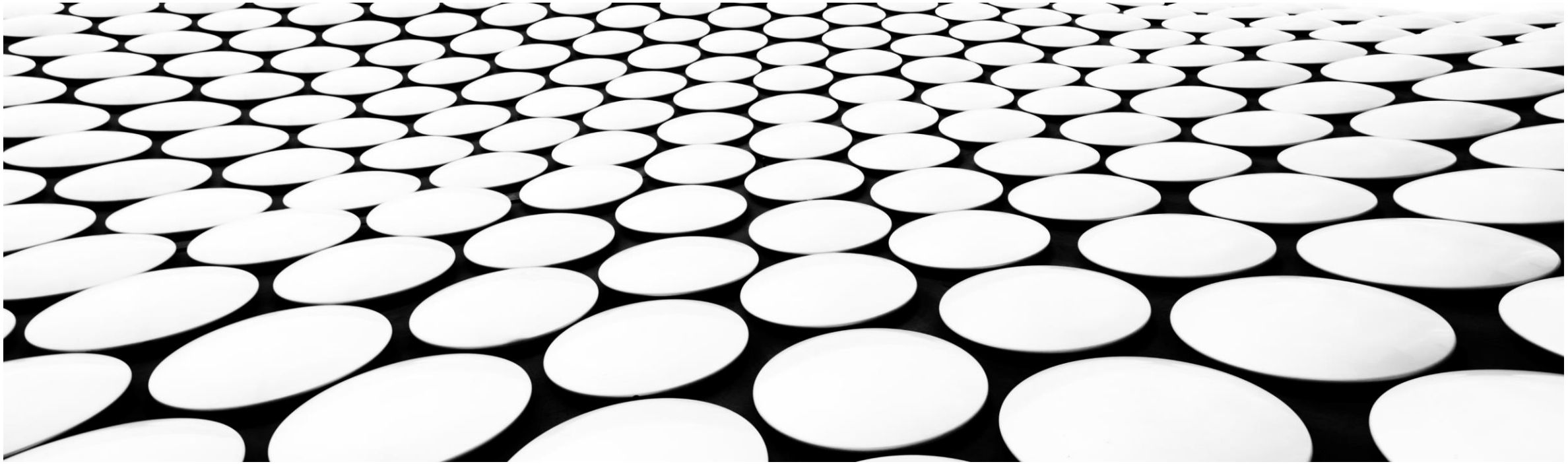
DAVIDE MIGLIETTA

IBM DS CAPSTONE PROJECT

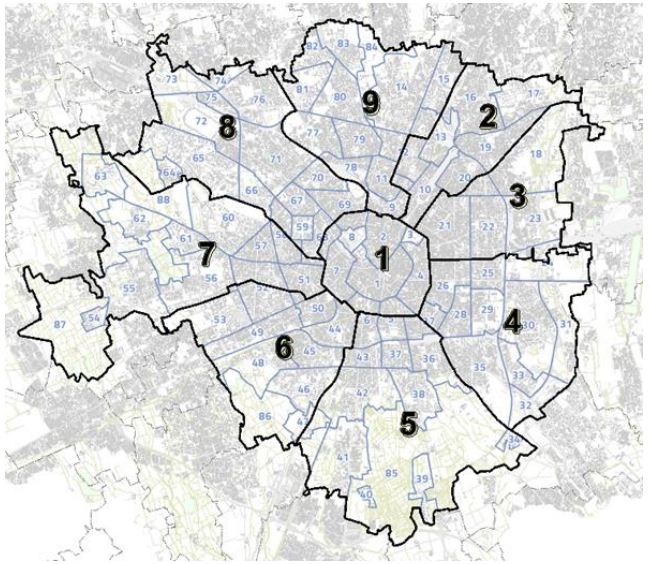
ANALYZING AND CLUSTERING NEIGHBORHOODS OF MILANO, ITALY



INTRODUCTION

- The scope of this project is to explore the city of Milano and its neighborhoods, by crossing data and information about parks, green area, and venues. The goal is to investigate and find the “most livable” parts of the city. The basic idea is that a neighborhood is more livable and enjoyable by its inhabitants if has a wide variety of services and venues (such as restaurants, bars, theatres) and a big extension of parks and green areas.

- Milano is divided in 9 “Municipi” (districts) and 88 “Nuclei di identità locale (NIL)” (neighborhoods), such as represented in the picture.



DATA AND DATA SOURCES

Data for the analysis have been found on:

- Foursquare, where data containing information about venues has been scraped. The information is about the name, geographical location and category of the venue.
- https://dati.comune.milano.it (official website of the “Comune di Milano”), where it was found data about geographical location and dimension of Municipi, NIL, dog areas and parks.

As first step of the work it has been necessary manipulate the data found at https://dati.comune.milano.it to organize it in dataset with aggregate information useful to the scope. In particular:

- For NIL and Municipi, 3 different dataset have been merged, aggregated and cleaned to obtain a more useful one, shown.

Out[60]:

ID_NIL	NIL	NIL_Long	NIL_Lat	NIL_Area_mq	MUN
1	DUOMO	9.186948	45.463707	2.341704e+06	1
2	BRERA	9.188157	45.474252	1.637395e+06	1
3	GIARDINI P.TA VENEZIA	9.200231	45.474564	2.496468e+05	1
4	GUASTALLA	9.201891	45.463219	1.548021e+06	1
5	PORTA VIGENTINA - PORTA LODOVICA	9.192446	45.450950	1.135239e+06	1

- Similar manipulation has been performed on parks and green areas data, to obtain:

Out[18]:

	MUN	park_area_mq	park_name	long_parks	lat_parks
0	6	49230.077148	PARCO DELLE CROCEROSSINE	9.123539	45.450540
1	9	1451.261719	GIARDINO VIA PORRO JENNER	9.179612	45.496733
2	1	351.915039	GIARDINO ROBERTO BAZLEN	9.197675	45.453966
3	2	973.018555	GIARDINO ALDO PROTTI	9.200186	45.493943
4	7	1640.686523	PARCO ANNARUMMA	9.118195	45.460160

Information about venues scraped from Foursquare:

In [176]:
```
print(milano_venues.shape)
milano_venues.head()
```

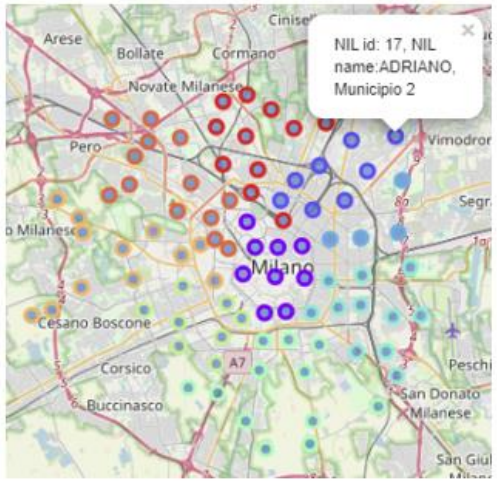
(2212, 5)

Out[176]:

	NIL	Venue	Venue Latitude	Venue Longitude	Venue Category
0	DUOMO	Piz	45.462163	9.185767	Pizza Place
1	DUOMO	Starbucks Reserve Roastery	45.464920	9.186153	Coffee Shop
2	DUOMO	Piazza del Duomo	45.464190	9.189527	Plaza
3	DUOMO	Ciacco. Gelato senz'altro	45.463704	9.186796	Ice Cream Shop
4	DUOMO	Venchi	45.465214	9.187340	Ice Cream Shop

METHODOLOGY AND DATA MANIPULATION

As mentioned, the very first step was to find data and manipulate it to have more useful and manageable ones. For instance, information about NIL coordinates and area were on different datasets; also, the "match" between NIL and Municipi was in a third dataset. From the three datasets were extract the needed information and aggregate in the previously shown dataframe. To check this phase success, a plot of the city using Folium has been performed. The goal was to check the correct position of the NIL using the given coordinates and correct assignation of the NIL to the Municipio.



“GREEN” CLASSIFICATION OF THE NIL

Classification and clustering of the neighborhoods. It has been calculated the number of parks, the extension of all the green areas compared to the total area of the NIL and the extension of the bigger park in the neighborhood.

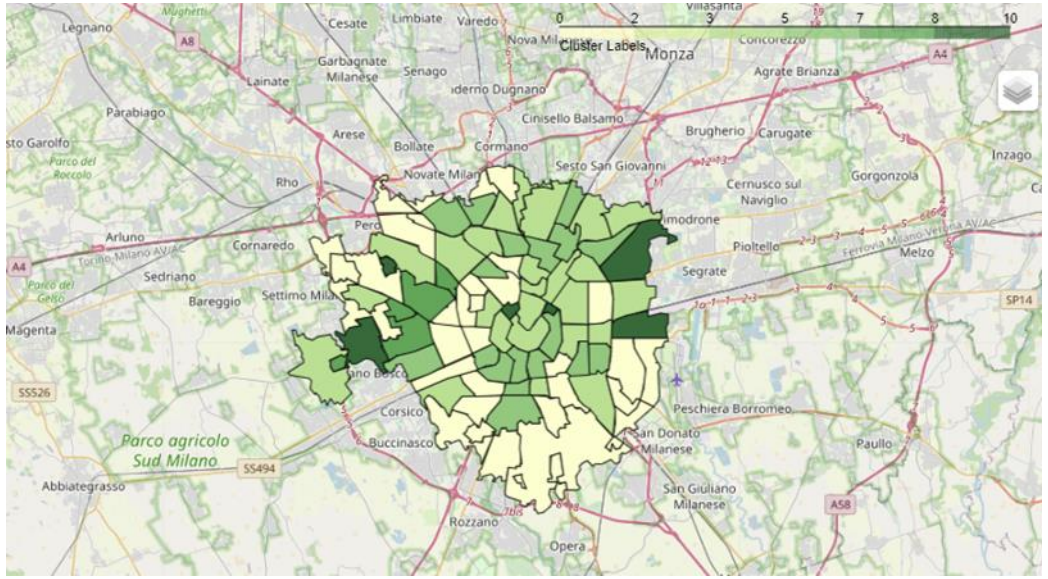
The necessary data (left) has been scaled using StandardScaler (right).

Out[1951]:

ID_NIL	num_of_parks	bigger_park_mq	%_parks_area
1	1.0	106.402832	0.004544
2	1.0	4665.222656	0.284917
3	2.0	192970.566406	85.020895
4	2.0	33585.192383	2.634846
5	4.0	73821.117188	8.532211

Out[1956]:

ID_NIL	num_of_parks	bigger_park_mq	%_parks_area
1	-0.021115	-0.498672	-0.425301
2	-0.021115	-0.468588	-0.407084
3	0.907933	0.774061	5.098584
4	0.907933	-0.277741	-0.254399
5	2.766029	-0.012220	0.128779



Each cluster is representing a group of neighborhoods with less or more “green characteristics”. The darker the green, the greener the NIL.

CLASSIFICATION OF THE NIL BY FOURSQUARE DATA

1 Information about venues scraped from Foursquare:

```
In [176]:
1 print(milano_venues.shape)
2 milano_venues.head()
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Out[176]:

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2 To complete the analysis, the obtained data from Foursquare has been explored and analyzed.

```
1 milano_venues['NIL'].value_counts()
```

```
GIARDINI P.TA VENEZIA                  100
PORTA TICINESE - CONCA DEL NAVIGLIO    100
BRERA                                   95
PORTA GARIBALDI - PORTA NUOVA           94
STAZIONE CENTRALE - PONTE SEVESO        87
PTA ROMANA                              79
DUOMO                                   75
```

```
1 milano_venues['Venue Category'].value_counts()
```

```
Italian Restaurant    216
Café                  144
Pizza Place           124
Hotel                  85
Ice Cream Shop         69
Cocktail Bar           62
Plaza                  59
Supermarket            45
```

3

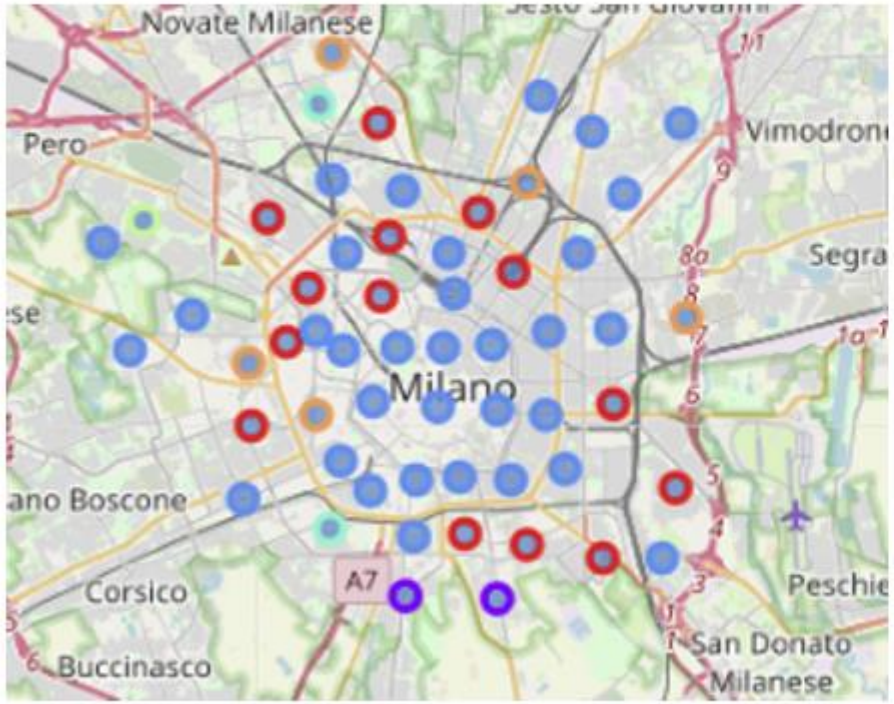
Out[188]:

	NIL	Art Gallery	Art Museum	Asian Restaurant	Athletics & Sports	Bakery	Bar	Bed & Breakfast	Beer Bar	Bistro	Bookstore	Boutique	Breakfast Spot	Brewery	Burger Joint	Bus Stop
0	ADRIANO	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.000000	0.0
1	AFFORI	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.000000	0.0
2	BANDE NERE	0.0	0.0	0.0	0.076923	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000000	0.0	0.000000	0.0
3	BICOCCA	0.0	0.0	0.0	0.000000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.041667	0.0	0.041667	0.0
4	BOVISA	0.0	0.0	0.0	0.000000	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.000000	0.1	0.000000	0.0

It has been performed a K-mean classification of the neighborhoods, but not all the data has been used. For example, the three most common venues were not included since spread all over the city and with a quite higher number compared to the others. That was not adding much information to the classification and it has been decided to look for insights “behind the surface”. The frequency of each category in each NIL has been determined. Again, the K for the classification has been determined by the elbow method and the chosen one was 6.

CLASSIFICATION OF THE NIL BY FOURSQUARE DATA

Six clusters have been obtained, showed in the map.



For example, Cluster number 3 (blue dots) was the one with a wider variety of venues indicating more choices for the population.

```
cluster3 #various venues
```

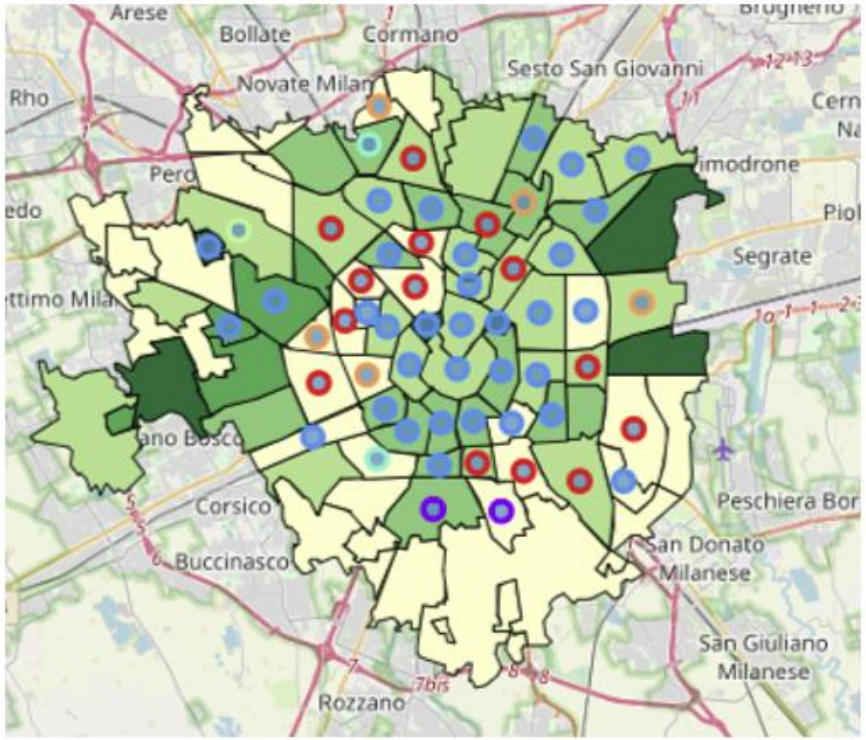
Cluster Labels	NIL	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue
3	ADRIANO	Plaza	Supermarket	Clothing Store
3	BICOCCA	Steakhouse	Plaza	Sandwich Place
3	BOVISA	Piadineria	Vegetarian / Vegan Restaurant	Gym
3	BRERA	Ice Cream Shop	Japanese Restaurant	Wine Bar

RESULTS AND CONCLUSIONS

Results

The results of the project were obtained by unifying the previously shown analysis.

A map of Milano grouping the two classification is shown here. The “best match” between the two classification are the blue dots and the darker green NIL, indicating many venues and variety and greener neighborhoods.



Conclusions

As visible in the map, this report concludes that the better part where to live in Milano are the center of the city, the west suburbs, and the north-east suburbs