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Battle of Neighborhoods in Doha, Qatar

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Introduction/Business Problem

Currently, I am living in ***Al Dafna*** Area in Doha, Qatar. I had chosen this place because my office (***Ooredoo HQ1***) was very close to my house. There are Cafes, Restaurants, Gym and Park near my house and I am very comfortable as it fits my criterion of a living place.

Now, my employer has located my department to another office (***Ooredoo HQ2***) which is near old Doha Air-Port. There are severe traffic issues in the morning and evening and a lot of my time is being wasted due to traffic jams while going to office or while coming back to home.

I want to move closer to my new office but I want my new house to be in similar area as ***Al Dafna***. I have compared neighboroods closer to my new office with ***Al Dafna*** and trying to find out which area is more suitable for me.

Data

I found a Wikipedia link that has details such as Name, Covered Area and Population of almost all Neighborhoods of Doha. Here is the link;

Webscraping was done by ***BeautifulSoup*** and then table was converted to Pandas DataFrame as shown in snapshot below;

	Community	Area(km2)	Population (2010)	Population density(/km2)
0	Al Bidda	0.8 km²	1067.0	1,398.0/km²
1	Al Dafna	1.1 km²	19.0	17.7/km²
2	Ad Dawhah al Jadidah	0.5 km²	13059.0	27,358.5/km²
3	Al Egla	NaN	NaN	NaN
4	Al Hilal	1.8 km²	11257.0	6,393.4/km²

I have used ***geocoder*** Library of Python to find out Latitudes and Longitudes of all communities in Doha. All unnecessary columns were removed and the communities without coordinates were also removed for analysis. Here is the snapshot showing final shape and first few rows of data frame;

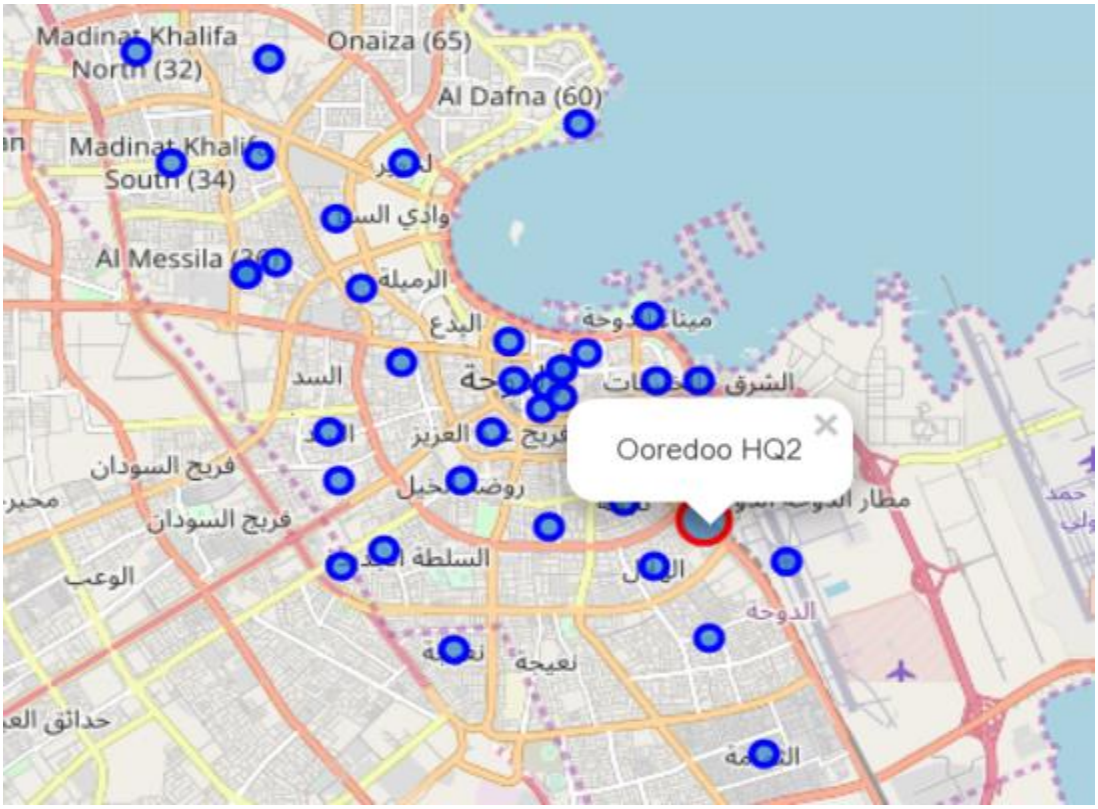
```
print(df_doha.shape)
df_doha.head()
```

```
(51, 3)
```

	Neighborhood	Latitude	Longitude
0	Al Bidda	25.290243	51.526697
1	Al Dafna	25.319584	51.536284
2	Al Hilal	25.260376	51.546488
3	Al Kharayej	25.209836	51.454974
4	Al Khulaifat	25.285061	51.552715

Methodology

Folium library was used to create a map of all neighborhoods as well as Ooredoo HQ2. It was used to mark closest neighborhoods from Ooredoo HQ2. It was found that Najma, Um Ghawailina and Al Hilal are three closest Neighborhoods.



Foursquare API was used to explore up to 100 nearby venues from each Neighborhood within the radius of 1km. Result was normalized and converted to Pandas dataFrame. It resulted in 2398 different venues of 190 different categories.

```
print(doha_venues.shape)
doha_venues.head()
```

```
(2398, 7)
```

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Al Bidda	25.290243	51.526697	Corniche (الكورنيش)	25.294657	51.529693	Waterfront
1	Al Bidda	25.290243	51.526697	Jasmine Thai Restaurant	25.288038	51.532121	Thai Restaurant
2	Al Bidda	25.290243	51.526697	Souq Waqif (سوق واقف)	25.287797	51.533051	Flea Market
3	Al Bidda	25.290243	51.526697	Usta Turkish Kebap & Doner	25.286076	51.531224	Turkish Restaurant
4	Al Bidda	25.290243	51.526697	Argan Restaurant	25.289311	51.531295	Moroccan Restaurant

A new Data Frame was then created with Neighborhood and frequency of each venue in that neighborhood as shown below;

```
print(doha_grouped.shape)
doha_grouped.head()
```

```
(50, 191)
```

	Neighborhood	Afghan Restaurant	African Restaurant	Airport	Airport Service	American Restaurant	Arcade	Art Gallery	Art Museum	Arts & Crafts Store	Asian Restaurant	Athletics & Sports	Auditorium	Auto Garage	BBQ Joint	Bagel Shop
0	Al Bidda	0.0	0.00	0.0	0.0	0.000000	0.00	0.021739	0.000000	0.0	0.000000	0.000000	0.0	0.0	0.021739	0.00
1	Al Dafna	0.0	0.01	0.0	0.0	0.010000	0.01	0.000000	0.000000	0.0	0.020000	0.000000	0.0	0.0	0.000000	0.01
2	Al Hilal	0.0	0.00	0.0	0.0	0.000000	0.00	0.000000	0.000000	0.0	0.041667	0.000000	0.0	0.0	0.000000	0.00
3	Al Kharayej	0.0	0.00	0.0	0.0	0.000000	0.00	0.000000	0.000000	0.0	0.000000	0.000000	0.0	0.0	0.000000	0.00
4	Al Khulaifat	0.0	0.00	0.0	0.0	0.013333	0.00	0.000000	0.013333	0.0	0.000000	0.026667	0.0	0.0	0.000000	0.00

A new dataFrame was then created with top 5 venues of each neighborhood.

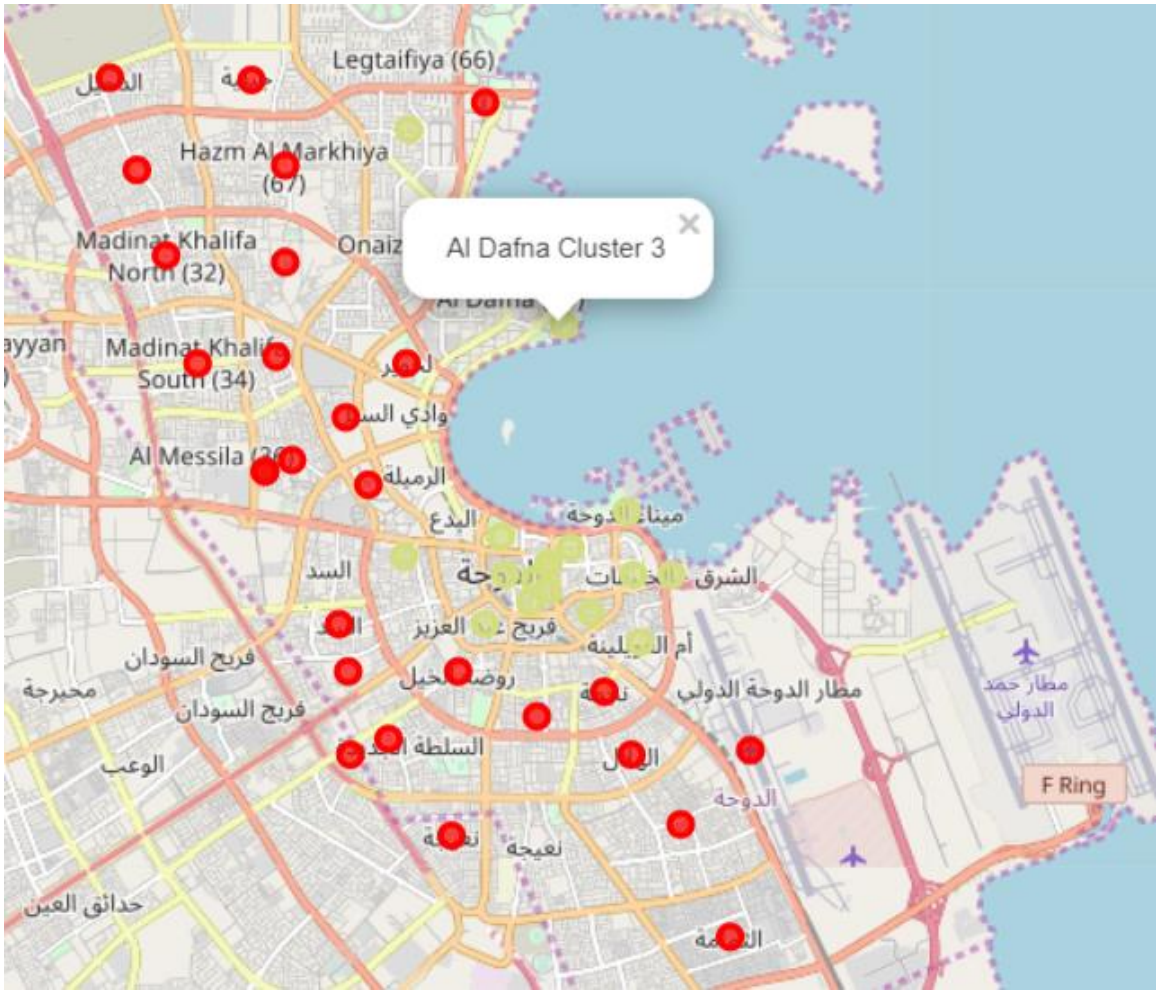
	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Al Bidda	Café	Middle Eastern Restaurant	Hotel	Italian Restaurant	Dessert Shop
1	Al Dafna	Coffee Shop	Hotel	Café	Middle Eastern Restaurant	Italian Restaurant
2	Al Hilal	Department Store	Pizza Place	Coffee Shop	Indian Restaurant	Sandwich Place
3	Al Kharayej	Coffee Shop	Zoo	Filipino Restaurant	French Restaurant	Food Truck
4	Al Khulaifat	Hotel	Café	Indian Restaurant	Middle Eastern Restaurant	Restaurant

KMeans clustering algorithm was used for segmentation. It was used to find out all neighborhoods of Doha which are part of same cluster as ***Al Dafna***. Clusters were analyzed by using top 10 venues nearby neighborhood as well as top 5 venues nearby. Cluster Labels were added in Data frame as shown below;

	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Al Bidda	25.290243	51.526697	3.0	Café	Middle Eastern Restaurant	Hotel	Italian Restaurant	Dessert Shop
1	Al Dafna	25.319584	51.536284	3.0	Coffee Shop	Hotel	Café	Middle Eastern Restaurant	Italian Restaurant
2	Al Hilal	25.260376	51.546488	0.0	Department Store	Pizza Place	Coffee Shop	Indian Restaurant	Sandwich Place
3	Al Kharayej	25.209836	51.454974	2.0	Coffee Shop	Zoo	Filipino Restaurant	French Restaurant	Food Truck
4	Al Khulaifat	25.285061	51.552715	3.0	Hotel	Café	Indian Restaurant	Middle Eastern Restaurant	Restaurant

Result

It was observed that majority of neighborhoods in Doha are majorly segregated in two clusters. It was verified by creating a map using Folium.



Other two clusters are;

Cluster 2

```
doha_merged.loc[doha_merged['Cluster Labels'] == 1, doha_merged.columns[[0] + list(range(4, doha_merged.shape[1]))]]
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
27	Industrial Area	Business Service	Zoo	Currency Exchange	French Restaurant	Food Truck

Cluster 3

```
doha_merged.loc[doha_merged['Cluster Labels'] == 2, doha_merged.columns[[0] + list(range(4, doha_merged.shape[1]))]]
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
3	Al Kharayej	Coffee Shop	Zoo	Filipino Restaurant	French Restaurant	Food Truck
14	Al Tarfa	Coffee Shop	Food Court	Zoo	Filipino Restaurant	French Restaurant

Discussion

From the analysis it is clear that city of Doha can be categorized in 3 different clusters;

1- Industrial Area
2- Areas that have Zoo
3- Residential Areas

Residential areas are further segmented in two clusters. Areas that are closer to Corniche Venue are mainly part of one cluster while other residential areas are part of another cluster. Data shows that one of the cluster has “Hotel” as one main venue that shows these areas are part of business Hub of Doha.

Cluster 4

```
doha_merged.loc[doha_merged['Cluster Labels'] == 3, doha_merged.columns[[0] + list(range(4, doha_merged.shape[1]))]]
```

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Al Bidda	Café	Middle Eastern Restaurant	Hotel	Italian Restaurant	Dessert Shop
1	Al Dafna	Coffee Shop	Hotel	Café	Middle Eastern Restaurant	Italian Restaurant
4	Al Khulaifat	Hotel	Café	Indian Restaurant	Middle Eastern Restaurant	Restaurant
7	Al Messila	Hotel	Middle Eastern Restaurant	Café	Restaurant	Coffee Shop
8	Al Mirqab	Hotel	Café	Middle Eastern Restaurant	Restaurant	Coffee Shop
9	Al Najada	Hotel	Middle Eastern Restaurant	Café	Restaurant	Coffee Shop
11	Al Rufaa	Hotel	Café	Restaurant	Middle Eastern Restaurant	Indian Restaurant
13	Al Souq	Hotel	Café	Middle Eastern Restaurant	Restaurant	Coffee Shop
16	Barahat Al Jufairi	Hotel	Café	Middle Eastern Restaurant	Restaurant	Coffee Shop
18	Doha Port	Hotel	Café	Restaurant	Harbor / Marina	Park
20	Fereej Abdul Aziz	Hotel	Indian Restaurant	Fried Chicken Joint	Fast Food Restaurant	Restaurant
22	Fereej Bin Mahmoud	Hotel	Café	Hookah Bar	Indian Restaurant	Intersection
35	Musheireb	Hotel	Middle Eastern Restaurant	Café	Restaurant	Indian Restaurant
38	New Al Mirqab	Hotel	Café	Middle Eastern Restaurant	Restaurant	Coffee Shop
42	Old Al Ghanim	Hotel	Café	Middle Eastern Restaurant	Indian Restaurant	Coffee Shop
44	Onaiza	Fruit & Vegetable Store	BBQ Joint	Hotel	Bed & Breakfast	Health & Beauty Service
47	Umm Ghuwailina	Hotel	Middle Eastern Restaurant	Pizza Place	Fast Food Restaurant	Department Store

Conclusion

After detailed analysis, we can conclude that among below mentioned areas that are close to Ooredoo HQ2;

1- Al Hilal
2- Umm Ghuwailina
3- Najma

	Neighborhood	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
1	Al Dafna	25.319584	51.536284	3.0	Coffee Shop	Hotel	Café	Middle Eastern Restaurant	Italian Restaurant
2	Al Hilal	25.260376	51.546488	0.0	Department Store	Pizza Place	Coffee Shop	Indian Restaurant	Sandwich Place
36	Najma	25.268953	51.542400	0.0	Asian Restaurant	Hotel	Department Store	Fast Food Restaurant	Gym
47	Umm Ghuwailina	25.275782	51.547866	3.0	Hotel	Middle Eastern Restaurant	Pizza Place	Fast Food Restaurant	Department Store

Umm Ghuwailina is part of same cluster as Al Dafna. If I have to move closer to my new office and an area that is similar to AL Dafna, ***Umm Ghuwailina*** is that area.