Post Offices Analysis of Abu Dhabi City

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1. Introduction

1.1. Background

Abu Dhabi is the largest emirate in the United Arab Emirates, occupying 84 per cent of the national landmass territory. It has 200 islands and a long coastline stretching 700km. Its total area is 67,340 sq. km. Abu Dhabi city in the emirate is the federal capital of the UAE.,The emirate of Abu Dhabi lies on the coast of the Arabian Gulf and is bordered by Sultanate of Oman to the east, the Kingdom of Saudi Arabia to the south and the west and the emirate of Dubai to the northeast. The three main regions of the emirate are: The city of Abu Dhabi, Al Ain in the east, Al Dhafrah (earlier known as Al Gharbia) in the west, For this analysis I will concentrate in "The city of Abu Dhabi"[1]

1.2. Problem

Determining the best location for new post office will require analysis of current post offices distribution, population distribution within The "city of Abu Dhabi" however I was not able to gather data for population distribution within The "city of Abu Dhabi" Neighborhood wise, so i will use current offices with 2.5Km radius as coverage area for the post office

1.3. Interest

Having more post office mean more coverage and less load for the currently operating offices, I will examine Neighborhoods with no post offices to try to determine best location with minimum office for the uncovered Neighborhoods

2. Data acquisition and cleaning

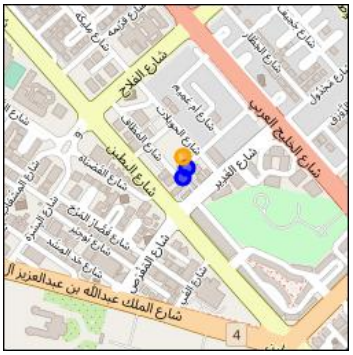
2.1. Data sources

For the analysis i was able to gather data from post offices and Neighborhoods using:
-Bayanat.ae, the official data portal of the UAE Government[2]
-Forsquare API to get post offices of city of Abu Dhabi
-BeautifulSoup4 for pulling Neighborhoods from Wikipedia page containing list of Neighborhoods of the city of Abu Dhabi[3]
-Nominatim to convert Neighborhoods address into latitude and longitude
-I used Google Map, to get the coordinates for some of Neighborhoods

2.2. Data Cleaning

I have obtained 25 post offices location from "bayanat.ae"[4] covering Abu Dhabi emirate where our interest is within the city of Abu Dhabi, and since I was not able to obtain a Second-level Administrative Divisions of Abu Dhabi I have dropped locations located more than 50Km from Abu Dhabi City center and International Airport Post Office was dropped since it is limited for Airport usage so I ended up with 15 post Offices from "Bayanat.ae" and 16 from Forsquare

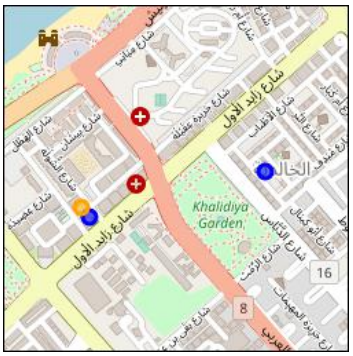
Plotted Post Office locations, Blue circles represent locations obtain using Forsquare, where Orange circle are locations obtain from "Bayant.ae" found out some duplicate and some missing locations from Forsquare



Al Buten Post Office

Abu Dhabi Central Post Office

Hamdan Post Office



Al Khaldiyah Post Office

Chamber of Commerce Post Office

Shabiyat Musafah Post Office

Since Bayanat.ae data was more accurate than Forsquare, I have decided to use “Bayanat.ae” data for the rest of my analysis,

To Obtain and Clean up Neighborhoods of the City of Abu Dhabi I have Used BeautifulSoup4 to pull data out of Wikipedia page contains list of Neighborhoods of the City of Abu Dhabi I ended up with 43 Neighborhoods

“ (page does not exist)” was found in some Neighborhoods names and it was clean up
Dropped “Al Qubesat” and “Al Rehhan” as I was unable to obtain accurate or even clear location for them

For some Neighborhoods I was unable to get the Geolocation using Nominatim for 5 of them it was due to spilling differences, listed below Neighborhoods names was changed to be able to obtain Geolocation using Nominatim for them

Name	New Name
Al Karama	Al Karamah
Al Maqtaa	Al Maqta
Al Meena	Al Mina
Al Moroor	Al Muroor
Al Khalidyah	al khalidiya

For the rest of the i have used Google map to search and obtain the GeoLocations

Neighborhoods	Lat	Long
Al Manaseer [5]	24.453333	54.363889
Al Muzoon [6]	24.4081379	54.4338398
Al Ras Al Akhdar [7]	24.4596244	54.3190142
Bani Yas [8]	24.3063479	54.5995936
Al Zaab [9]	24.4667598	54.356339
Hideriyyat [10]	24.417739	54.3576465
Marina Village [11]	24.4772307	54.3179553
Qasr El Shatie [12]	24.4261292	54.380629
Al Samha [13]	24.695833	54.676111
Missing Neighborhoods Added Manually		
Al Bahyah [14]	24.547706	54.6628323
Al Shahama [15]	24.524108	54.6770834
Al Rahbah [16]	24.605807	54.6944333

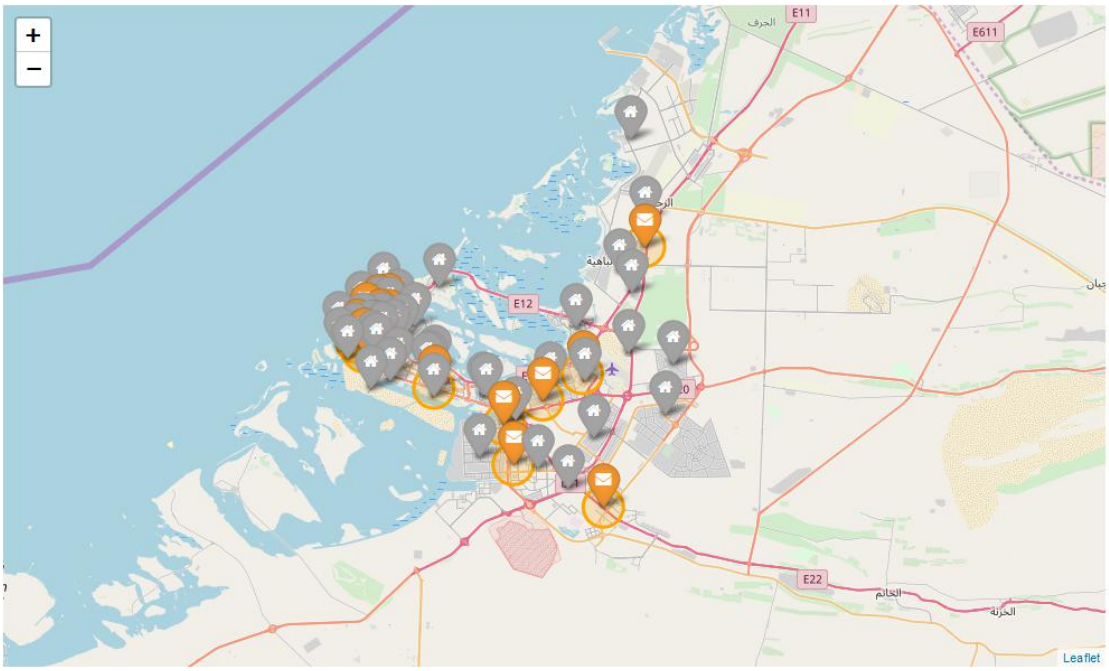
3. Methodology

Before we can suggest new post Office we have to know what currently we have and how post offices covers Abu Dhabi city Neighborhoods, it was decided to use radius of 2500 meter for coverage, and so for current Post offices have calculated the total Neighborhoods within 2500m radius and for the Neighborhoods I have calculated total Post offices within the same radius of 2500 meter

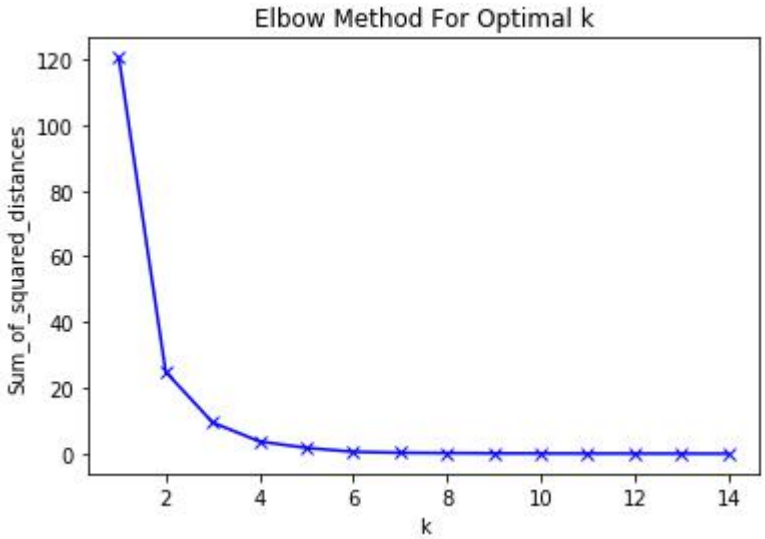
	name	lng	lat	nbCount
4	Al Nadi Sayahi Post Office	54.379688	24.498306	3
5	Bani Yas Post Office	54.643620	24.285358	0
7	Hamdan Post Office	54.366886	24.496719	5
9	Al Falah Post Office	54.379513	24.481054	7
10	Al Musafah Post Office	54.521702	24.377821	1

	Neighborhood	lat	lng	poCount
0	Al Aman	24.431990	54.426550	1
1	Al Bateen	24.451315	54.328144	2
2	Al Dhafrah	24.476147	54.369360	5
3	Al Falah	24.444696	54.728187	0
4	Al Karamah	24.465300	54.371509	4

I used python folium library to visualize geographic details of Abu dhabi City and its Neighborhoods and post Office with coverage



Analyzing current coverage I have used unsupervised learning K-means algorithm to cluster the Neighborhoods . K-Means algorithm is one of the most common cluster method of unsupervised learning. First, I will run K-Means to cluster the Neighborhoods into 3 clusters because when I analyze the K-Means with elbow method it ensured me the 3 degree for optimum k of the K-Means.



Below is the Neighborhoods table with Cluster

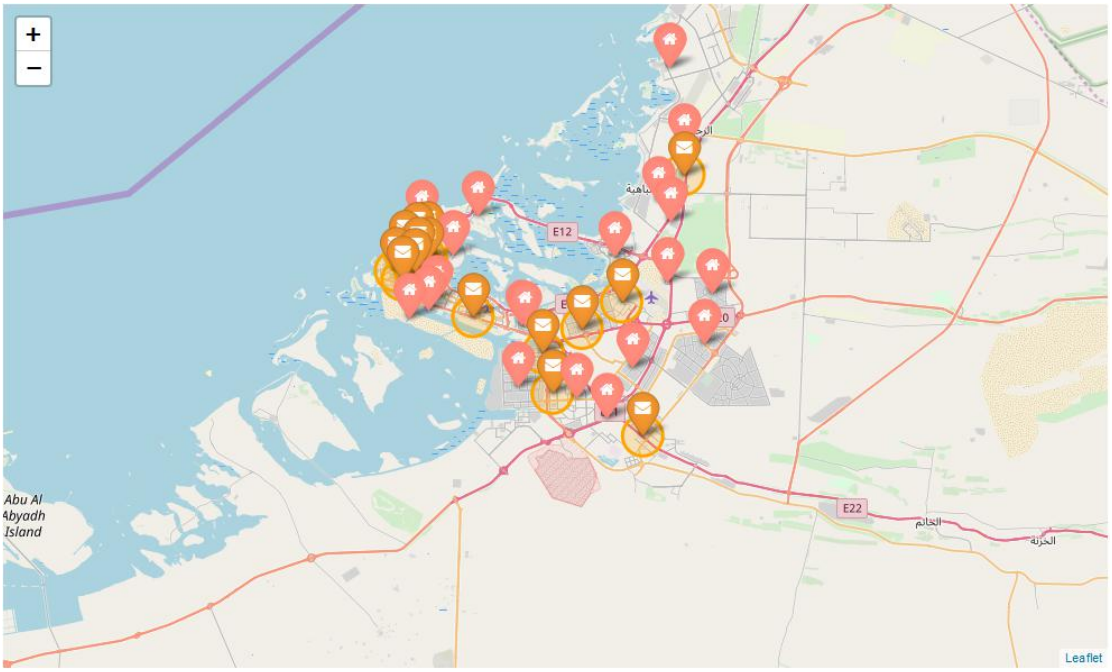
	Neighborhood	ClusterLabels	lat	lng	poCount
0	Al Aman	0	24.431990	54.426550	1
1	Al Bateen	0	24.451315	54.328144	2
2	Al Dhafrah	1	24.476147	54.369360	5
3	Al Falah	2	24.444696	54.728187	0
4	Al Karamah	1	24.465300	54.371509	4

Count Neighborhoods per cluster

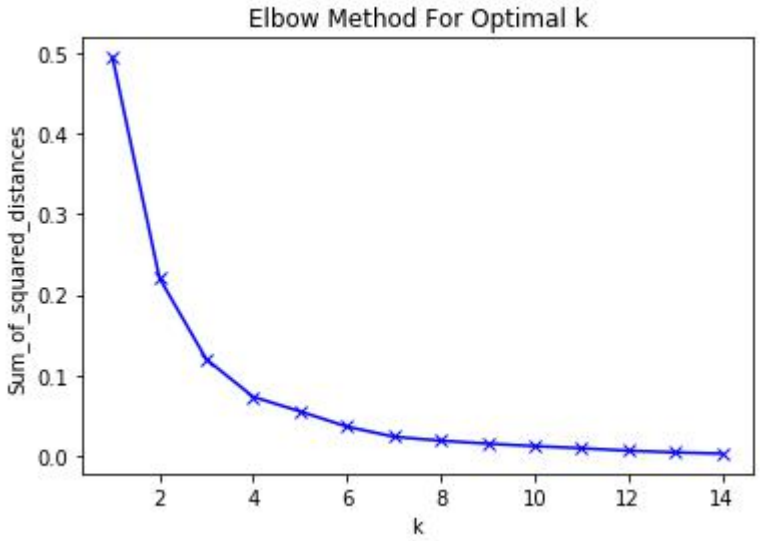
	poCount
	count
ClusterLabels	
0	15
1	9
2	20

I carried on with 20 in cluster 2 Neighborhoods with no or zero post offices covered,created a new data-frame for them, and visualize them using folium library

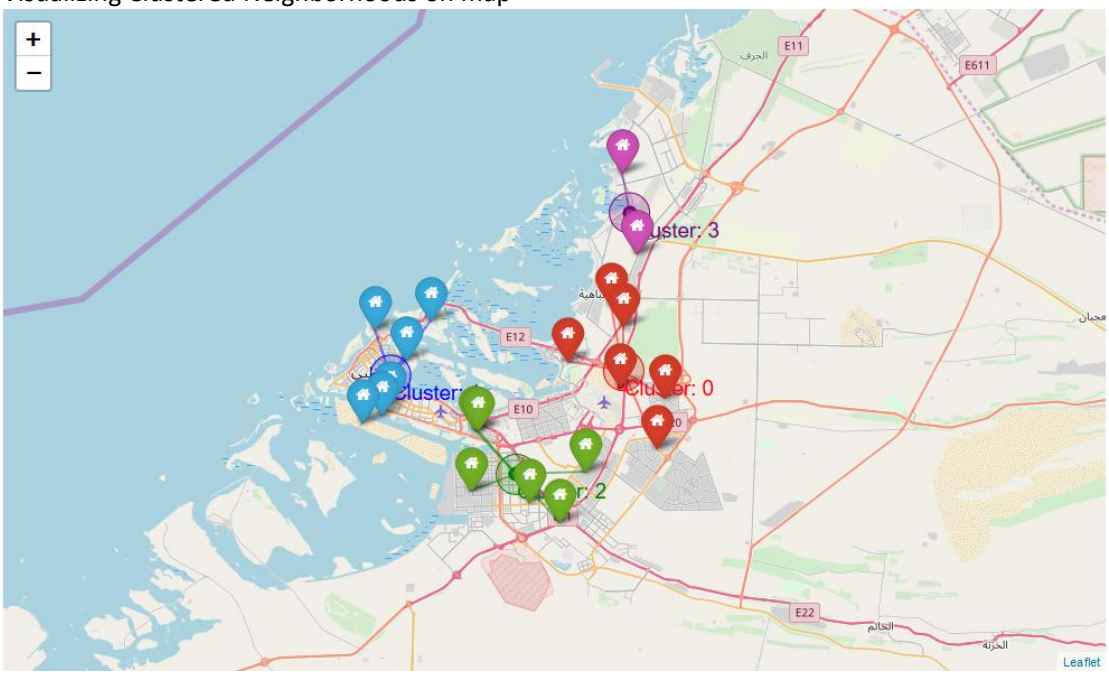
	Neighborhood	ClusterLabels	lat	lng	poCount
3	Al Falah	2	24.444696	54.728187	0
7	Al Madina	2	24.340878	54.490708	0
11	Al Maqta	2	24.407985	54.499372	0
13	Al Mina	2	24.520660	54.372529	0
15	Al Mushrif	2	24.436912	54.391006	0



I have used KMean algorithm to cluster the Neighborhoods, looking for minimum post Office with maximum Neighborhoods coverage, elbow method it ensured me the 4 degree for optimum k of the K-Means.

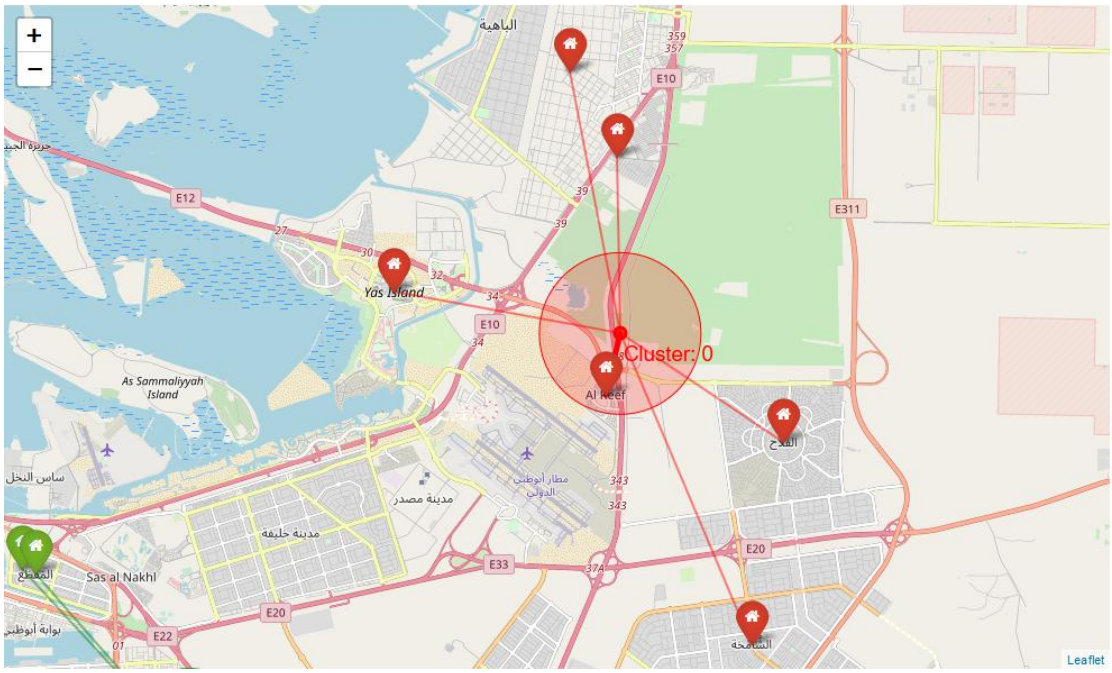


Visualizing Clustered Neighborhoods on map

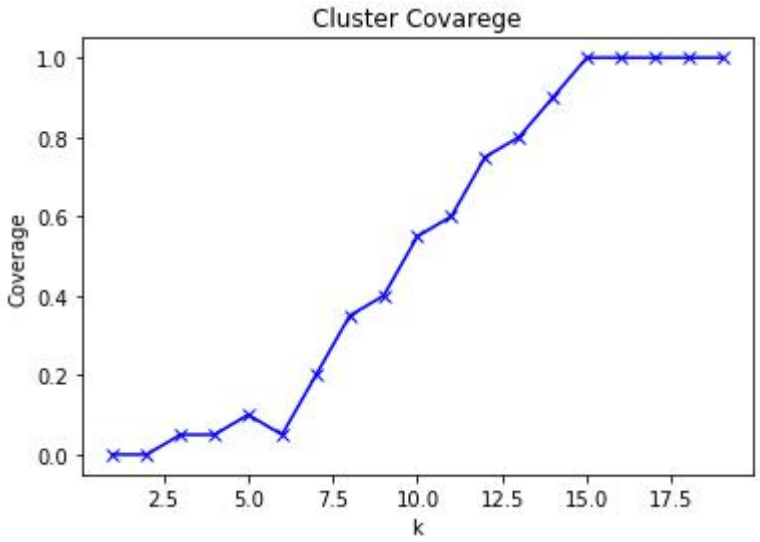


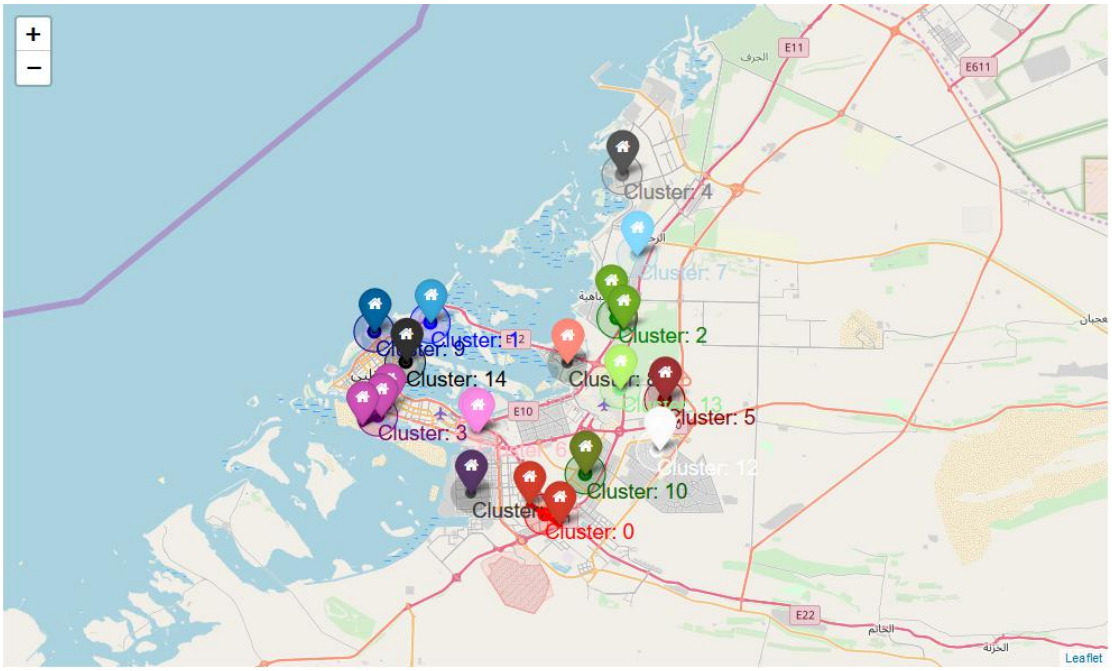
Using “cluster_centers_” as suggested post office location I Created a function to include covered Neighborhoods within 2500m radius of suggested post Office location and ended up having only 1 Neighborhood covered

	Cluster	TotalNeighborhoods	TotalCovered
0	0	6	1
1	1	6	0
2	2	6	0
3	3	2	0



as I intend to have minimum post Office with maximum Neighborhoods coverage, 4 clusters will not achieve the needed result, so I have created a functions to calculate the maximum coverage with minimum clusters (post Offices) and ended up with 15 cluster (post offices) to cover 20 uncovered Neighborhoods





	Cluster	TotalNeighborhoods	TotalCovered
0	0	2	2
1	1	1	1
2	2	2	2
3	3	3	3
4	4	1	1
5	5	1	1
6	6	2	2
7	7	1	1
8	8	1	1
9	9	1	1
10	10	1	1
11	11	1	1
12	12	1	1
13	13	1	1
14	14	1	1

0/15 Suggested Post Office(s) with no Neighborhoods Covered
15/15 Suggested Post Office(s) fully Cover their Clustered Neighborhoods
11/15 Suggested Post Office(s) cover 1 Neighborhood


Saadiyat Beach
Cluster: 1


359
357
E10
39


Cluster: 3


Cluster: 4

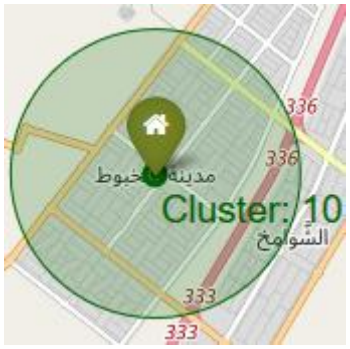

Cluster: 5


ساس النخل
بوابة أبوظبي


الرحبة
366
Cluster: 7


30
32
Cluster: 8
34


Cluster: 9


336
336
Cluster: 10
333
333


Cluster: 11


E311


343


11
Cluster: 14

4. Results

Started with the radius of 2.5 Km for coverage I have used unsupervised learning K-means algorithm to cluster to cluster the 20 uncovered Neighborhoods into 4 clusters because when I analyze the K-Means with elbow method it ensured me the 4 degree for optimum k of the K-Means. However 4 k cluster resulted in only 1 Neighborhoods being covered, further analysis indicated that 15 cluster will cover all of the 20 uncovered Neighborhoods

5. Discussion

As included in the introduction section, Determining the best location for new post office have will require analysis of current post offices distribution, population distribution if we have data for population distribution within Neighborhood

6. Conclusion

7. References

[1] The Official Portal of the UAE Government
https://www.government.ae/en/about-the-uae/the-seven-emirates/abu-dhabi

[2] The official data portal of the UAE Government, https://bayanat.ae/en

[3] Abu Dhabi - Wikipedia https://en.wikipedia.org/wiki/Abu_Dhabi

[4] Emirates post offices GIS location
http://data.bayanat.ae/en_GB/dataset/emirates-post-offices-gis-location

[5] Google Maps