Coursera Capstone Athens Project

The Battle of Neighborhoods - Final Report

1. Introduction Section :

Discussion of the business problem

1.1 Scenario and Background

I just started working as an Application Support Engineer although my real passion is to find a job and work as a data scientist. I currently live within walking distance from "Megaro Mousikis metro station" near the center of Athens therefore I have access to good public transportation to work. Likewise, I enjoy many amenities in the neighborhood , such as international cousine restaurants, cafes, food shops and entertainment. Although you don' t really care about my personal life I have just recently started looking for a bigger house in order to live with my girlfriend and start a family. Although, I am very excited about it, I am a bit stressed towards the process to secure a comparable place to live in Athens, since there is a significant raise in rental prices within the last few years. Therefore, I decided to apply the skills I have learned during studying for the Coursera courses to explore ways to make sure my decision is factual and rewarding. Of course, there are alternatives to achieve the answer using available Google and Social media tools, but it will be rather rewarding doing it myself with the tools used so far.

1.2 Problem to be resolved:

The challenge to resolve is being able to find a rental apartment unit in Attica GR that offers similar characteristics and benefits to my current situation. Therefore, in order to set a basis for comparison, I want to find a rental unit subject to the following conditions:

- Apartment with min 2 bedrooms with monthly rent not to exceed 700 euro/month
- Unit located within walking distance (<= 1.5 km) from a subway metro station in Attica
- Area with amenities and venues similar to the ones described for current location (See item 2.1)

1.3 Interested Audience:

I believe this is a relevant project for everyone considering moving to a major city in Europe, US or Asia, since the approach and methodologies used here are applicable in all cases. The use of FourSquare data and mapping techniques combined with data analysis will help resolve the key questions arisen. Lastly, this project is a good practical case towards the development of Data Science skills.

2. Data Section:

Description of the data and its sources that will be used to solve the problem

2.1 Data of Current Situation

I Currently reside in the neighborhood of 'Kolonaki' near Athens city center. Foursquare will be used to identify the venues around the area of residence which will be shown in Athens map displayed in methodology and execution in section 3.0 . It serves as a reference for comparison with the desired future location.

2.2 Data Required to resolve the problem

In order to make a good choice of a similar apartment, the following data is required:
List/Information of Attica neighborhoods with their geodata (latitude and longitude).
List/Information of the subway metro stations with Geodata. Listed apartments for rent in Athens area with descriptions (number of bedrooms, apartment size, price, location). Venues and amenities in Athens neighborhoods (e.g. top 10).

2.3 Sources and manipulation

The list of Athens neighborhoods is scraped from Wikipedia link https://en.wikipedia.org/wiki/Category:Neighbourhoods_in_Athens and is passed to a list and then to the pandas DataFrame "df_neighborhoods" along with latitude and longitude retrieved from Nominatim.

	Neighborhood	Latitude	Longitude
0	Agios Eleftherios, Athens, Greece	38.020044	23.731724
1	Agios Panteleimonas, Athens, Greece	37.996564	23.726957
2	Akadimia Platonos, Greece	37.989357	23.711217
3	Akadimia, Athens, Greece	37.980285	23.734528
4	Anafiotika, Greece	37.972351	23.728043

A list of Athens subway metro stations was scraped once again from Wikipedia (https://en.wikipedia.org/wiki/List_of_Athens_Metro_stations). The geolocation was obtained again using Nominatim and passed to the pandas DataFrame "df_stations".

	Station	Latitude	Longitude
0	Nerantziotissa station	38.045158	23.792984
1	Piraeus station	37.943159	23.647059
2	Elliniko metro station	37.907554	23.737044
3	Agia Paraskevi metro station	38.020815	23.816783
4	Agios Dimitrios metro station	37.946833	23.737825

A list of places for rent was collected by web-browsing nepstick site: https://www.nestpick.com/athens/ working as search engine for rental apartments, retrieving data from different real etate sites. Afterwards data are passed to a DataFrame with the following columns ['name', 'category', 'normalized_price', 'number_of_bedrooms', 'apartment_size', 'latitude', 'longitude']. The loop algorithms used are shown in the execution of data in section 3.0. "Great_circle" function from geolocator was used to calculate distances between two points, as in this case to calculate average rent price for units around each subway station and at 1.5 km radius. Foursquare is used to find the avenues at Athens neighborhoods in general and a cluster is created to later be able to search for the venues depending on the location shown.

2.4 How the data will be used to solve the problem

The data will be used as follows: Use Foursquare and geopy data to map top 10 venues for all Athens neighborhoods and clustered in groups. Use foursquare and geopy data to map the location of subway metro stations, separately and on top of the above clustered map in order to be able to identify the venues and amenities near each metro station, or explore each subway location separately. Use Foursquare and geopy data to map the location of rental places, in some form, linked to the subway locations. Create a map that depicts, for instance, the average rental price per square ft, around a radius of 1.5 km around each subway station. I will be able to quickly point to the popups to know the relative price per subway area.

3. Methodology section:

This section represents the main component of the report where the data are gathered and prepared for analysis. The tools described are used here and the Notebook cells indicate the execution of steps.

The analysis and the strategy:

The strategy is based on mapping the above described data in section 2.0, in order to facilitate the choice of at least two candidate places for rent. The choice is made based on the demands imposed: location near a subway, rental price and similar venues to the current location. This visual approach and maps with popup labels allow quick identification of location, price and feature, thus making the selection very easy.

The processing of these data and its mapping will allow to answer the key questions to make a decision:

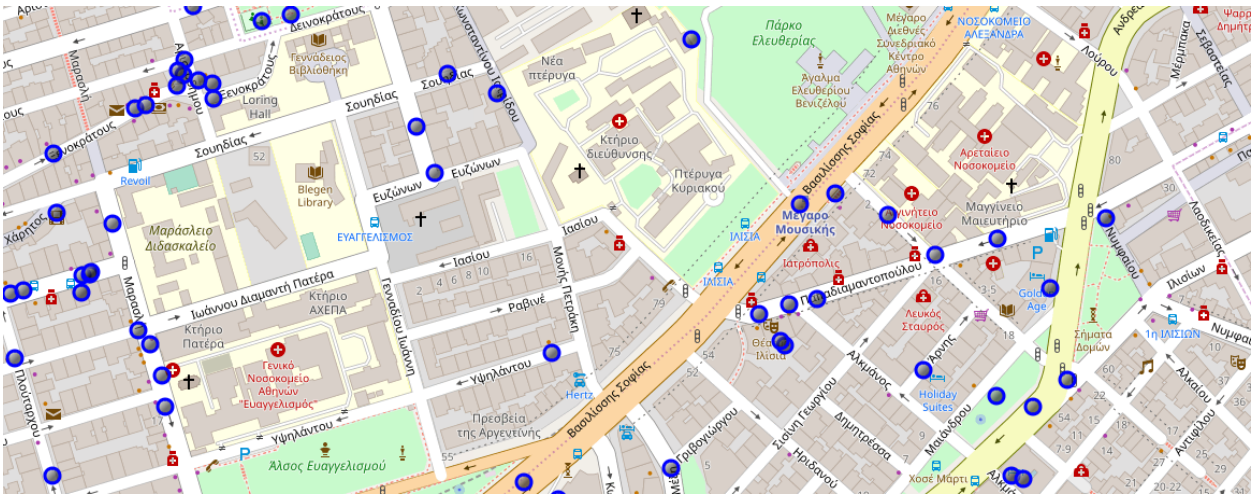
- What is the cost of available rental places that meet the demands?
- What is the cost of rent around 1.5 km radius from each subway metro station?
- What is the area of Athens with best rental pricing that meets criteria established?
- What is the distance from work place and the tentative future rental home?
- What are the venues of the two best places to live? How the prices compare?
- How venues distribute among Athens neighborhoods and around metro stations?
- Are there tradeoffs between size and price and location?

- Any other interesting statistical data findings of the real estate and overall data.

METHODOLOY EXECUTION - Mapping Data

Athens Map - Current residence and venues in neighborhood

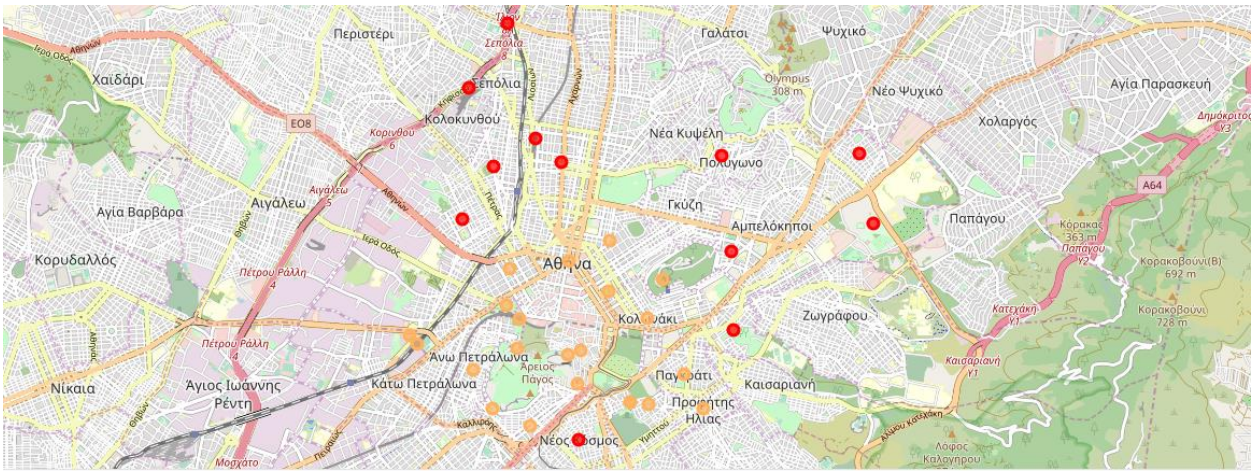
	name	categories	lat	lng
0	Simul	Modern European Restaurant	37.977822	23.750482
1	Hopper Cafe	Café	37.978198	23.752847
2	CV Distiller	Whisky Bar	37.976270	23.751681
3	Hilton Athens	Hotel	37.976058	23.750193
4	Aethrion	Hotel Bar	37.976264	23.750075
5	Galaxy Restaurant & Bar	Hotel Bar	37.976071	23.750546
6	Milos Restaurant	Seafood Restaurant	37.976016	23.750012
7	Ιλίσια - Ντενίση	Theater	37.977877	23.752804
8	Hiltonia Spa	Spa	37.975773	23.750279
9	L'Abreuvoir	French Restaurant	37.979939	23.747093



ATHENS NEIGHBORHOODS - DATA AND MAPPING

Explore Neighborhoods in Athens

The resulting clusters are visualized on the Athens map according to the top ten venues of each neighborhood with the help of Foursquare Api.



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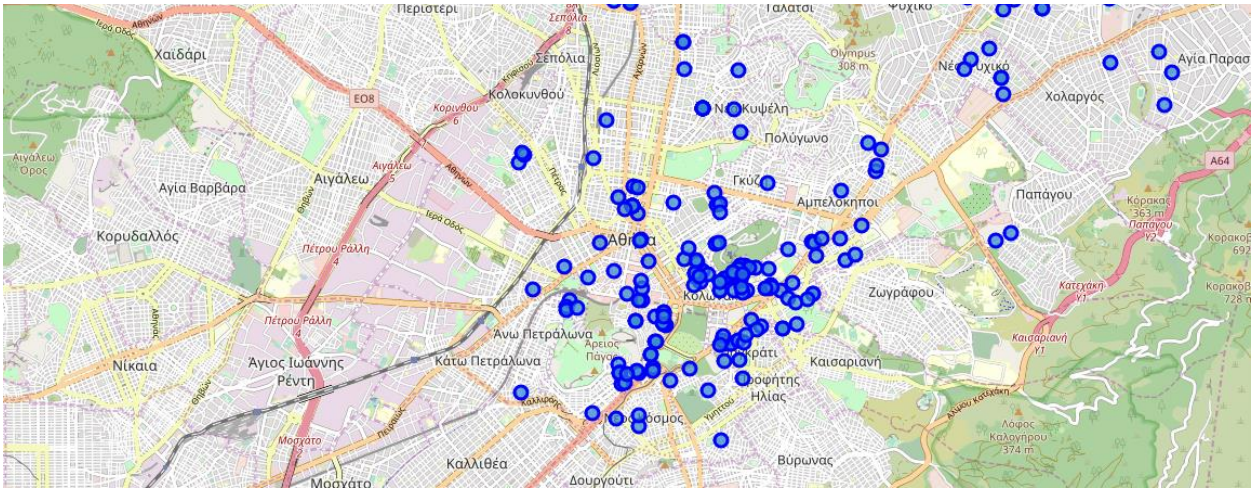
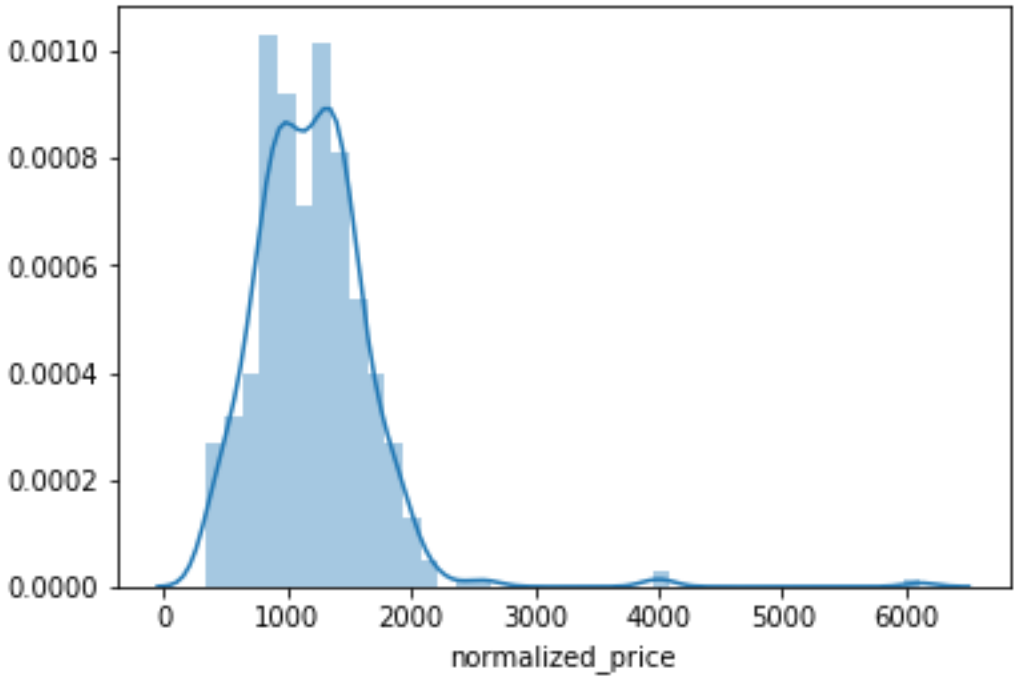
Map of Athens places for rent

The data of the rental houses are directly retrieved by scraping Nepstick site along with the latitude and longitude of each house.



After the I examined the prices of rental houses of Athens and how the prices varies in accordance with the number of bedrooms. The results can be seen in the following two plots.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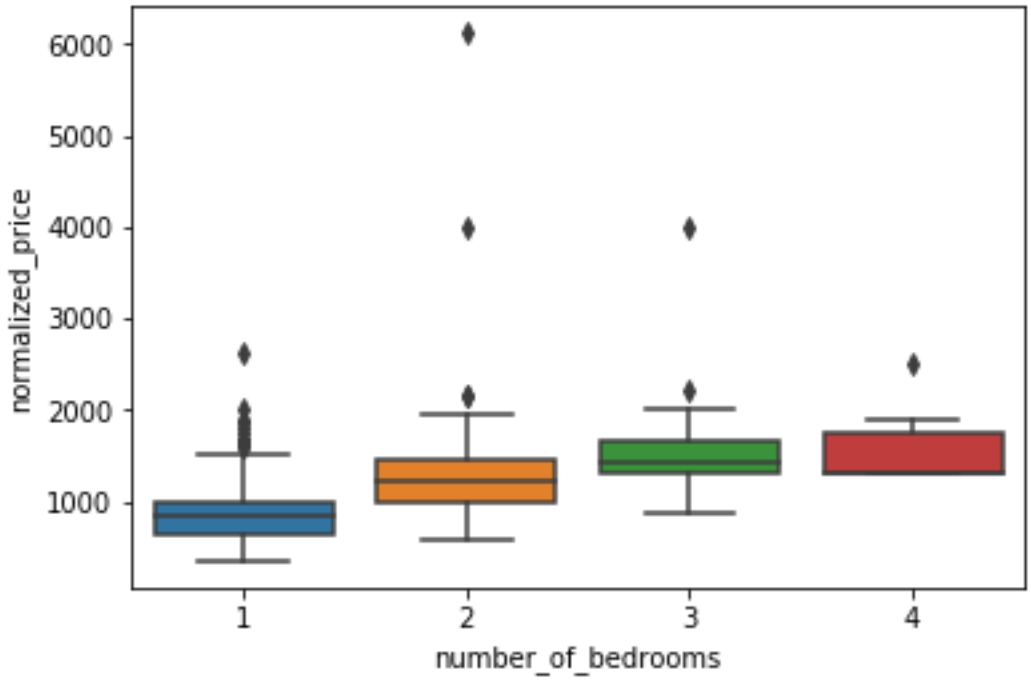
normalized_price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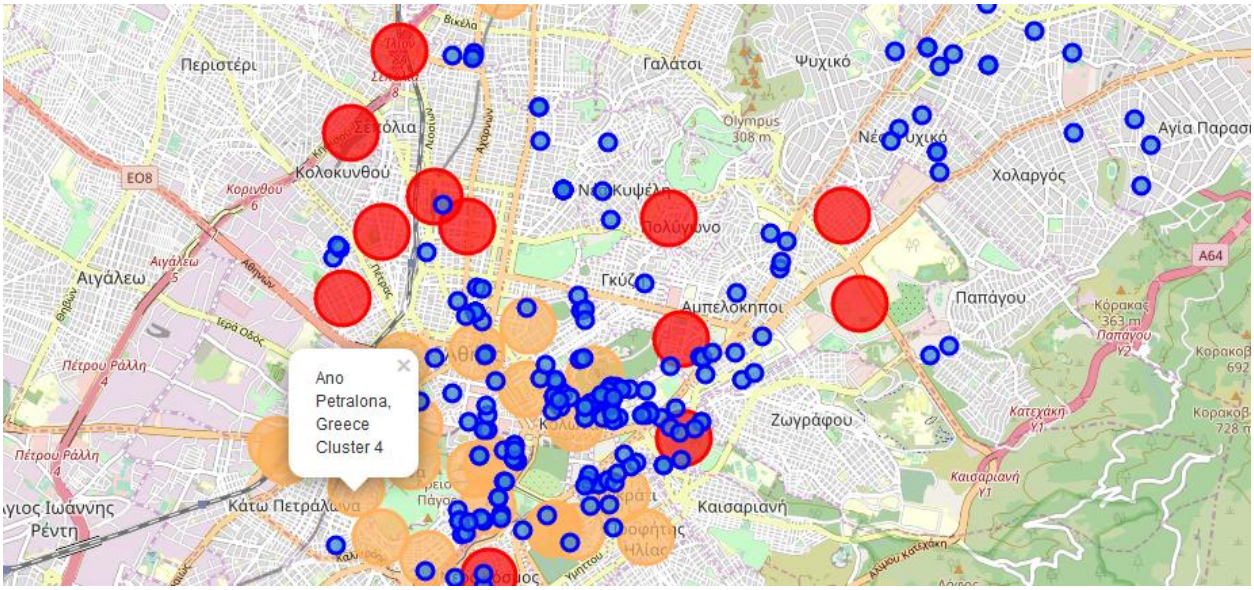
number_of_bedrooms

Map of Athens showing the places for rent and the cluster of venues



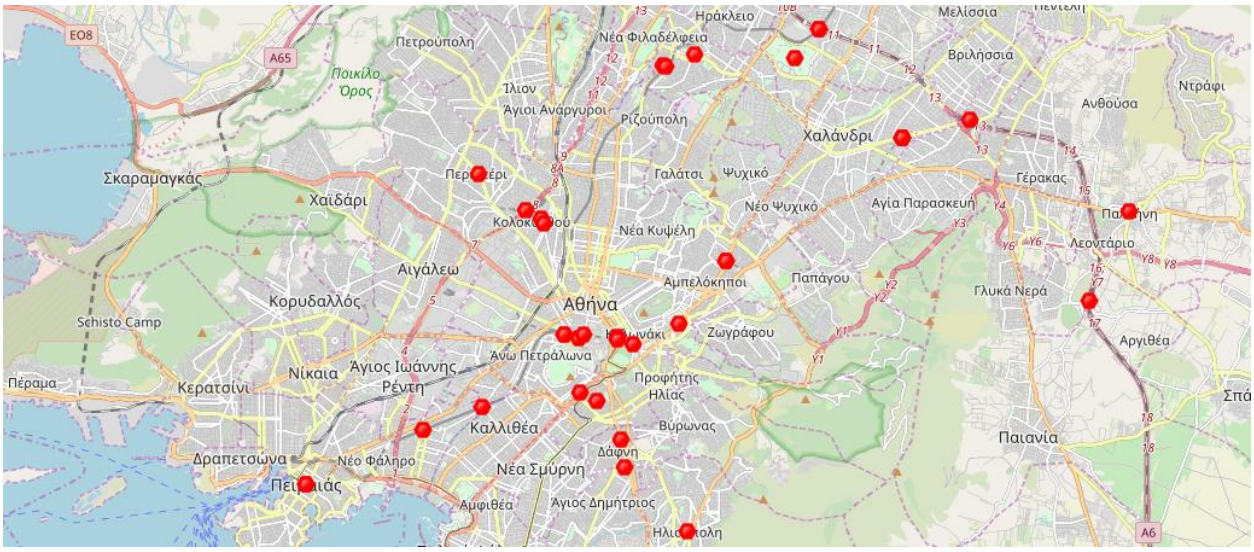
Now, one can point to a rental place for price and address location information while knowing the cluster venues around it.

This is an insightful way to explore rental possibilities.

Now one can explore a particular rental place and its venues in detail

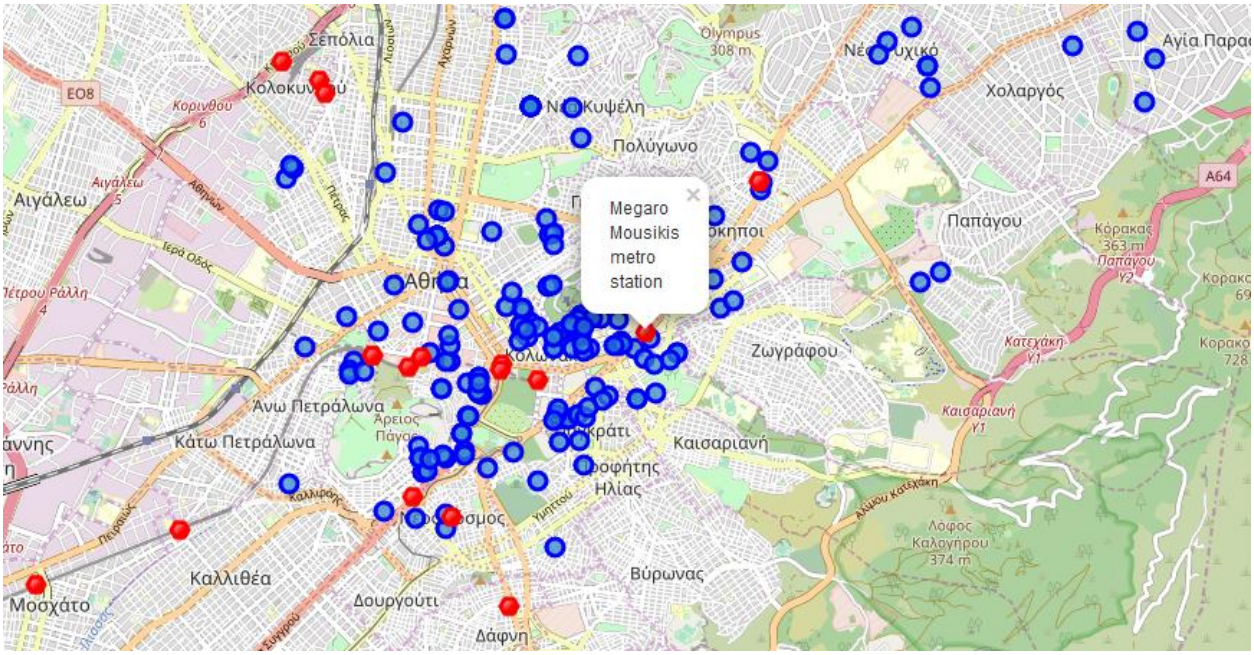
In the map above, examination of apartments with rental place below 700/month is straightforward while knowing the venues around it.
We could find an apartment with at the right price and in a location with desirable venues. The next step is to see if it is located near a subway metro station, in next cells work.

Mapping Athens Subway locations



Map of Athens showing places for rent and the subway locations nearby

Now, we can visualize the desirable rental places and their nearest subway station. Popups display rental address and monthly rental price and the subway station name.
Notice that the icon in the top-right corner is a "ruler" that allows to measure the distance from a rental place to a specific subway station.



4.0 Results

ONE CONSOLIDATE MAP

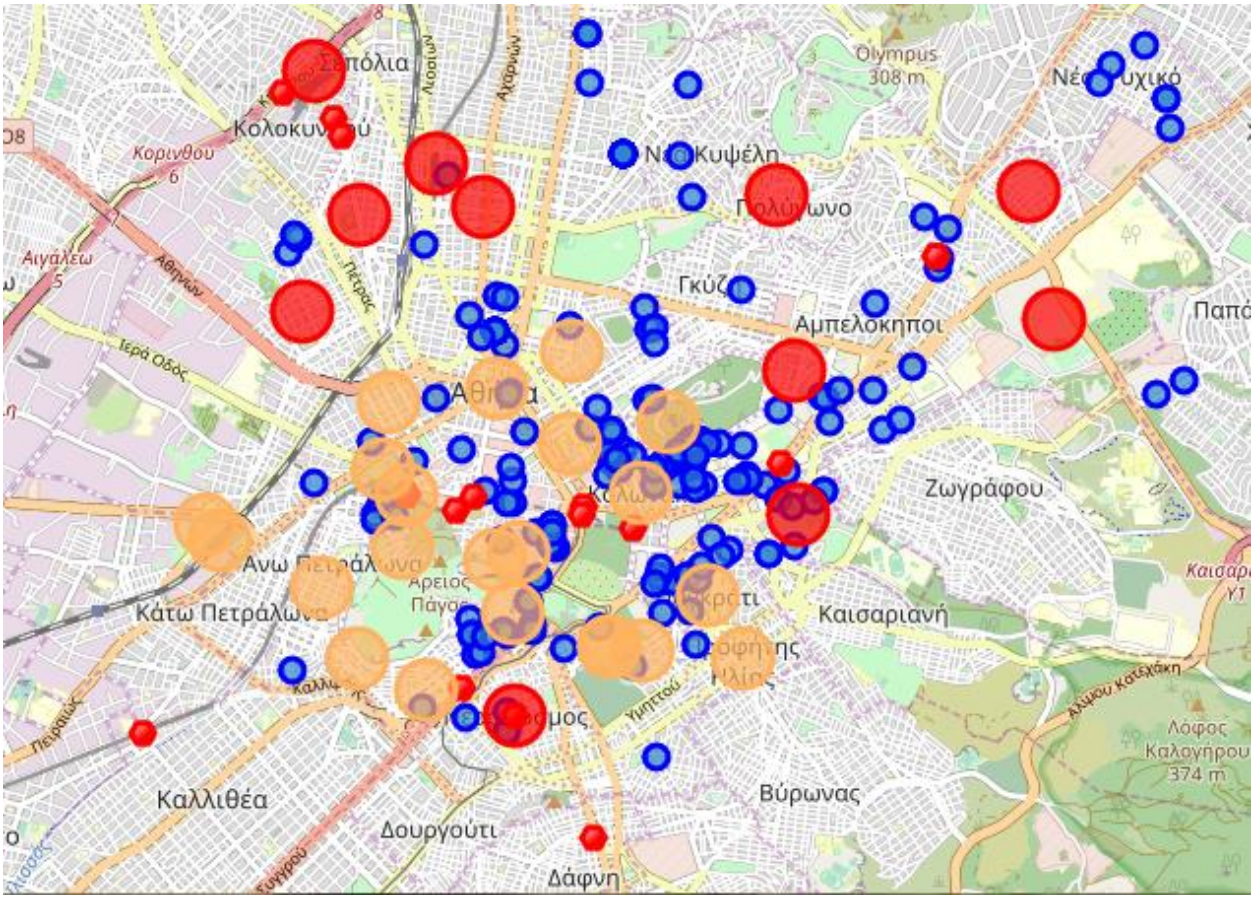
Let's consolidate all the required information to make the apartment selection in one map

Map of Athens with rental places, subway locations and cluster of venues

Red dots are Subway stations, Blue dots are apartments available for rent, Bubbles are the clusters of venues.

Problem Resolution - Select the apartment for rent

The above consolidate map was used to explore options.



After examining, I have chosen two locations that meet the requirements which will assess to make a choice.

- Apartment 1: 10 Geometrou Theodorou Street in the Neos Kosmos Neighborhood and near 'Neos Kosmos' metro station, Cluster # 0 Monthly rent : 650 Euros
- Apartment 2: 19 Nikis Street between Plaka and Kolonaki Neighborhoods and near 'Syntagma' metro station, Cluster # 4 Monthly rent : 590 Euros

Venues for Apartment 1 - Cluster 0

	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
1	Agios Panteleimonas, Athens, Greece	37.996564	23.726957	0	Café	Hotel	Movie Theater	Bakery	Theater	Supermarket	Food & Drink Shop	Music Venue	Coffee Shop	Pizza Place
2	Akadimia Platonos, Greece	37.989357	23.711217	0	Coffee Shop	Supermarket	Plaza	Greek Restaurant	Spa	Hardware Store	Souvlaki Shop	Dessert Shop	Sandwich Place	Grocery Store
7	Attiki, Athens, Greece	37.999539	23.722840	0	Greek Restaurant	Café	Snack Place	Music Venue	Souvlaki Shop	Theater	Tsipouro Restaurant	Brewery	Donut Shop	Bakery
9	Ellinoroson, Greece	37.997683	23.774666	0	Café	Dessert Shop	Coffee Shop	Souvlaki Shop	Seafood Restaurant	Supermarket	Bakery	Gym	Greek Restaurant	Italian Restaurant
13	Goudi, Greece	37.988821	23.776850	0	Café	Soccer Field	Theater	Performing Arts Venue	Basketball Stadium	Pizza Place	Art Museum	Electronics Store	Donut Shop	Gaming Cafe
16	Ilisia, Athens, Greece	37.975425	23.754530	0	Café	Hotel	Mediterranean Restaurant	Souvlaki Shop	Bakery	Coffee Shop	Greek Restaurant	Fish Taverna	Theater	Modern Greek Restaurant
22	Kolonos, Greece	37.996069	23.716221	0	Supermarket	Café	Greek Restaurant	Park	Lounge	Fruit & Vegetable Store	Souvlaki Shop	Bougatsa Shop	Gift Shop	Gym

Venues for Apartment 2 - Cluster 4

	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	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
0	Agios Eleftherios, Athens, Greece	38.020044	23.731724	4	Bar	Café	Coffee Shop	Dessert Shop	Creperie	Bakery	Supermarket	Souvlaki Shop	Greek Restaurant	Kafenio
3	Akadimia, Athens, Greece	37.980285	23.734528	4	Bar	Café	Cocktail Bar	Coffee Shop	Theater	Bookstore	Comfort Food Restaurant	Souvlaki Shop	Jewelry Store	Gourmet Shop
4	Anafiotika, Greece	37.972351	23.728043	4	Historic Site	Hotel	Greek Restaurant	Café	Bar	Wine Bar	Plaza	Ice Cream Shop	Taverna	Gift Shop
5	Ano Petralona, Greece	37.970467	23.712938	4	Café	Cocktail Bar	Meze Restaurant	Coffee Shop	Pie Shop	Greek Restaurant	Bar	Supermarket	Taverna	Thai Restaurant
6	Asteroskopeio, Greece	37.973125	23.719985	4	Greek Restaurant	Historic Site	Café	Meze Restaurant	Mediterranean Restaurant	Park	Bar	Bakery	Coffee Shop	Record Shop
11	Exarcheia, Greece	37.986653	23.734839	4	Bar	Café	Coffee Shop	Greek Restaurant	Wine Bar	Dessert Shop	Vegetarian / Vegan Restaurant	Souvlaki Shop	Cretan Restaurant	Plaza
12	Gazi, Athens, Greece	37.974813	23.702751	4	Nightclub	Snack Place	Bar	Performing Arts Venue	Motorcycle Shop	Kafenio	Soccer Stadium	Café	Pharmacy	Food & Drink Shop
15	Gyzi, Greece	39.643246	22.413638	4	Café	Bar	Greek Restaurant	Historic Site	Theater	Electronics Store	Park	Restaurant	Nightclub	Souvlaki Shop

Apartment Selection

Using the "one map" above, I was able to explore all possibilities since the popups provide the information needed for a good decision.

Based on current residence venues, I feel that Cluster 4 type of venues is a closer resemblance to my current place. That means that APARTMENT 2 is clear winner.