

Enhancing electric mobility in Barcelona

Electric vehicle charging stations in the city of Barcelona

Introduction

The aim of this project is to enhance electric mobility in Barcelona. It has been developed in the scope of IBM Data Science Specialization to strengthen the knowledge on data analysis and visualization using the Foursquare location data. It locates the nearest electric parking stations to a referenced food venue from Foursquare within Barcelona.

The project clusters Barcelona's neighborhood based on the most common type of restaurants venues from Foursquare and locates the nearest electric vehicle charging stations to a selected place.

Urban mobility

Urban mobility is becoming one of the main pollution emission and a key stress factor on citizens' lives. Within Europe, the large majority of its population lives in an urban environment. Urban mobility accounts for 40 % of all CO2 emissions of road transport and up to 70 % of other pollutants from transport.

Barcelona is an example of the increasing problems caused by transport increase and traffic. The question on how can pollution free urban mobility is enhanced in Barcelona arises. Thus, the willingness to boost the use of electric vehicles by facilitating information about the nearest charging stations.

This would allow electric vehicles drivers to look for a restaurant –or any other venue- and identify the nearest charging locations next to that restaurant.

Data readiness

Barcelona information and location

The initial data requires identifying and locating Barcelona's neighborhood. The data used in this project has been downloaded from the Barcelona City Hall Open Data website.

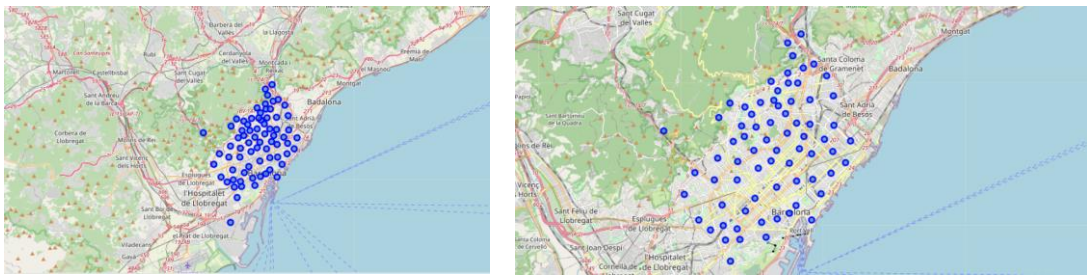
Codi_Barri	Nom_Barri	Nom_Districte
1	el Raval	Ciutat Vella
2	el Barri Gòtic	Ciutat Vella
3	la Barceloneta	Ciutat Vella
4	Sant Pere, Santa Caterina i la Ribera	Ciutat Vella
5	el Fort Pienc	Eixample

Once Barcelona's neighborhoods have been listed, the list of addresses including street coordinates was used to generate the neighborhood coordinates as the mean of each one of

its different addresses. Albeit it might not be the official neighborhood’s coordinates; it should be representative as an average among all their addresses.

Codi_Barri	Nom_Barri	Nom_Districte	LATITUD	LONGITUD
1	el Raval	Ciutat Vella	41.379878	2.168835
2	el Barri Gòtic	Ciutat Vella	41.382370	2.176181
3	la Barceloneta	Ciutat Vella	41.379373	2.189934
4	Sant Pere, Santa Caterina i la Ribera	Ciutat Vella	41.386124	2.180597
5	el Fort Pienc	Eixample	41.397413	2.180783
6	la Sagrada Família	Eixample	41.405752	2.176447
7	la Dreta de l'Eixample	Eixample	41.394536	2.168325
8	l'Antiga Esquerra de l'Eixample	Eixample	41.389335	2.154957
9	la Nova Esquerra de l'Eixample	Eixample	41.383454	2.149162
10	Sant Antoni	Eixample	41.378282	2.159319

The following images show these neighborhoods plotted into a map



Three different databases were loaded; two of them to compile the required information about Barcelona’s neighborhoods and the third one to include the reference to the electric charging stations in Barcelona which had already the coordinates.

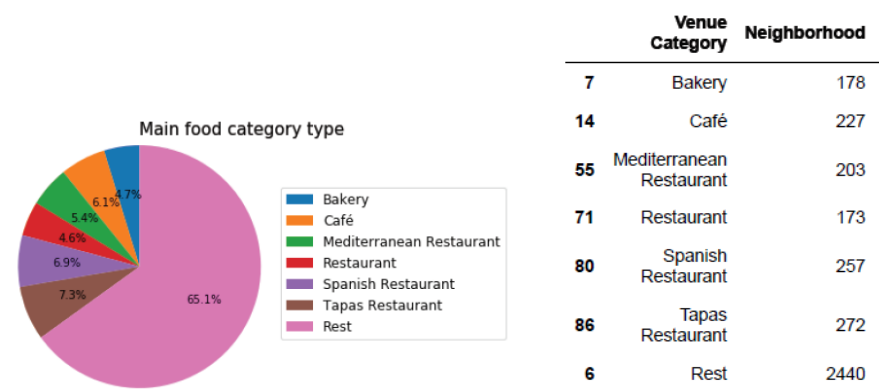
Foursquare venues

In addition, the Foursquare API has been used to obtain a large database with nearby venues for each neighborhood. The list of venues was tailored to explore the most popular restaurants for each neighborhood.

	Neighborhood	Neighborhood Latitude	Neighborhood Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	el Raval	41.379878	2.168835	La Robadora	41.379500	2.170463	Gastrop
1	el Raval	41.379878	2.168835	A Tu Bola	41.380096	2.169054	Tap Restaur
2	el Raval	41.379878	2.168835	Guixot	41.378509	2.167806	Spani Restaur
3	el Raval	41.379878	2.168835	Teddys - Libanés	41.380939	2.167959	Fast Fo Restaur
4	el Raval	41.379878	2.168835	Ófis Restaurant	41.378636	2.170668	Mediterrane Restaur

There is a list of almost 100 different food venue categories. This is why it has been filtered with the most common ones in order to have a reference in terms on how category types are representative from the whole.

The dataframe per neighborhood can contain up to one hundred references, identifying the most popular venues:



The sample later on provided for electric station location refers to La Vila de Gràcia neighborhood, where the most common food venues are:

----la Vila de Gràcia----

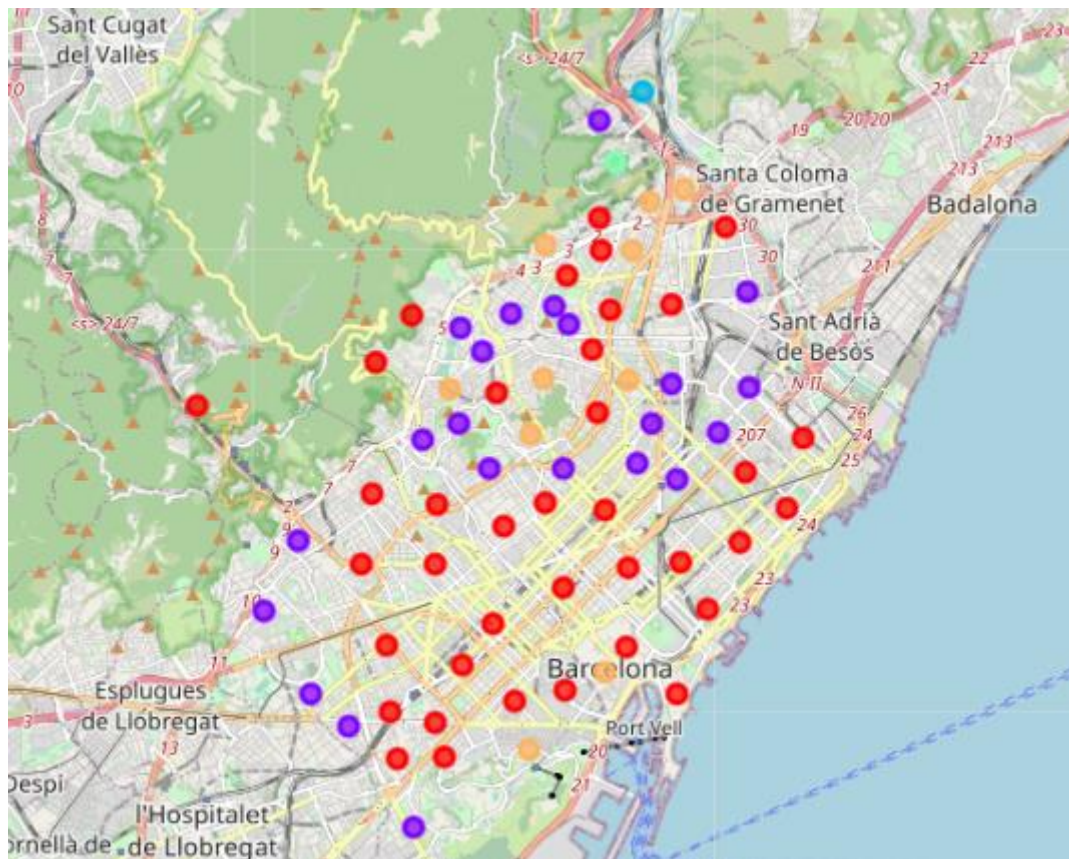
	venue	freq
0	Mediterranean Restaurant	0.12
1	Café	0.09
2	Tapas Restaurant	0.09
3	Pizza Place	0.08
4	Restaurant	0.07

Clustering the neighborhoods

The next step is to cluster the different neighborhoods based on the venues information gathered into 5 different groups and plotting those into the map.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Baró de Viver	Diner	Restaurant	Asian Restaurant	Deli / Bodega	Tapas Restaurant
1	Can Baró	Spanish Restaurant	Chinese Restaurant	Tapas Restaurant	Bakery	Snack Place
2	Can Peguera	Café	Spanish Restaurant	Restaurant	German Restaurant	Wings Joint
3	Canyelles	Tapas Restaurant	Café	Mediterranean Restaurant	Wings Joint	Food Court
4	Ciutat Meridiana	Bakery	Mediterranean Restaurant	Café	Wings Joint	Food Truck
5	Diagonal Mar i el Front Marítim del Poblenou	Mediterranean Restaurant	Restaurant	Café	Spanish Restaurant	Hot Dog Joint
6	Horta	Bakery	Sandwich Place	Tapas Restaurant	Café	Pizza Place

This would allow to cluster Barcelona's neighborhoods based on the most common food venues of these clusters.

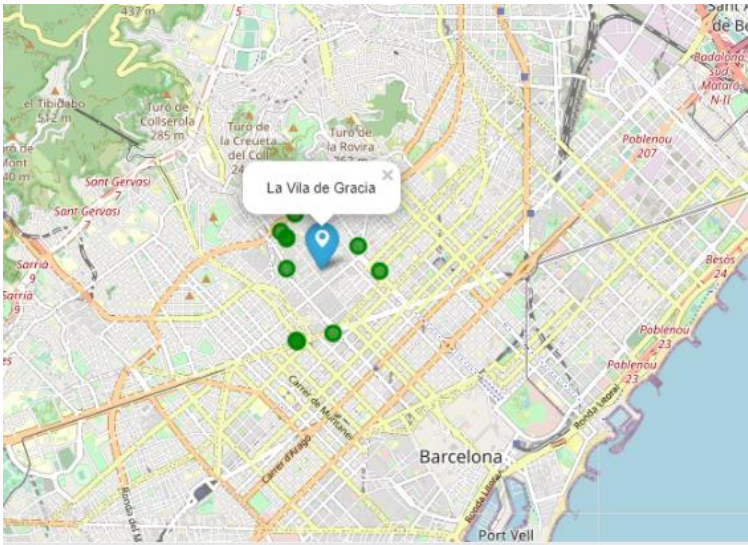


Locating a spot and finding the nearest parking stations

Once the neighborhoods are clustered, you can decide the location you would like to go which neighborhood goes to based on the previous information or locate the venue you were looking for and get its location.

	LATITUD	LONGITUD	TIPO_CONNECTOR
0	41.329694	2.114526	CHADEMO,MENNEKES,COMBO 2
1	41.359949	2.133299	SCHUKO,SCHUKO

Once located, the project calls the distance function based on latitude and longitude



Conclusion and discussion

The accomplishment of this project has been thankful to the Barcelona City Hall open data and the fermium services offered by both IBM Cloud and Foursquare. The amount of accessible data has and is expected to keep growing on the years to come. However, to maintain reliant sources of open data accessible might become a challenge.

This project has been developed in the scope of an academic course to strengthen the knowledge using the Foursquare location data. There is additional data that could be reviewed in detail and tailored to identify patterns. Barcelona is a well-known and tourist city which might and thus, might be useful to differentiate recommendations between residents, visitors or even food critics.

References

- Project link
https://eu-de.dataplatform.cloud.ibm.com/analytics/notebooks/v2/3e429b7a-40e4-49fc-9113-8bd87d7232eb/view?access_token=13d297bd00ac2444832dc64e5fe44817dc8151ef5e6b0318c78343ede2ca5ed4
- Clean transport, Urban transport. Urban mobility
https://ec.europa.eu/transport/themes/urban/urban_mobility_en
- Open Data BCN. Ajuntament de Barcelona's open data service
<https://opendata-ajuntament.barcelona.cat/en>
- Foursquare
<https://foursquare.com/>