

Dubai Metro Station Clustering



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Executive Summary:

Dubai is a fast growing multi community city with maximum expat population of different culture and nationality. Most of the people in city are of working class. As per Dubai Road and Transport Authority Dubai has almost 540 cars for every 1000 people which is higher than New York and London.

Because of high number of cars on road and very densely populated area, people often spend lot of time in traffic and avoiding traffic is main agenda for people.

RTA started Dubai Metro in 2009 to handle its traffic problem. Dubai Metro is now lifeline of Dubai and its working population is depend on Dubai Metro. Staying near Dubai Metro is most convenient, specially in early morning while going to Office and School and other times when traffic on road is high.

Foursquare.com has very rich database of venues around the world it also provides tips and photos in detail. Foursquare provide APIs to developers to explore these data. We will use Foursquare APIs in this work to get Dubai Metro information like name/latitude/longitude and also different venue details around each Dubai Metro station.

Introduction:

Dubai is located in the United Arab Emirates and is the capital city of the Emirate of Dubai. Dubai is located along the eastern coast of the Arabian Peninsula, at the southwest corner of the Arabian Gulf. This global city has become known as the Middle East's business hub and for being a city of rich culture, and it is also renowned for its beaches, sunny weather, deserts, and hospitality. Its diverse and fast-growing economy has led to incredible growth over the decades.

In terms of population, Dubai has an estimated population of 2,800,000 in 2019. The population is also composed of just 15% native residents, with the remaining 85% being composed of expatriates. About 85% of the expatriate population – or 71% of the total population -- is Asian, primarily from India (accounting for 51%). Other Asians in Dubai are originally from Pakistan (17%), Bangladesh (9%) and the Philippines (3%). The city also has a high number of Somalis, and British expatriates make up the largest population of Western expatriates.

The city limits are roughly 35 square kilometers with a metropolis area at a total of 4,114 square kilometers. The population density in the metro area is approximately 762.6 individuals living per square kilometer.

Dubai's Roads and Transport Authority (RTA) reveal that the emirate has 1.4 million registered vehicles for a city with an official population of 2.80 million. The number of vehicles currently on Dubai roads suggests that the vehicles equal 540 for every 1,000 residents, implying that the emirate has more cars per person than New York (305 per 1,000) or London (213 per 1,000).

Since Dubai is densely populated and higher number of car per person, traffic is always a problem on Dubai roads. To overcome traffic and pollution problem RTA started Dubai Metro from Sep 2009 which is now a life line of Dubai. Everyone wants to stay near Dubai Metro to avoid traffic congestion while going to school or office in early morning.

Business Problem:

A residential location near Dubai Metro is most wanted. We have to find out which metro station is best suited for residential purpose.

To decide best residential area we have considered five categories listed below.

1. Food & Drink Shops
2. School
3. Medical Center
4. Gym
5. Restaurants
6. Shopping Mall

In this project we have to identify which metro station is best considering above 6 conditions and categorize them and plot them on map to visual identification.

Data Section

To solve this problem we will use Foursquare APIs and collect data of Dubai Metro Stations.

Find out Dubai Metro Station Details including Name, Latitude, and Longitude.

Using search endpoint with category id of “Metro Station” we will get all metro station details. We will convert JSON into dataframe. Once dataframe is received we will remove unwanted columns except Name, Categories, Street, Latitude and Longitude.

While analyzing metro station data we found that “ADCB Metro Station” and Ittihad Metro Station have two rows. We will delete one row to avoid duplicate data.

After deleting duplicate “ADCB Metro Station” and Ittihad Metro Station we have total 48 rows.

For each metro station we will find venue details of each category listed below with search endpoint using category id from Foursquare.

S. No.	Category	Category Id
1	Food & Drink Shops	4bf58dd8d48988d1f9941735
2	Schools	4bf58dd8d48988d13b941735
3	Medical Center	4bf58dd8d48988d104941735
4	Fitness Center	4bf58dd8d48988d175941735
5	Restaurants	4d4b7105d754a06374d81259
6	Shopping Mall	4bf58dd8d48988d1fd941735

Now we have metro station details and venue for each metro station in radius of 500 meters.

We will group venue detail by **Name** of Metro station and **Venue Category** to get number of venues for each category at each metro station.

Methodology

First we will fetch all metro station using Foursquare API. It will provide Name, Latitude, and Longitude of all metro stations.

Once we have metro station details, we will fetch venue details of each metro station for all categories of our interest namely Food & Drink Shops, Schools, Medical Center, Fitness Center, Restaurants and Shopping Mall using Foursquare API.

To check number of venues at each metro station we will plot Bar chart for each category. It will show us how many venues are there around each metro station for every category.

We will list out top 5 metro station for each venue category with number of venues.

After preparing Bar chart, we will categorize all metro station in 3 categories (Red, Blue and Green). To categorize all metro station we will use K-means algorithm.

Using K-means algorithm we will label each metro station with its respective category and plot these categories on Dubai map using folium library.

Each category will be displayed with separate color for better visualization.

Results Section

When we fetched Dubai metro station, we got 50 metro station but when analyse the metro station names, we found that two metro station were duplicate in the list so we deleted duplicate metro station.

We also displayed all metro station on Dubai map using folium library and shown in Figure 1

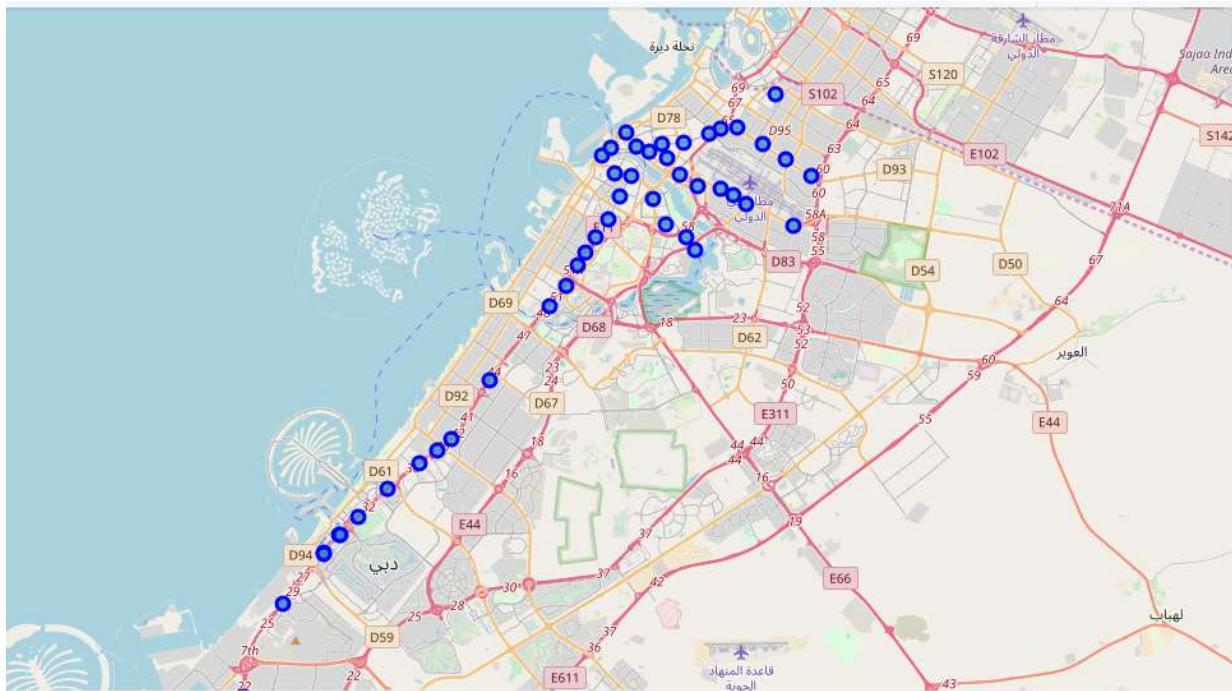


Figure 1: Metro Stations on Dubai Map

Once we fetched venue details for each category we got below mentioned details.

Food and Drinks

Top 5 metro station in term of no of venues in **Food and Drinks** category are mentioned below.

S. No	Metro Station	No of Venues
1	Al Rigga Metro Station (الرقة محطة)	35
2	Salah Al Din Metro Station	28
3	Damac Properties Metro Station	24
4	Dubai Marina Platform - Dubai Metro	24
5	Al Fahidi Metro Station (الفهيدى محطة)	23

We can see that **Al Rigga Metro Station** has maximum **Food and Drinks** venues in 500 meter radius.

Bar Plot of **Food and Drinks** venues against metro station is shown in Figure 2

Bar Chart of Food and Drinks Venues

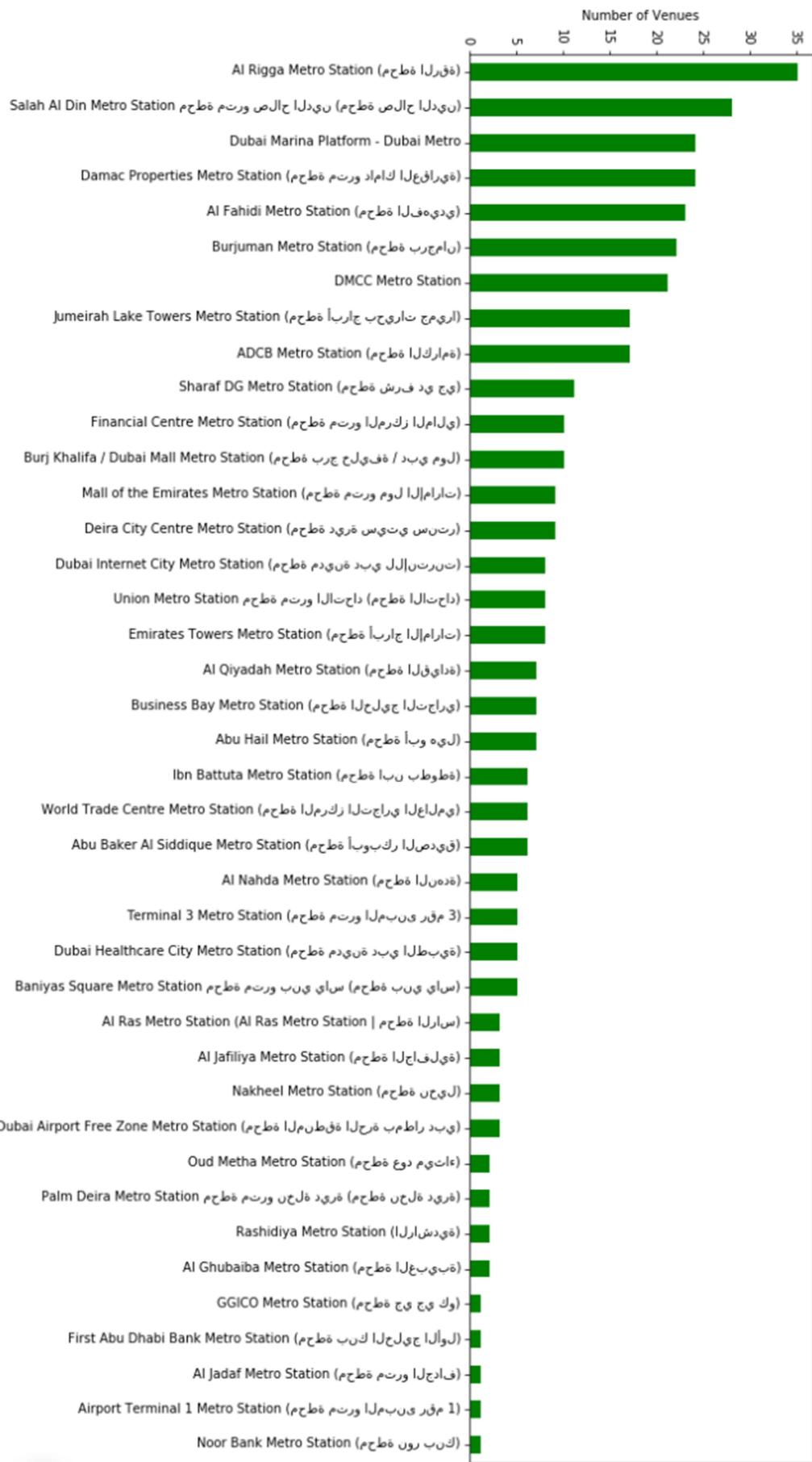


Figure: 2

Schools

Top 5 metro station in term of no of venues in **Schools** category are mentioned below.

S. No	Metro Station	No of Venues
1	DMCC Metro Station	7
2	Jumeirah Lake Towers Metro Station	7
3	Dubai Marina Platform - Dubai Metro	7
4	Damac Properties Metro Station	7
5	Dubai Airport Free Zone Metro Station	6

We can see that **DMCC Metro Station** has maximum **Schools** venues in 500 meter radius.

Bar Plot of **Schools** venues against metro station is shown in Figure 3

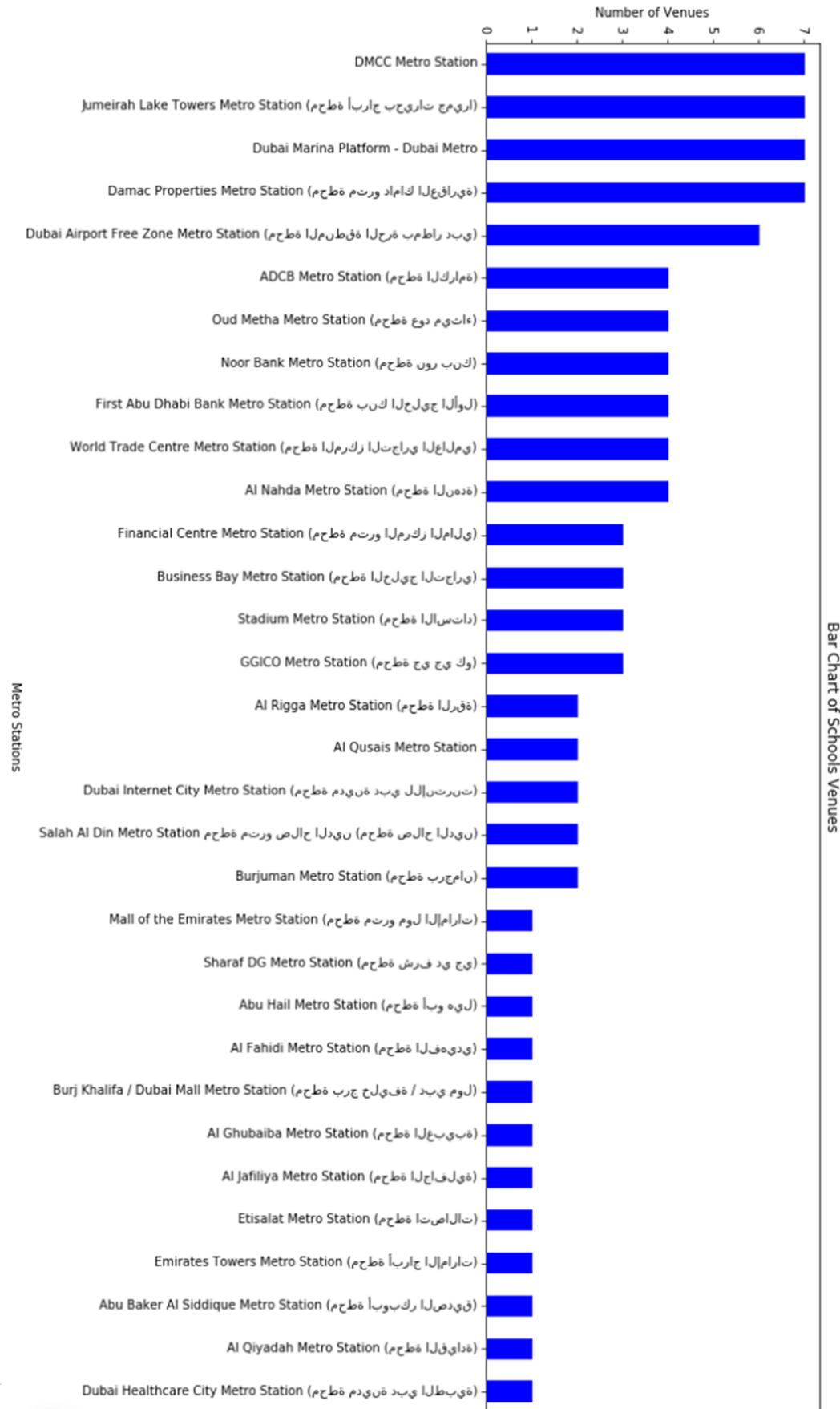


Figure 3

Medical Center

Top 5 metro station in term of no of venues in **Medical Center** category are mentioned below.

S. No	Metro Station	No of Venues
1	Dubai Healthcare City Metro Station	49
2	Oud Metha Metro Station (ميتاء عود محطة)	46
3	Al Rigga Metro Station (الرقة محطة)	44
4	Burjuman Metro Station (برجuman محطة)	39
5	Salah Al Din Metro Station	32

We can see that **Dubai Healthcare City Metro Station** has maximum **Medical Center** venues in 500 meter radius.

Bar Plot of **Medical Center** venues against metro station is shown in Figure 4

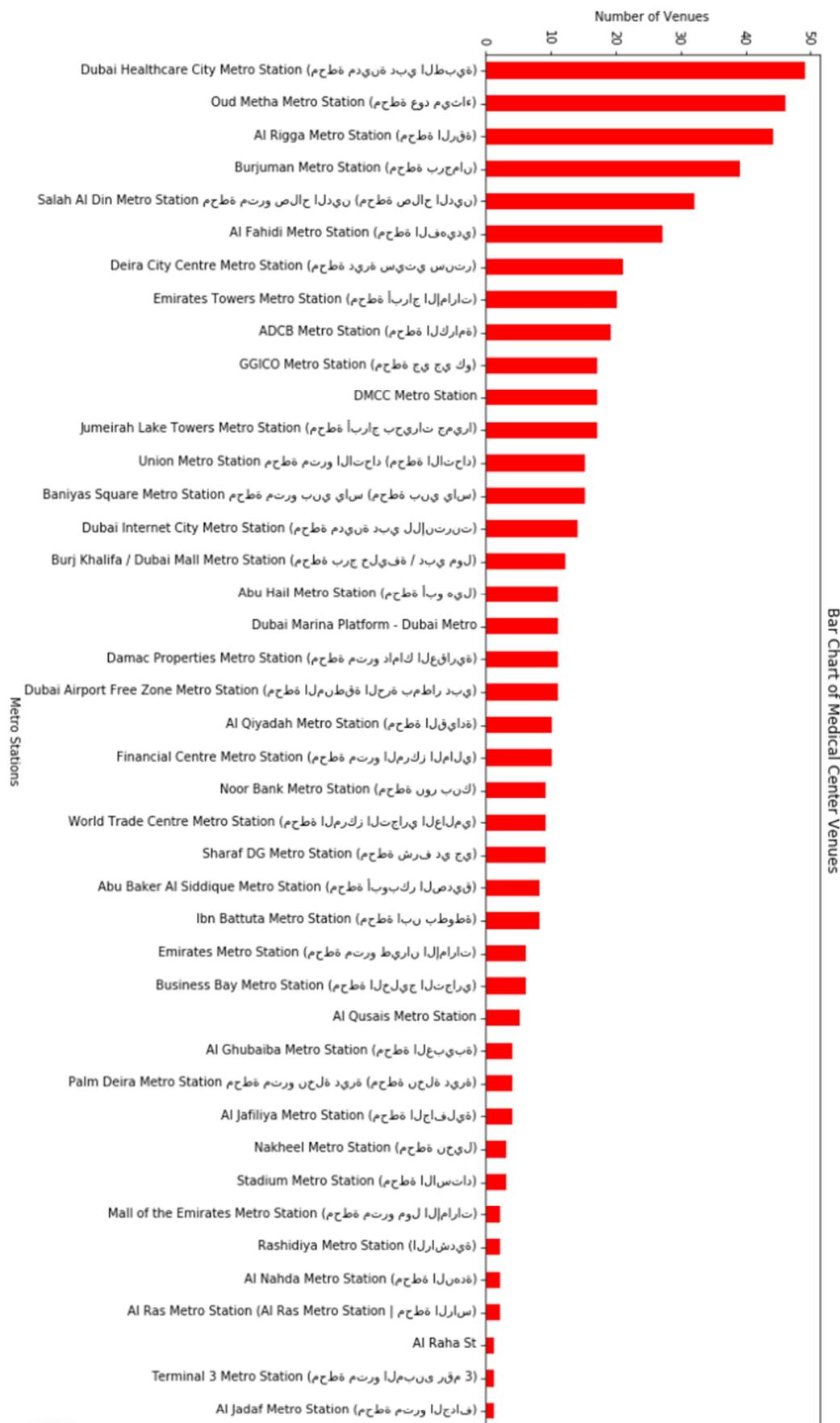


Figure 4

Fitness Center

Top 5 metro station in term of no of venues in **Fitness Center** category are mentioned below.

S. No	Metro Station	No of Venues
1	Jumeirah Lake Towers Metro Station	49
2	DMCC Metro Station	49
3	Dubai Marina Platform - Dubai Metro	36
4	Damac Properties Metro Station	35
5	Dubai Internet City Metro Station	32

We can see that **Jumeirah Lake Towers Metro Station** and **DMCC Metro Station** has maximum **Fitness Center** venues in 500 meter radius.

Bar Plot of **Fitness Center** venues against metro station is shown in Figure 5



Figure 5

Restaurants

Top 5 metro station in term of no of venues in **Restaurants** category are mentioned below.

S. No	Metro Station	No of Venues
1	ADCB Metro Station (الكرامة محطة)	50
2	Ibn Battuta Metro Station (بطوطة ابن محطة)	50
3	Deira City Centre Metro Station	50
4	Dubai Airport Free Zone Metro Station	50
5	Dubai Internet City Metro Station	50

We can see that **ADCB Metro Station, Ibn Battuta Metro Station, Deira City Centre Metro Station, Dubai Airport Free Zone Metro Station** and **Dubai Internet City Metro Station** has maximum **Restaurants** venues in 500 meter radius.

Bar Plot of **Restaurants** venues against metro station is shown in Figure 6

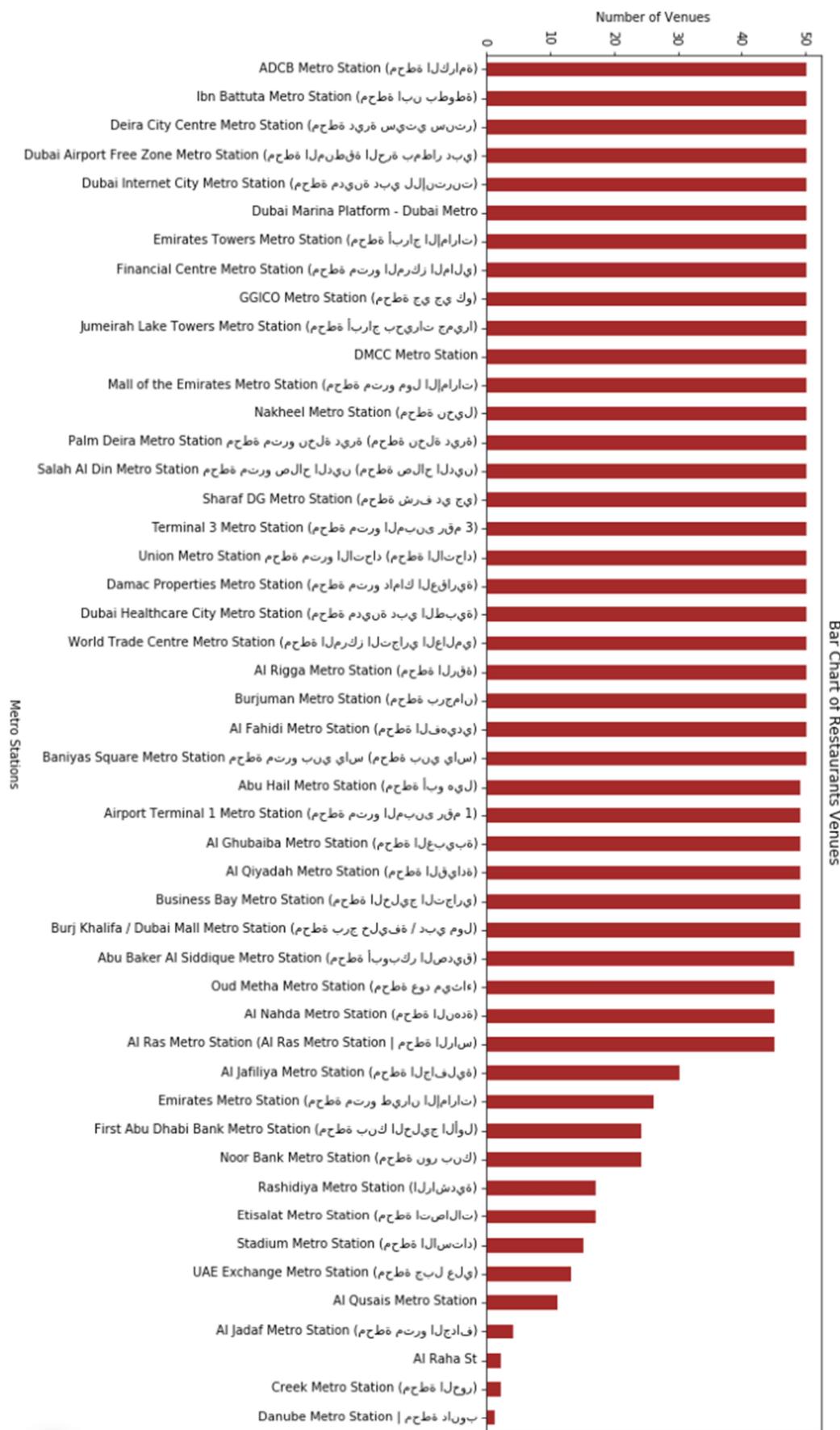


Figure 6

Shopping Mall

Top 5 metro station in term of no of venues in **Shopping Mall** category are mentioned below.

S. No	Metro Station	No of Venues
1	Union Metro Station	10
2	Mall of the Emirates Metro Station	10
3	Ibn Battuta Metro Station (بطوطة ابن محبطة)	10
4	Salah Al Din Metro Station	9
5	Baniyas Square Metro Station	5

We can see that **Union Metro Station**, **Mall of the Emirates Metro Station** and **Ibn Battuta Metro Station** has maximum **Shopping Mall** venues in 500 meter radius.

Bar Plot of **Shopping Mall** venues against metro station is shown in Figure 7

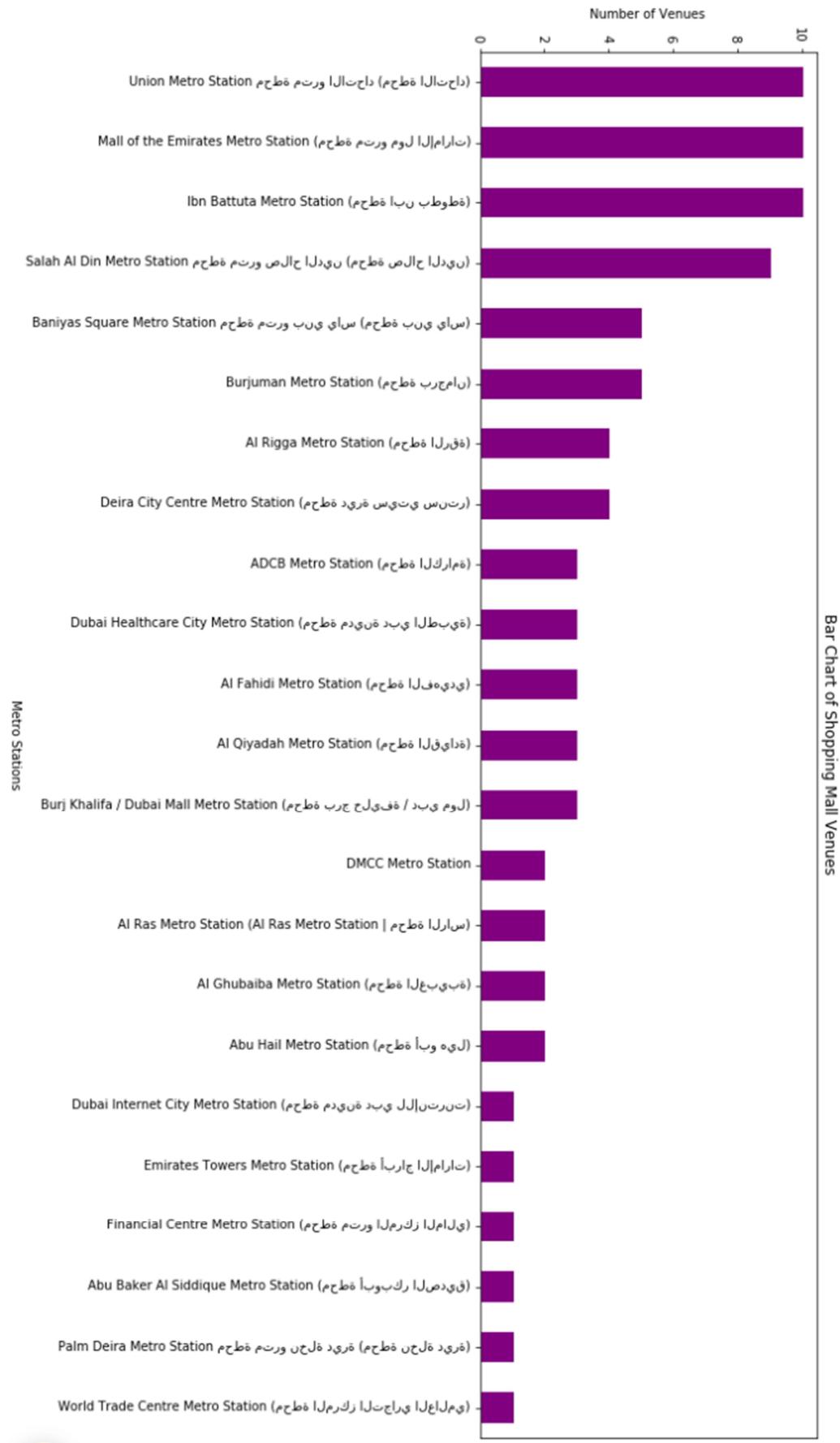


Figure 7

Metro Station Categorization

After fetching all data we created dataframe with features (categories) as column and ran K-means algorithm with k-cluster value as 3.

After categorization we labelled all metro station and changed the label names to **Red**, **Blue** and **Green**.

When we checked the mean values of all venues for each category we found values mentioned in **Figure 8**

We can see that label **Blue** has maximum no of venues across different features followed by label **Red** and then label **Green**

	Latitude	Longitude	Food and Drinks	Schools	Medical Center	Fitness Center	Restaurants	Shopping Mall
Cluster Labels								
blue	25.186181	55.251099	16.857143	3.285714	25.571429	25.928571	49.642857	2.357143
green	25.125402	55.232949	0.615385	1.153846	2.384615	0.769231	14.307692	0.000000
red	25.224215	55.291678	5.904762	1.476190	8.000000	6.571429	49.142857	2.523810

Figure 8 : Mean values of all feature for each Label

We also plot all metro station on Dubai Map with its respective category color to better visualization. It is shown in Figure 9 below

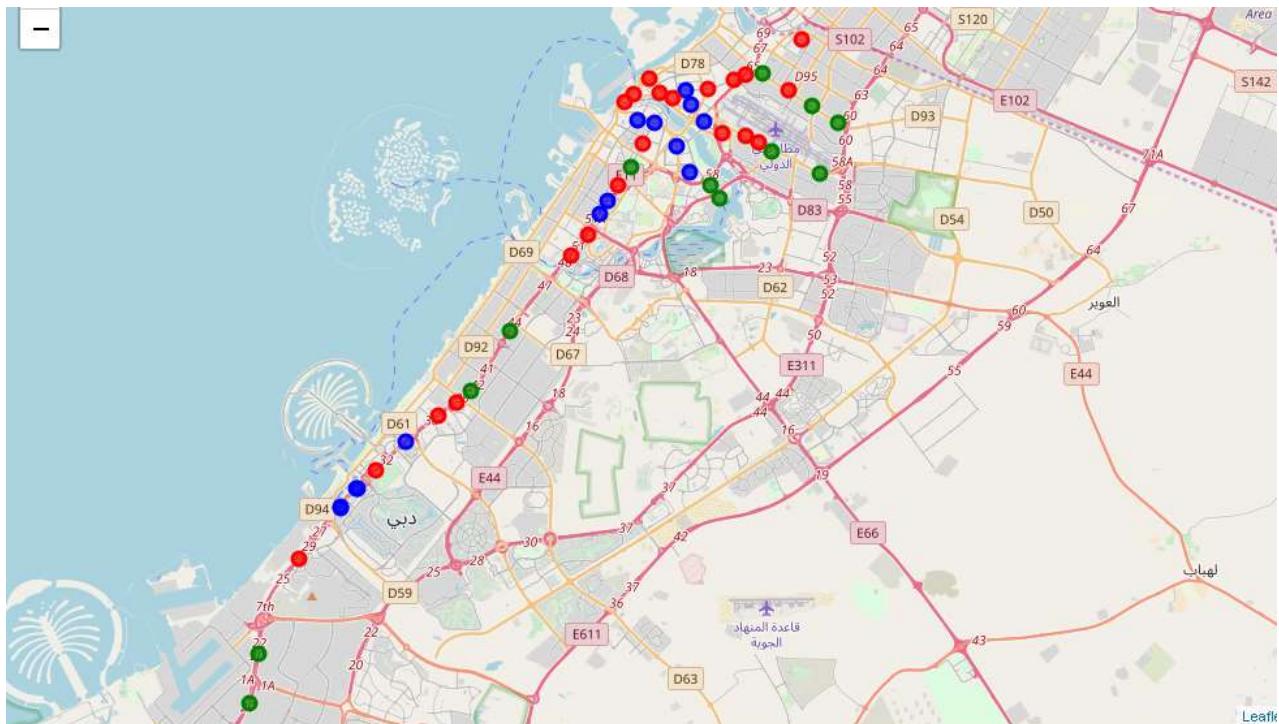


Figure 9: Metro station with label color on Dubai Map

Label of all Metro Station and no of venues against each feature is shown in Figure 10

Metro Station	Cluster Labels	Latitude	Longitude	Food and Drinks	Schools	Medical Center	Fitness Center	Restaurants	Shopping Mall
ADCB Metro Station (محطة الكرامة)	red	25.244514	55.298161	17	4	19	8	50	3
Abu Baker Al Siddique Metro Station (محطة أبو بكر الصديق)	red	25.270957	55.332781	6	1	8	5	48	1
Abu Hail Metro Station (محطة أبو هيل)	red	25.275329	55.346341	7	1	11	3	49	2
Airport Terminal 1 Metro Station (محطة مترو الميني رقم 1)	red	25.248523	55.352390	1	0	0	2	49	0
Al Fahidi Metro Station (محطة الفهidi)	blue	25.255787	55.295596	23	1	27	21	50	3
Al Ghubaiba Metro Station (محطة الغبايب)	red	25.264666	55.288707	2	1	4	1	49	2
Al Jadaf Metro Station (محطة مترو الدجاف)	green	25.224933	55.333726	1	0	1	1	4	0
Al Jafilya Metro Station (محطة الجفليا)	green	25.233237	55.291975	3	1	4	3	30	0
Al Nahda Metro Station (محطة النهدا)	red	25.294453	55.381987	5	4	2	2	45	0
Al Qiyadah Metro Station (محطة القياده)	red	25.277739	55.352602	7	1	10	4	49	3
Al Qusais Metro Station (محطة قصاعي)	green	25.262677	55.387484	0	2	5	0	11	0
Al Raha St (محطة الراس)	green	24.425832	54.532418	0	0	1	0	2	0
Al Ras Metro Station (Al Ras Metro Station محطة الراس)	red	25.268495	55.293166	3	0	2	1	45	2
Al Rigga Metro Station (محطة الرقة)	blue	25.263412	55.323844	35	2	44	24	50	4
Baniyas Square Metro Station (محطة مترو دبي باس (محطة في باس))	red	25.268905	55.307159	5	0	15	5	50	5
Burj Khalifa / Dubai Mall Metro Station (محطة برج خليفة / دبي مول)	red	25.201384	55.269504	10	1	12	11	49	3
Burjuman Metro Station (محطة برجuman)	blue	25.254902	55.304190	22	2	39	10	50	5
Business Bay Metro Station (محطة الخليج التجاري)	red	25.191092	55.260383	7	3	6	19	49	0
Creek Metro Station (محطة الخور)	green	25.218915	55.339029	0	0	0	0	2	0
DMCC Metro Station (محطة مترو داماك العقارية)	blue	25.071058	55.139046	21	7	17	49	50	2
Damac Properties Metro Station (محطة مترو داماك العقارية)	blue	25.080159	55.147757	24	7	11	35	50	0
Danube Metro Station محطة دانوب	green	25.001114	55.095654	0	0	0	0	1	0
Deira City Centre Metro Station (محطة ديرة سيتي سنتر)	blue	25.255160	55.330278	9	0	21	16	50	4
Dubai Airport Free Zone Metro Station (محطة المنطقة الحرة بمطار دبي)	red	25.269911	55.375107	3	6	11	6	50	0
Dubai Healthcare City Metro Station (محطة مدينة دبي الطبية)	blue	25.230876	55.322835	5	1	49	8	50	3
Dubai Internet City Metro Station (محطة مدينة دبي للإنترنت)	blue	25.102092	55.173536	8	2	14	32	50	1
Dubai Marina Platform - Dubai Metro (محطة مترو مارينا دبى)	blue	25.077952	55.147406	24	7	11	36	50	0
Emirates Metro Station (محطة مترو إمارات)	green	25.241019	55.366436	0	0	6	2	26	0
Emirates Towers Metro Station (محطة أبراج إمارات)	blue	25.217161	55.279612	8	1	20	31	50	1
Etisalat Metro Station (محطة اتصالات)	green	25.254691	55.401499	0	1	0	0	17	0
Financial Centre Metro Station (محطة مترو المركز المالي)	blue	25.211158	55.275584	10	3	10	31	50	1
First Abu Dhabi Bank Metro Station (محطة بنك الخليج الأول)	green	25.126572	55.207742	1	4	0	3	24	0
GGICO Metro Station (محطة جي كيو)	red	25.249543	55.340144	1	3	17	6	50	0
Ibn Battuta Metro Station (محطة ابن بطوطة)	red	25.046338	55.117326	6	0	8	7	50	10
Jumeirah Lake Towers Metro Station (محطة أبراج بحيرات جميرا)	blue	25.070943	55.138799	17	7	17	49	50	0
Mall of the Emirates Metro Station (محطة مترو مول إمارات)	red	25.121257	55.200381	9	1	2	6	50	10
Nakheel Metro Station (محطة نخيل)	red	25.088806	55.157864	3	0	3	8	50	0
Noor Bank Metro Station (محطة نور بنك)	green	25.155496	55.228426	1	4	9	0	24	0
Oud Metha Metro Station (محطة وود مهتا)	blue	25.243715	55.315967	2	4	46	9	45	0
Palm Deira Metro Station (محطة مترو نخلة دبى)	red	25.275920	55.301979	2	0	4	1	50	1
Rashidiya Metro Station (الراشديه)	green	25.230103	55.391491	2	0	2	0	17	0
Salah Al Din Metro Station (محطة مترو صلاح الدين)	blue	25.270162	55.320938	28	2	32	12	50	9
Sharaf DG Metro Station (محطة شرف دي جي)	red	25.114598	55.190837	11	1	9	8	50	0
Stadium Metro Station (محطة الاستاد)	green	25.278001	55.361400	0	3	3	1	15	0
Terminal 3 Metro Station (محطة مترو الميني رقم 3)	red	25.245039	55.359577	5	0	1	3	50	0
UAE Exchange Metro Station (محطة مترو على)	green	24.977628	55.091051	0	0	0	0	13	0
Union Metro Station (محطة الاتحاد)	red	25.266179	55.313780	8	0	15	12	50	10
World Trade Centre Metro Station (محطة المركز التجاري العالمي)	red	25.224871	55.285053	6	4	9	20	50	1

Discussion Section

With above results we can identify that metro station with label Blue are most suitable for residential purpose as we have lot of options for each type of venues like Food and Drinks, Restaulrant, Medical Center, Schools etc.

And we also identified that metro station with label green has least number of venues across same category and may not be that desirable for residential purpose.

But this report does not consider the availablility of residential appartments and rent of residential apartment in these areas. These factor may effect the actual desirablitiy of people to rent the apartment in these areas.

Conclusion Section

We conclude with this report that people may consider options available of different venues near metro station while deciding to rent apartment. We also conclude that some metro station has higher number of option around them compare to other metro stations.