

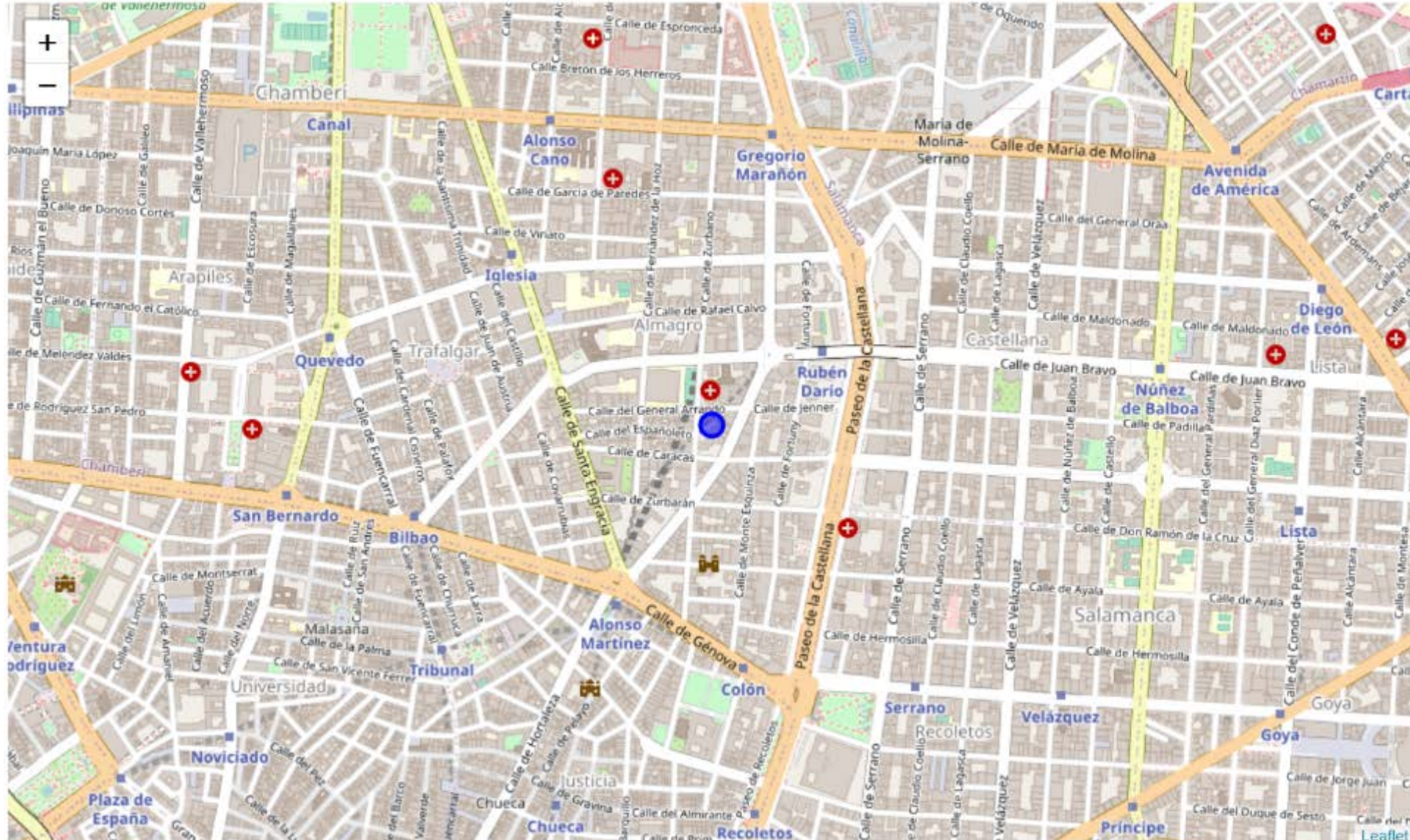
# **Capstone Project**

**Finding a Philadelphia Neighborhood Most Similar to Almagro, Madrid**

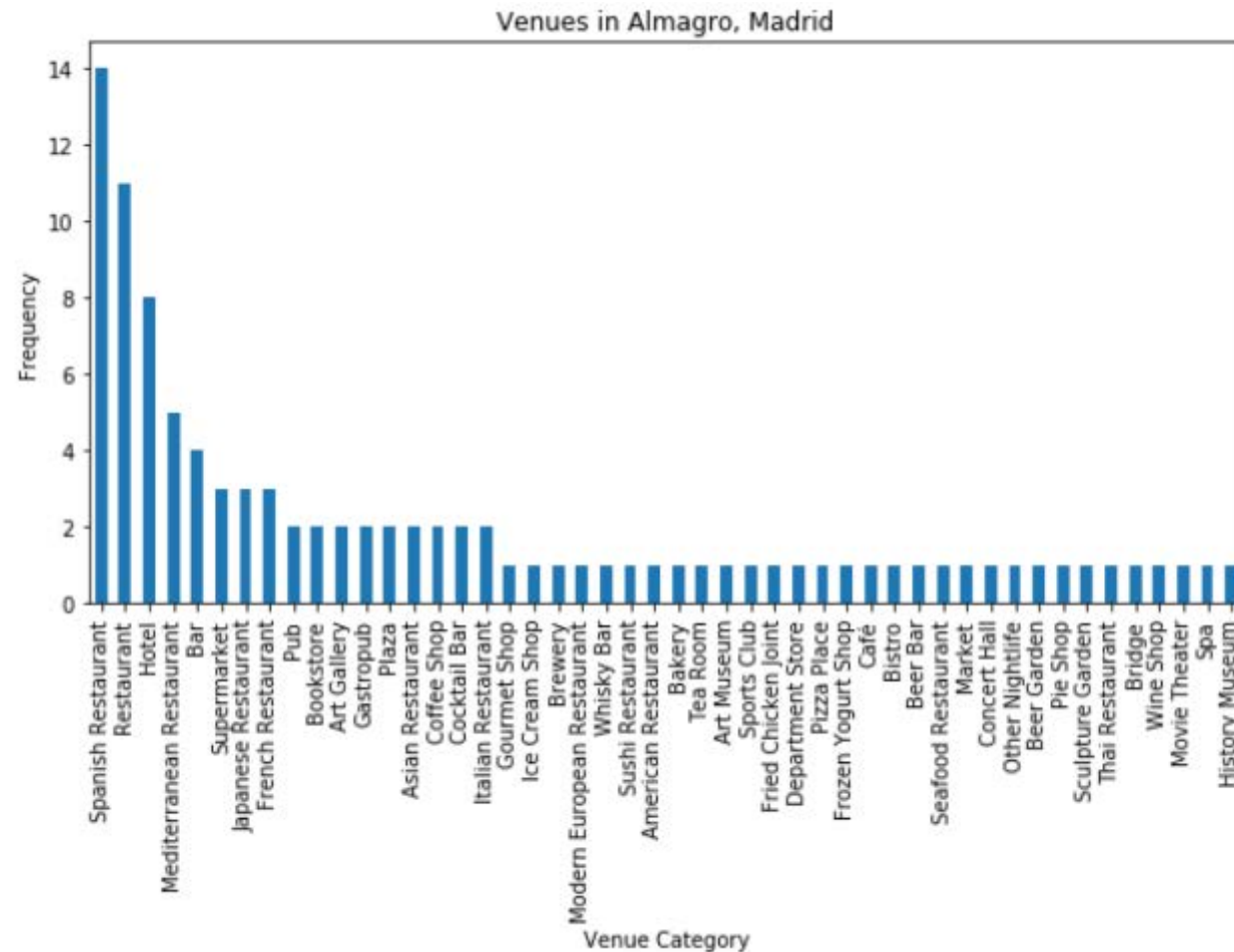
# Introduction

- The project objective is to find a neighborhood in Philadelphia, PA, USA, that is most similar to Almagro, Madrid
- The program is also applicable for finding a neighborhood in any city that is similar to some other target neighborhood.
- The algorithm could be used by people who are planning to move to a new city and want to find a neighborhood that is most similar to a known neighborhood that they find desirable. T
- The algorithm also incorporates real estate price data so that the user can compare similarity between neighborhoods and median housing prices to find a most optimal match for his/her particular situation.

# Target Neighborhood – Almagro, Madrid



# Venues Categories in Almagro, Madrid



Almagro has a high concentration and wide variety of restaurants. Spanish and Mediterranean restaurants are most common. There are also a good number of bars/pubs and hotels, and some art galleries.

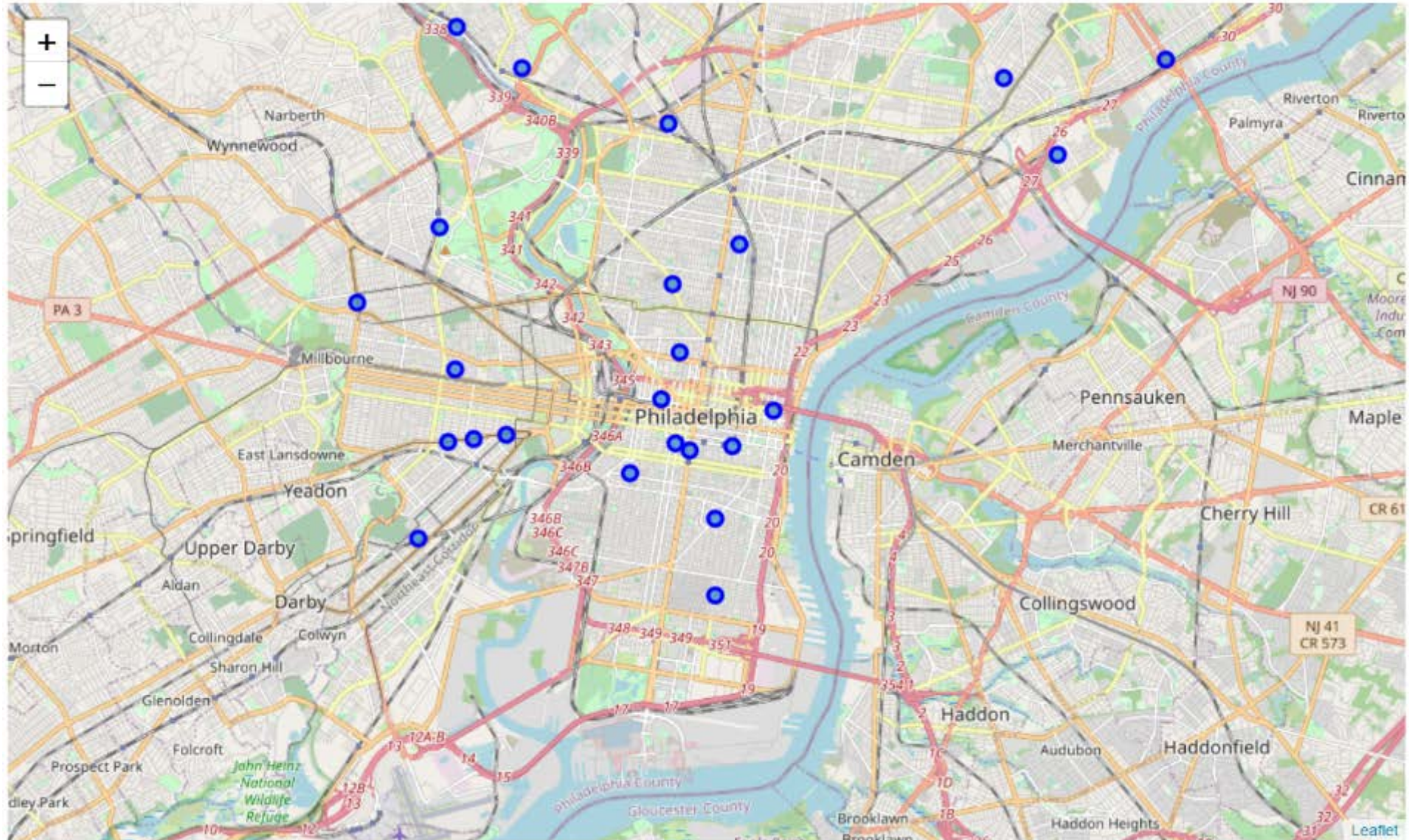


# Dataframe of Philadelphia Neighborhoods for Analysis

	Neighborhood	Zip Code	2017 Median Price	1-Yr. Change	3-Yr. Change	10-Yr. Change	Latitude	Longitude
0	Center City West: Broad to 18th, Callowhill to	19102	\$580,500	-10%	37%	78%	39.946212	-75.165016
1	Rittenhouse	19103	\$530,000	9%	12%	20%	39.955870	-75.171830
2	University City/West Philadelphia	19104	\$219,375	-3%	28%	70%	39.848252	-75.209377
3	Old City/Society Hill	19106	\$404,625	8%	4%	-1%	39.953578	-75.144727
4	Center City East: Broad to 8th, Callowhill to ...	19107	\$335,000	15%	20%	-7%	39.847072	-75.154640
5	Fox Chase	19111	\$170,000	10%	17%	0%	40.080375	-75.080391
6	Tiamesdale South	19114	\$189,880	9%	19%	-6%	40.060628	-75.012622
7	Burlington	19115	\$225,000	11%	21%	0%	40.085084	-75.049773
8	Somerton	19116	\$233,000	5%	8%	1%	40.116368	-75.018372
9	Chestnut Hill	19118	\$451,000	-5%	-0%	11%	40.097815	-75.187308
10	Mount Airy	19119	\$257,200	7%	14%	0%	40.052291	-75.188576
11	Olney	19120	\$80,000	14%	42%	-5%	44.965675	1.827778
12	Strawberry Mansion/Bensburytown	19121	\$170,000	45%	143%	138%	39.977210	-75.168867
13	Temple/Old Kensington	19122	\$305,000	38%	103%	118%	39.984489	-75.153013
14	Northern Liberties/East Spring Garden	19123	\$410,500	-5%	29%	28%	39.848816	-75.223406
15	Junkies/Frankford	19124	\$85,000	12%	48%	-9%	40.015194	-75.089053
16	Fishtown/Kensington	19125	\$309,150	5%	44%	107%	40.121661	9.836675
17	Oak Lane	19126	\$140,450	0%	27%	17%	44.111037	9.838797
18	Manayunk	19127	\$235,000	5%	7%	-6%	40.024769	-75.221294
19	Rindborough/Andorra	19128	\$259,450	8%	12%	3%	40.017049	-75.205852
20	East Falls	19129	\$224,900	5%	8%	3%	40.006745	-75.170010
21	Fairmount	19130	\$350,000	5%	10%	14%	39.864489	-75.167457
22	Wynnsfield/Carroll Park	19131	\$99,900	22%	32%	11%	39.987532	-75.225379
23	North Philadelphia West	19132	\$27,500	26%	38%	-21%	44.008751	9.817743
24	North Philadelphia East	19133	\$41,000	44%	59%	-9%	44.008731	9.775781
25	Richmond	19134	\$84,450	30%	107%	43%	44.123010	9.703318
26	Tacony	19135	\$187,000	13%	34%	-11%	40.016730	-75.048864
27	Holmesburg	19136	\$139,000	9%	24%	1%	40.041997	-75.026135
28	Orindesburg	19137	\$146,450	21%	30%	5%	40.091018	-75.075835
29	East Germantown	19138	\$109,450	29%	37%	23%	44.111484	9.848488
30	West Market	19139	\$60,000	30%	71%	9%	39.961289	-75.221523
31	Hunting Park	19140	\$38,050	22%	48%	-24%	45.445863	1.578142
32	Logan	19141	\$99,450	12%	28%	21%	40.585544	-3.121644
33	Elmwood	19142	\$40,000	9%	45%	-31%	38.830008	-75.230725
34	Kingsessing	19143	\$78,500	11%	32%	12%	39.948549	-75.217172
35	Germantown	19144	\$119,400	20%	20%	15%	40.036057	-75.167624
36	South Philly: S. of Tasker, W. of Broad	19145	\$209,000	18%	74%	84%	39.947720	-75.168289
37	Graduate Hospital/Point Breeze	19146	\$365,000	9%	10%	75%	39.842056	-75.178274
38	Bella Vista/Queen Village/Peenunk Square North	19147	\$439,500	10%	24%	37%	39.933811	-75.158858
39	South Philly: S. of Tasker, E. of Broad	19148	\$216,000	10%	39%	51%	39.919435	-75.158008
40	Oxford Circle/Mayfair	19149	\$146,000	14%	33%	10%	39.446465	17.927804
41	Cedarbrook	19150	\$157,000	9%	15%	7%	45.225482	1.861242
42	Overbrook	19151	\$132,500	9%	25%	10%	39.873653	-75.245311
43	Rhawnhurst	19152	\$205,000	14%	28%	5%	40.051590	-75.058291
44	Eastwick	19153	\$133,500	21%	27%	-1%	40.667254	-2.980596
45	Tiamesdale North	19154	\$189,900	8%	18%	1%	40.020270	-75.020578



# Locations of Philadelphia Neighborhoods

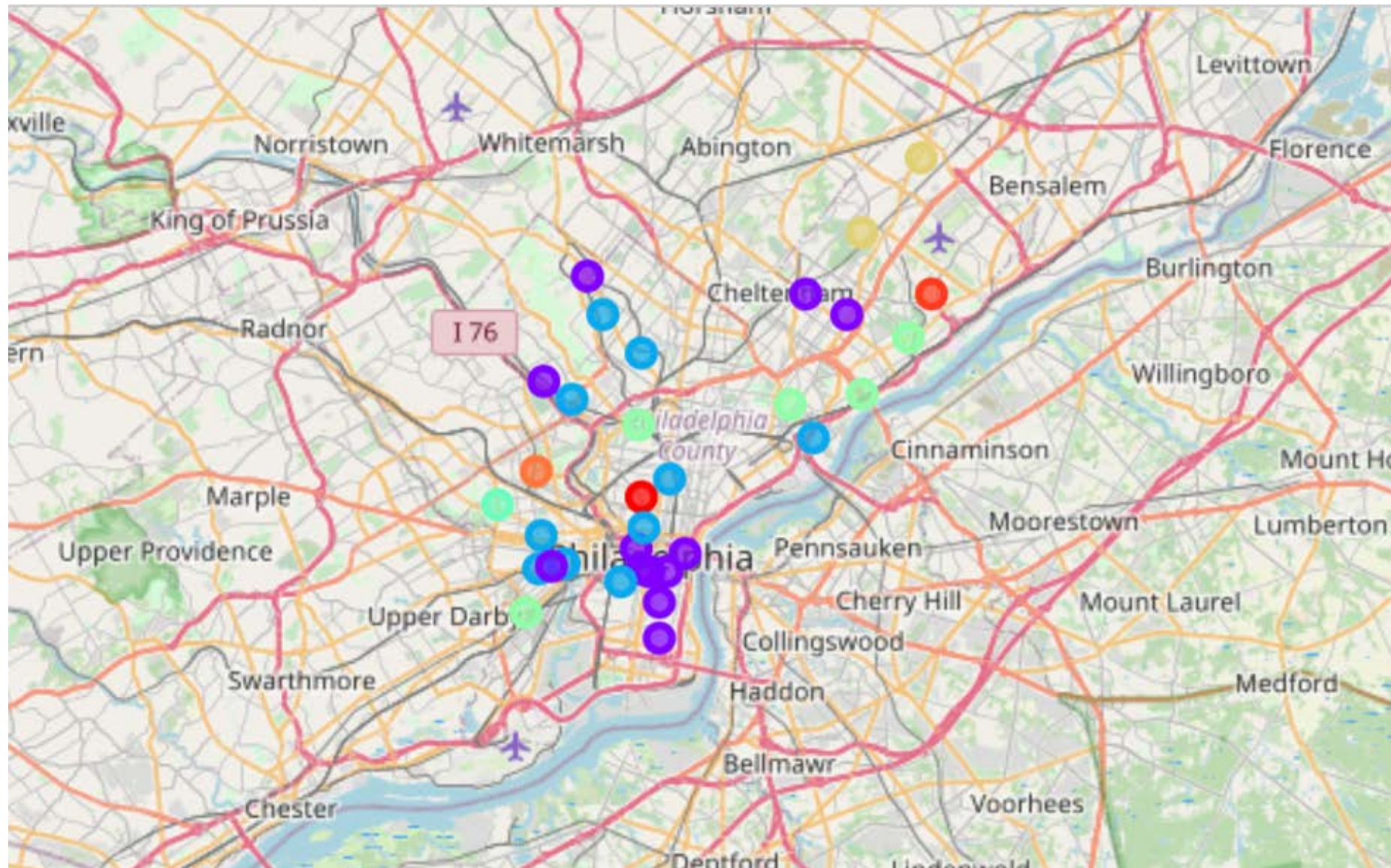


# Most Common Venues by Neighborhood

	Neighborhood	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	Almagro	Spanish Restaurant	Restaurant	Hotel	Mediterranean Restaurant	Bar	Supermarket	French Restaurant	Japanese Restaurant	Gastropub	Bookstore
1	Bella Vista/Queen Village/Passyunk Square North	Sandwich Place	Mexican Restaurant	Vietnamese Restaurant	Bakery	Coffee Shop	Gym	Bookstore	Restaurant	French Restaurant	Food Truck
2	Bridesburg	Pharmacy	Pizza Place	Bus Station	Food & Drink Shop	Gas Station	Bar	Food Truck	Restaurant	Sports Bar	American Restaurant
3	Bustleton	Indian Restaurant	Cosmetics Shop	Grocery Store	Pizza Place	Pharmacy	Salon / Barbershop	Diner	Chinese Restaurant	Skating Rink	Mediterranean Restaurant
4	Center City East: Broad to 8th, Callowhill to ...	Historic Site	Coffee Shop	American Restaurant	Sandwich Place	Bar	Japanese Restaurant	Restaurant	Italian Restaurant	Jewelry Store	Breakfast Spot
5	Center City West: Broad to 16th, Callowhill to...	Coffee Shop	Pizza Place	Vegetarian / Vegan Restaurant	Mexican Restaurant	Bakery	Mediterranean Restaurant	Yoga Studio	Italian Restaurant	Spa	Hotel
6	Chestnut Hill	Chinese Restaurant	Bakery	Hotel	Japanese Restaurant	Smoke Shop	Supermarket	Gas Station	Church	Paper / Office Supplies Store	Trail
7	East Falls	Clothing Store	Dessert Shop	Thrift / Vintage Store	Donut Shop	Fast Food Restaurant	Discount Store	Pharmacy	Restaurant	Bus Station	Ice Cream Shop
8	East Germantown	Hotel	Athletics & Sports	Fast Food Restaurant	Café	Smoke Shop	Electronics Store	Grocery Store	Multiplex	Pizza Place	Department Store
9	Eastwick	Hotel	Zoo Exhibit	Donut Shop	Flea Market	Fast Food Restaurant	Farmers Market	Falafel Restaurant	Fabric Shop	Event Space	Ethiopian Restaurant



# K-Means Clusters of Philadelphia Neighborhoods



Almagro falls into the purple colored cluster.



# K-Means Cluster #1 – Most Similar to Almagro

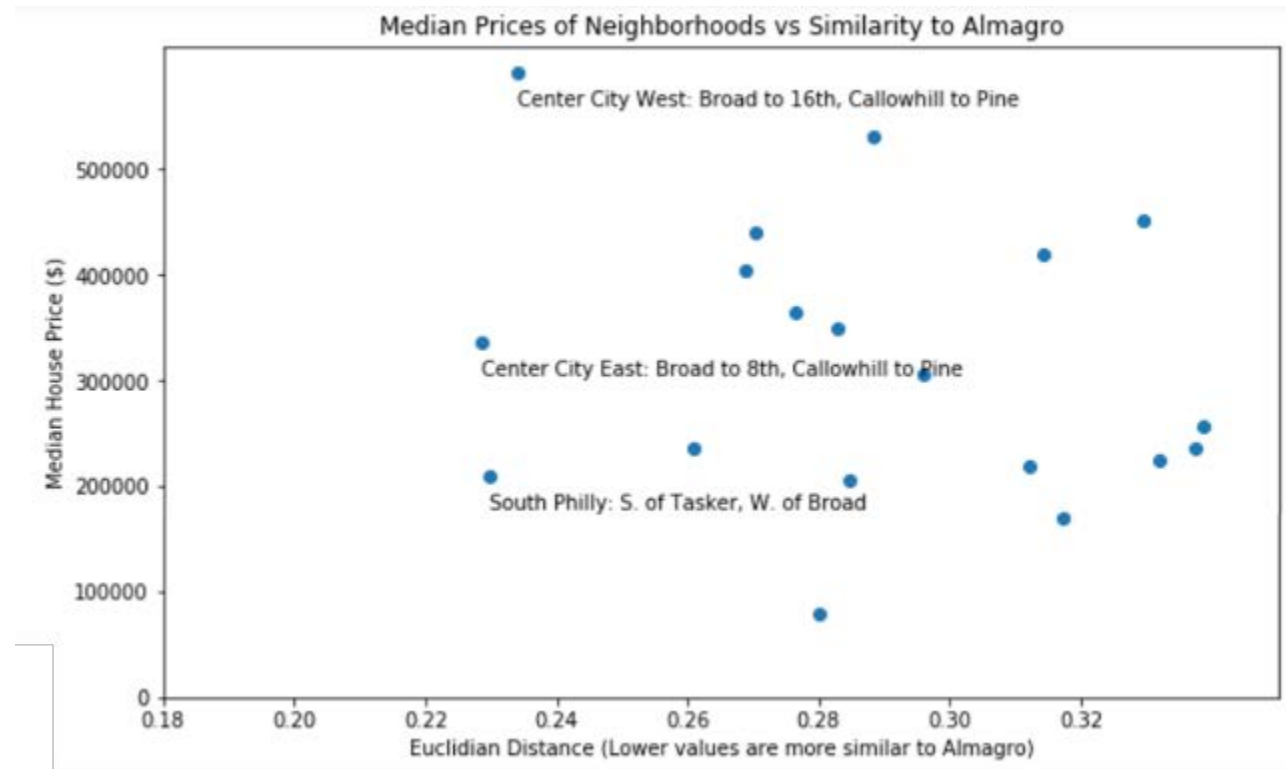
Neighborhood	Zip_Code	2017 Median Price	1-Yr. Change	3-Yr. Change	10-Yr. Change	Latitude	Longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
Center City West: Broad to 16th, Callowhill to ...	19102	\$590,500	-16%	37%	76%	39.946212	-75.165018	1.0	Coffee Shop	Pizza Place	Vegetarian / Vegan Restaurant	Mexican Restaurant	Bakery
Rittenhouse	19103	\$530,000	9%	12%	20%	39.955870	-75.171830	1.0	Salad Place	Clothing Store	Science Museum	Grocery Store	Falafel Restaurant
Old City/Society Hill	19106	\$404,625	8%	4%	-1%	39.953578	-75.144727	1.0	Art Gallery	Italian Restaurant	Coffee Shop	Sushi Restaurant	Hotel
Center City East: Broad to 8th, Callowhill to ...	19107	\$335,000	15%	20%	-7%	39.947072	-75.154648	1.0	Historic Site	Coffee Shop	American Restaurant	Sandwich Place	Bar
Fox Chase	19111	\$170,000	10%	17%	0%	40.060375	-75.080391	1.0	Clothing Store	Bar	Coffee Shop	Diner	Bus Station
Chestnut Hill	19118	\$451,000	-5%	-6%	11%	40.067815	-75.197339	1.0	Chinese Restaurant	Bakery	Hotel	Japanese Restaurant	Smoke Shop
Manayunk	19127	\$235,000	5%	7%	-6%	40.024769	-75.221294	1.0	Bar	New American Restaurant	Pizza Place	Mexican Restaurant	Gym / Fitness Center
Kingsessing	19143	\$78,500	11%	32%	12%	39.948549	-75.217172	1.0	Ethiopian Restaurant	Deli / Bodega	Diner	Indian Restaurant	Mediterranean Restaurant
South Philly: S. of Tasker, W. of Broad	19145	\$209,000	16%	74%	84%	39.947720	-75.168289	1.0	New American Restaurant	Seafood Restaurant	Pizza Place	Hotel	Steakhouse
Bella Vista/Queen Village/Passyunk Square North	19147	\$439,500	19%	24%	37%	39.933811	-75.158858	1.0	Sandwich Place	Mexican Restaurant	Vietnamese Restaurant	Bakery	Coffee Shop
South Philly: S. of Tasker, E. of Broad	19148	\$216,000	10%	39%	51%	39.919435	-75.158808	1.0	Mexican Restaurant	School	Park	Cambodian Restaurant	Taco Place
Rhawnhurst	19152	\$205,000	14%	28%	5%	40.051590	-75.058291	1.0	Pharmacy	Shoe Store	Clothing Store	Mexican Restaurant	Miscellaneous Shop
Almagro						40.431381	-3.693014	1.0	Spanish Restaurant	Restaurant	Hotel	Mediterranean Restaurant	Bar

# Neighborhoods Ranked by Euclidian Distance from Almagro

	Zip_Code	2017 Median Price	1-Yr. Change	3-Yr. Change	10-Yr. Change	Latitude	Longitude	Dist_Almagro
<b>Neighborhood</b>								
Almagro		NaN				40.431381	-3.693014	0.000000
Center City East: Broad to 8th, Callowhill to Pine	19107	335000.0	15%	20%	-7%	39.947072	-75.154648	0.228429
South Philly: S. of Tasker, W. of Broad	19145	209000.0	16%	74%	84%	39.947720	-75.168289	0.229783
Center City West: Broad to 16th, Callowhill to Pine	19102	590500.0	-16%	37%	76%	39.946212	-75.165018	0.234094
Manayunk	19127	235000.0	5%	7%	-6%	40.024769	-75.221294	0.260853
Old City/Society Hill	19106	404625.0	8%	4%	-1%	39.953578	-75.144727	0.268831
Bella Vista/Queen Village/Passyunk Square North	19147	439500.0	19%	24%	37%	39.933811	-75.158858	0.270344
Graduate Hospital/Point Breeze	19146	365000.0	9%	18%	78%	39.942056	-75.179274	0.276360
Kingsessing	19143	78500.0	11%	32%	12%	39.948549	-75.217172	0.280215
Fairmount	19130	350000.0	5%	10%	14%	39.964489	-75.167457	0.282740
Rhawnhurst	19152	205000.0	14%	28%	5%	40.051590	-75.058291	0.284540
Rittenhouse	19103	530000.0	9%	12%	20%	39.955870	-75.171830	0.288249
Temple/Olde Kensington	19122	305000.0	36%	103%	118%	39.984489	-75.153013	0.295973
University City/West Philadelphia	19104	219375.0	-3%	29%	76%	39.949252	-75.209377	0.311984
Northern Liberties/East Spring Garden	19123	418500.0	-5%	20%	28%	39.948016	-75.223406	0.314139
Fox Chase	19111	170000.0	10%	17%	0%	40.060375	-75.080391	0.317136
Chestnut Hill	19118	451000.0	-5%	-6%	11%	40.067815	-75.197339	0.329355
East Falls	19129	224900.0	5%	8%	3%	40.006745	-75.170010	0.331755
Bustleton	19115	235000.0	11%	21%	0%	40.085084	-75.049773	0.337375
Mount Airy	19119	257200.0	7%	14%	9%	40.052291	-75.188576	0.338711
Holmesburg	19136	139000.0	9%	24%	1%	40.041997	-75.026135	0.344975
West Market	19139	60000.0	36%	71%	9%	39.961299	-75.221523	0.348434
Somerton	19116	233000.0	5%	8%	1%	40.116368	-75.018372	0.349508
Fishtown/Kensington	19125	309150.0	5%	44%	107%	44.121661	9.836875	0.351332
South Philly: S. of Tasker, E. of Broad	19148	216000.0	10%	39%	51%	39.919435	-75.158808	0.361075

Most Promising  
Candidates

# Scatter Plot of Similarity vs. Median Housing Price



Three neighborhoods are identified as promising candidates:

1. Center City East: Broad to 8th, Callowhill to Pine
2. South Philly: S. of Tasker, W. of Broad, and
3. Center City West: Broad to 16th, Callowhill to Pine.

Of these neighborhoods, South Philly is clearly the most affordable, with a median house price of \$209,000.



# Conclusions

- An effective algorithm has been developed for identifying neighborhoods in a selected city that are most similar to some desirable neighborhood in another city.
- The algorithm utilizes k-means clustering to find groups of similar and dissimilar neighborhoods, and then identifies the most similar neighborhoods by calculating Euclidian distance from the target neighborhood in the multidimensional space.
- Finally, the housing price statistics are incorporated in the analysis to identify neighborhoods that might be more affordable for the user, yet still relatively similar to the target neighborhood.
- When applied for finding a neighborhood in the city of Philadelphia, Pennsylvania, USA that is most similar to Almagro in Madrid, Spain, three neighborhoods are identified as promising candidates:
  - Center City East: Broad to 8th, Callowhill to Pine
  - South Philly: S. of Tasker, W. of Broad
  - Center City West: Broad to 16th, Callowhill to Pine.
- Of these neighborhoods, South Philly is clearly the most affordable, with a median house price of \$209,000.