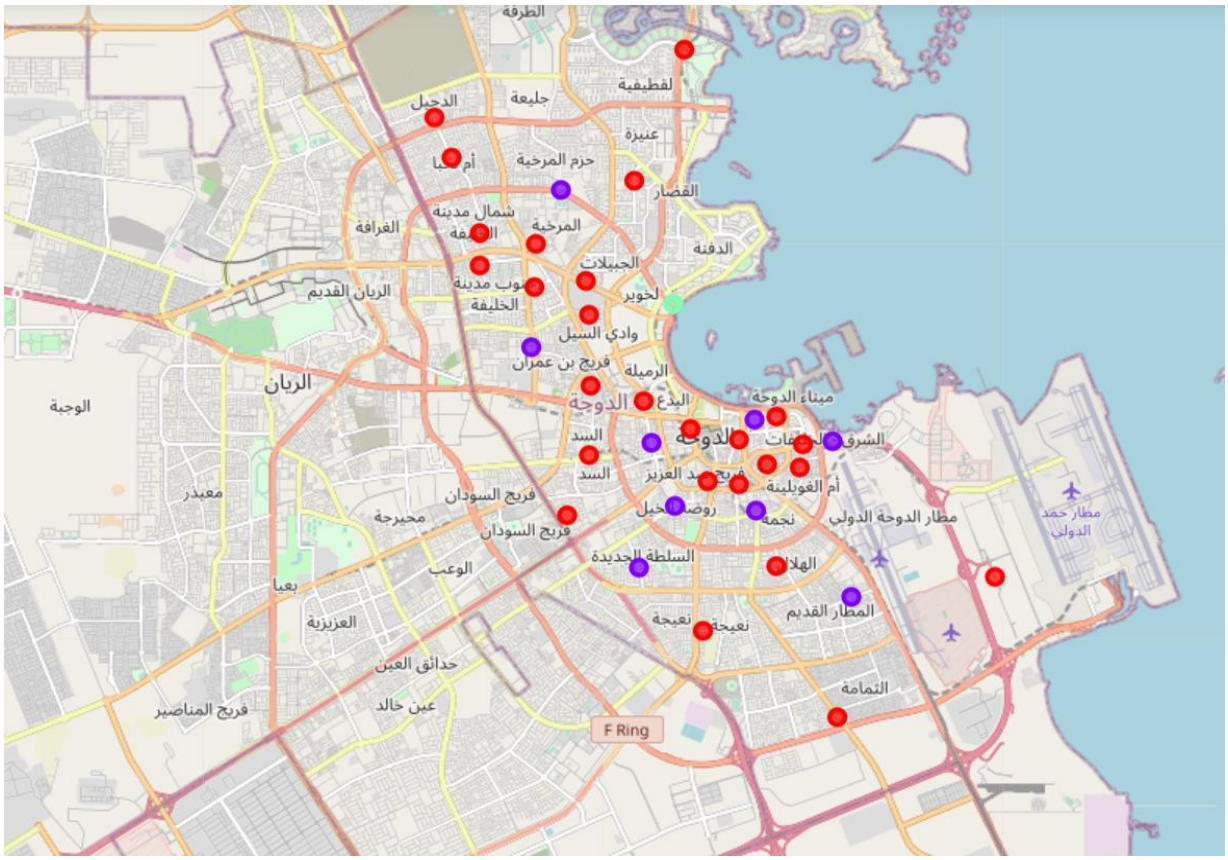
- In later stage , we also added the columns of (population , density , # of venues) as to be considered while clustering .

- As data has different scales , we have used a standardization of the X's before running the clustering process . we have used StandardScaler Library .

- The number of clusters were chosen based on Silhouette scores.
  And K equals to 3 .

Results

- An output was obtained after fitting a clustering model using SK-Learn library and was plotted in map to have wider view in order to take the right Decision about the next shop's location in Doha .
  The map as below :



Conclusions

- We have successfully analysed the neighbourhoods in Doha, Qatar for determining which would be the best neighbourhoods for opening a new dessert shop. We have considered in our decision the location data and some demographics about the city . We have plotted the neighbourhoods and its corresponded info in the map above . By looking into map in Conjunction with the current dessert_shops list , It was noticed that most Dessert shops are located in the north and west of Doha . interestingly ,these locations aren't the most populated ones . Therefore , I see a great opportunity to locate a new dessert shop near the port in the city centre . This area is highly dense populated area having a lot venues and malls(which's a sign of good traffic) but not dessert (crepe and waffles) shops . The Industrial area is highly populated and has no dessert shops but I eliminated it as it's unlikely for dessert shops to work successfully in such areas .

- The optimal neighbourhoods would be :

1. Ad Dawhah al Jadidah --- as it's the centroid of other populated neighbourhoods and it seems easier to reach .
2. Old Al Ghanim