Recommendations of new restaurant locations –
Neighborhood comparison between Pittsburgh and Cleveland

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Where to expand new restaurants franchise in a new city?

There are similar cities (e.g. populations) that are nearby, but their restaurant landscapes can be quite different.

I am interested in using **Pittsburgh, PA** and **Cleveland, OH** as examples to compare their neighborhood and make recommendations of restaurant new locations.

Four fast-food restaurant chains: **Shake Shack, BIBIBOP Asian Grill, Potbelly Sandwich Shop,** and **Krispy Krunchy Chicken**, for which they only exist in Cleveland and other city but not Pittsburgh are studied here

Data acquisition and cleaning

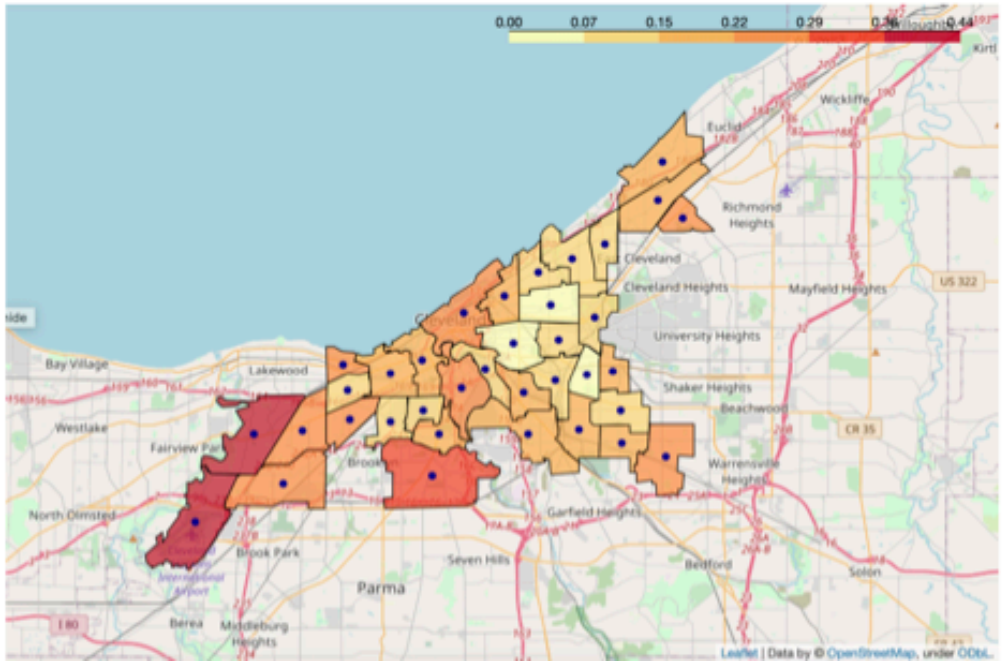
- **.json files**:

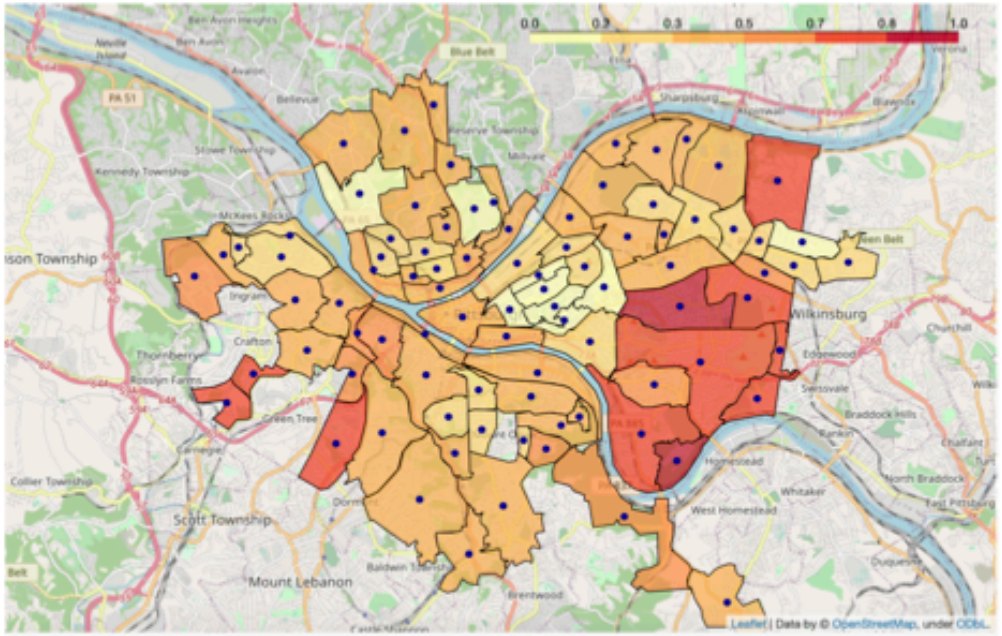
  From data.opendatasoft.com where they provide Zillow neighborhood json files.

- **Census data**:
  - No direct neighborhood data from census.gov
  - **Pittsburgh data (2018):** from University of Pittsburgh Center for Social & Urban Research. The median household income data comes from city-data.com (2016).
  - **Cleveland data (2014)** : from the Center for Community Solutions.
  - To correct for income and population from different years, I applied cumulative inflation rate (income) and population growth in each cities.

- **Venue data:**

  From foursqure.com, where all the venues within the boundary of each neighborhood are aquired.



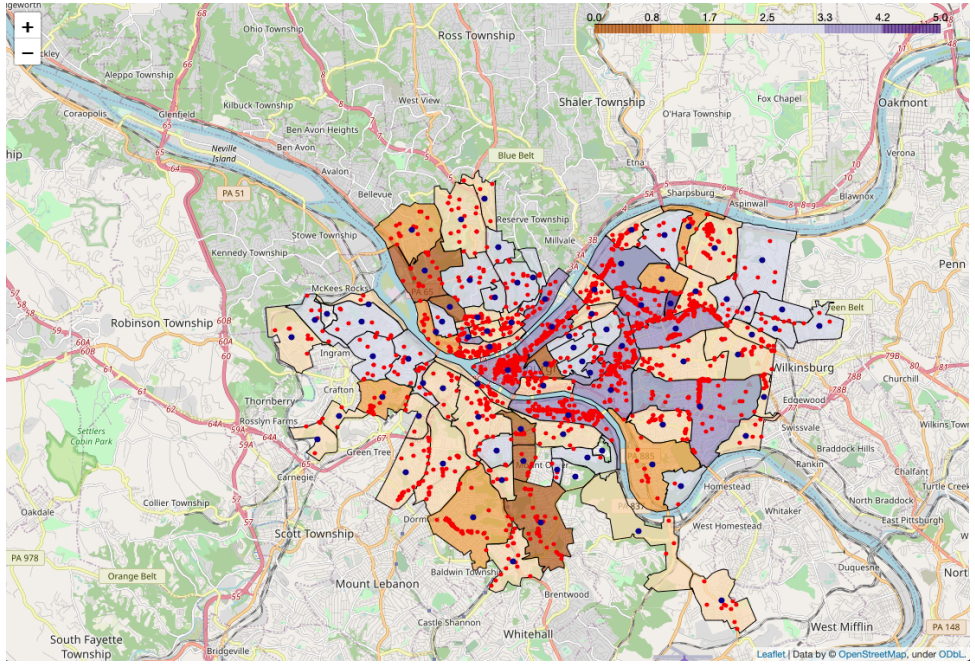


Dataset of Pittsburgh & Cleveland

The final data consist of 88 neighborhoods in Pittsburgh and 36 neighborhoods in Cleveland.

This dataset consist of geometric, census, and venue information of those neighborhoods.

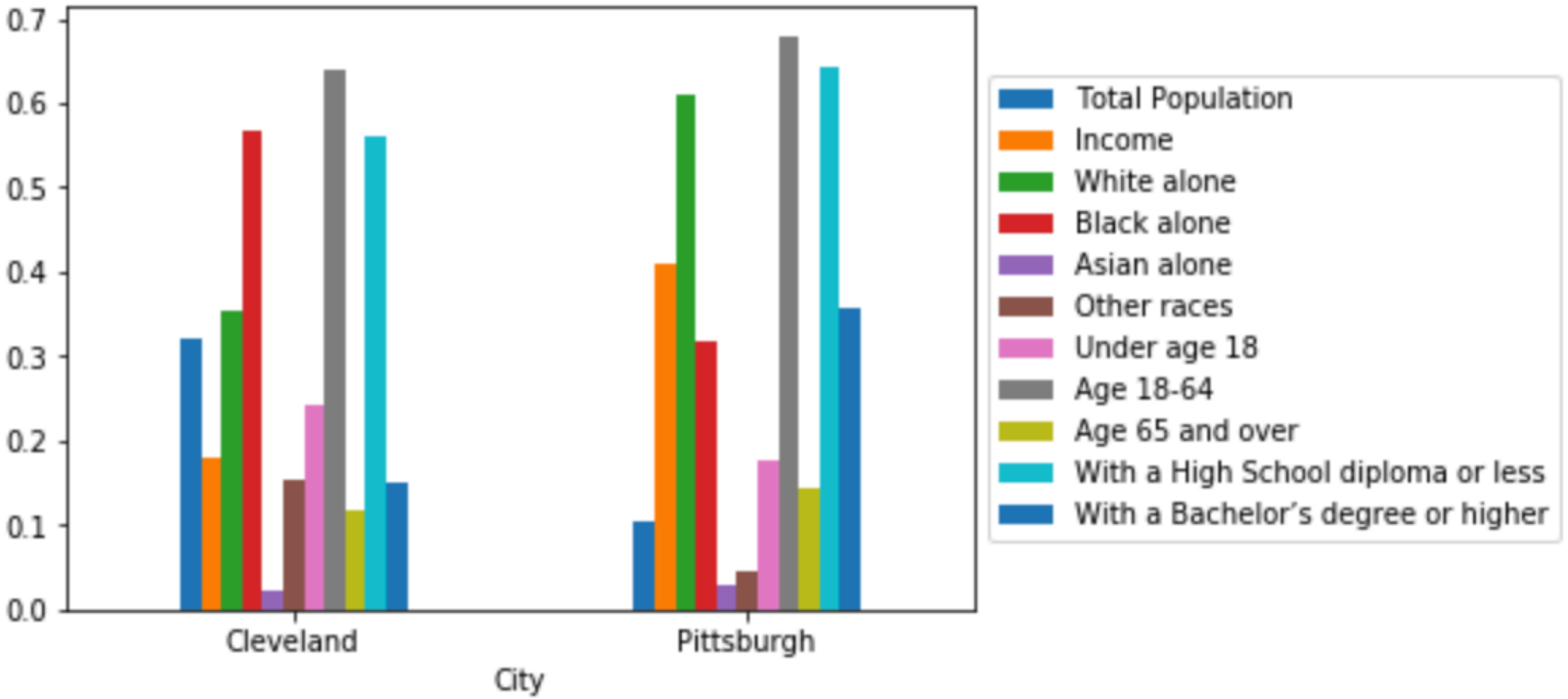
Venue data and target restaurant data



	name	location.lat	location.lng	Neighborhood
0	Shake Shack	41.500488	-81.688413	Downtown
1	Shake Shack	41.410683	-81.838909	Riverside
2	BIBIBOP Asian Grill	41.509769	-81.604765	University District
3	Potbelly Sandwich Shop	41.500102	-81.689495	Downtown
4	Potbelly Sandwich Shop	41.509573	-81.604878	University District
5	Potbelly Sandwich Shop	41.410988	-81.833552	Riverside
6	Potbelly Sandwich Shop	41.426462	-81.826805	Puritas-Longmead
7	Krispy Krunchy Chicken	41.448198	-81.638803	South Broadway
8	Krispy Krunchy Chicken	41.440113	-81.735091	Old Brooklyn

- The goals are to use the venue and census information to make Pittsburgh location recommendations to the fast-food restaurant chains in Cleveland.

Overall census feature behaviors of each city



- The median population of Cleveland neighborhoods is much higher than Pittsburgh
- Pittsburgh neighborhoods have higher average income than Cleveland.
- Pittsburgh has higher white population than Cleveland.
- Cleveland has higher African American population.
- There are higher fraction of people in Pittsburgh with higher education background.

Overall venue feature behaviors of each city

(a)

Venue Category	Neighborhood
Bar	176
Pizza Place	152
Coffee Shop	132
Sandwich Place	112
Park	103
American Restaurant	89
Grocery Store	72
Italian Restaurant	71
Convenience Store	69
Discount Store	66

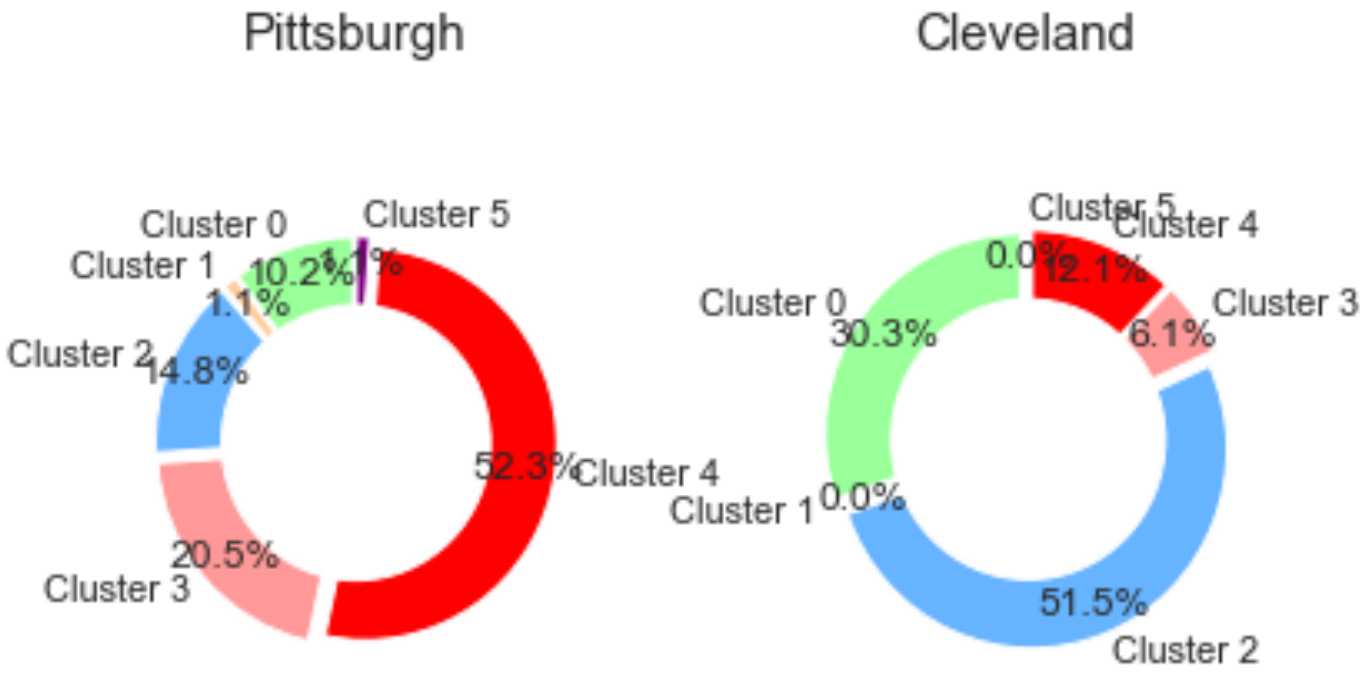
(b)

Neighborhood	Venue Category
Downtown	332
Central Business District	158
Tremont	156
Southside Flats	155
Ohio City - West Side	147
Old Brooklyn	145
Squirrel Hill South	107
Kamm's Corner	107
Detroit Shoreway	99
University District	92

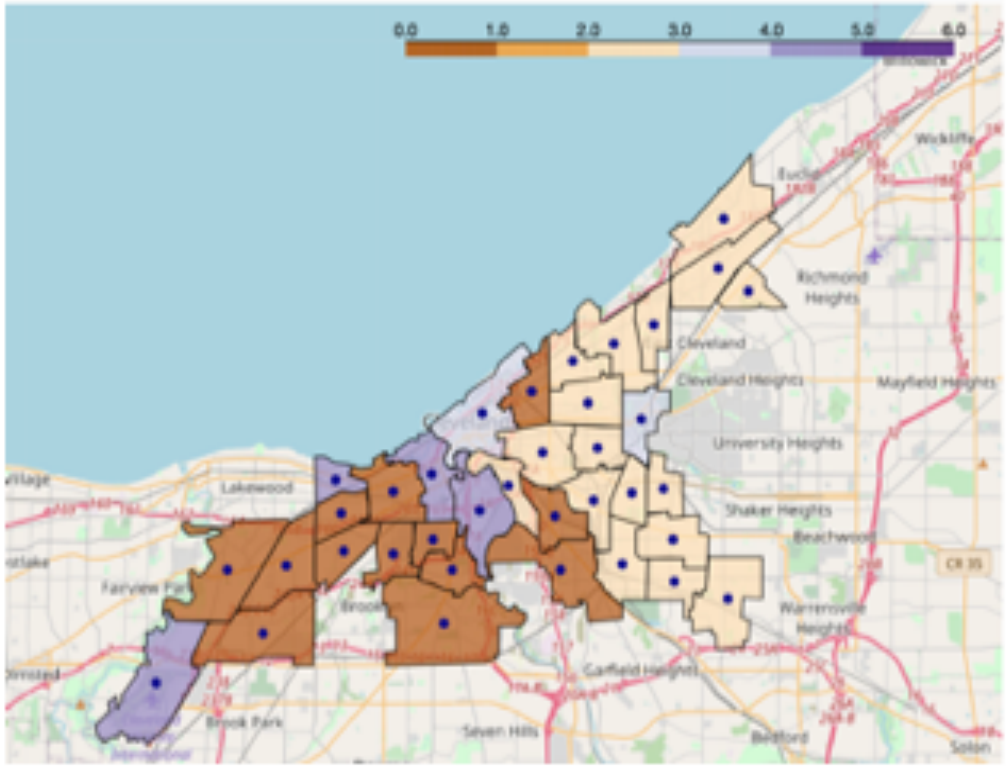
- Bar is the most common venues; Pizza Place is the second; and Coffee shop is the third.
- the neighborhood which has the most venue categories is Downtown in Cleveland (332). The second is Central Business District in Pittsburgh (downtown), which has 158 different venues.

Neighborhood Clustering with K-means clustering algorithm

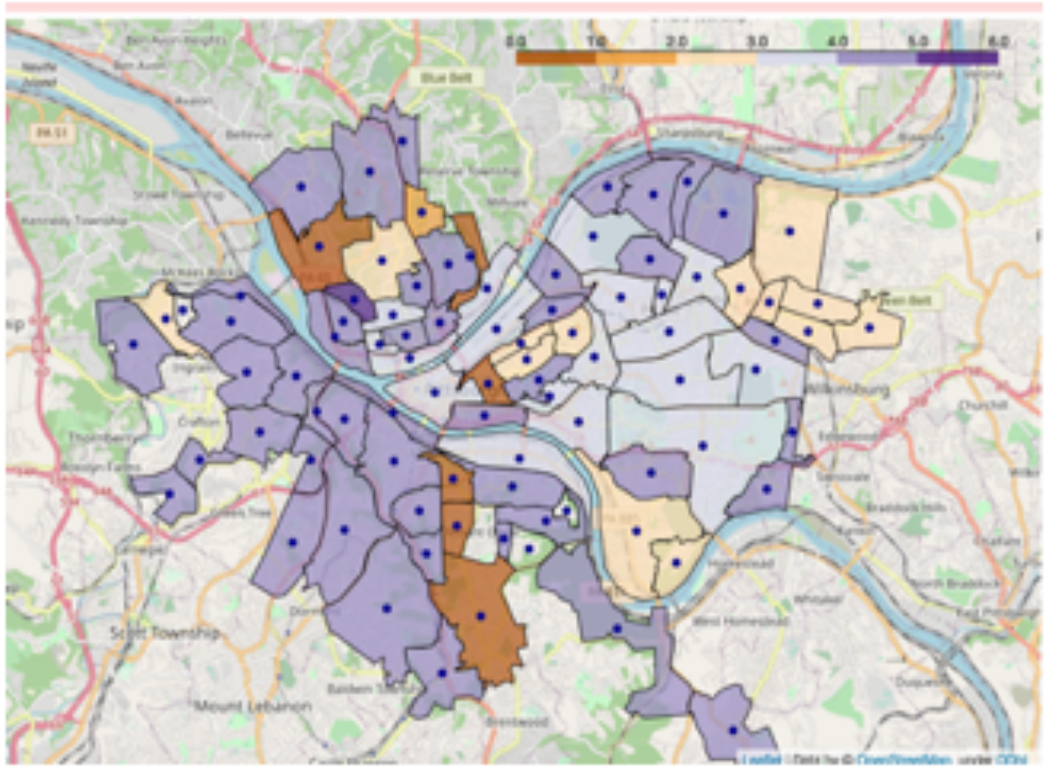
K-means clustering algorithm is applied to divide all neighborhoods into **6** clusters



(a) Cleveland



(b) Pittsburgh



Cluster type spatial distribution

Cluster Characteristics

Based on mean feature values in each cluster for which those that are the highest or the lowest among the clusters

- **Cluster 0: High population residential area**
  Those areas tend to have more **grocery store, diner, pizza and sandwich places**, and **Chinese restaurants**.
- **Cluster 1*: Black population with low education background and more youth***
  Those areas tend to have more **fast food restaurant** and less other kind of restaurants.
- **Cluster 2: Elder people with low income**
  Those areas tend to have more **discount store** and **seafood restaurants**.
- **Cluster 3: Working-age population with high education background**
  Those areas have more **coffee shops, American restaurants, burger joints**, and **pubs**.
- **Cluster 4: White population with high income**
  Those areas tend to have more **parks**.
- **Cluster 4: Low population areas**
  They may be near **bus stations**.

	name	location.lat	location.lng	Neighborhood	cluster
0	Shake Shack	41.500488	-81.688413	Downtown	3
1	Shake Shack	41.410683	-81.838909	Riverside	4
2	BIBIBOP Asian Grill	41.509769	-81.604765	University District	3
3	Potbelly Sandwich Shop	41.500102	-81.689495	Downtown	3
4	Potbelly Sandwich Shop	41.509573	-81.604878	University District	3
5	Potbelly Sandwich Shop	41.410988	-81.833552	Riverside	4
6	Potbelly Sandwich Shop	41.426462	-81.826805	Puritas-Longmead	0
7	Krispy Krunchy Chicken	41.448198	-81.638803	South Broadway	0
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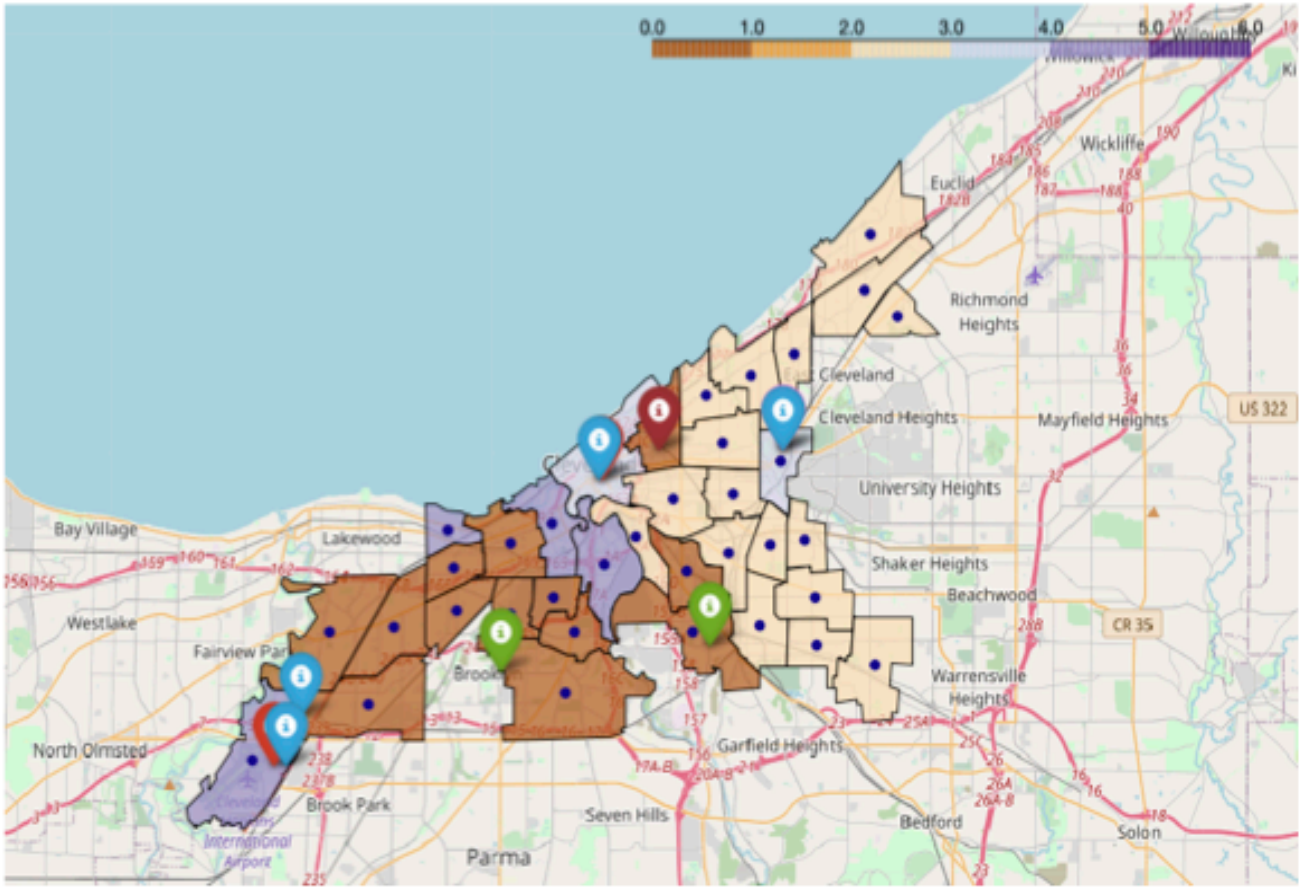

Distribution of target restaurant locations, clustering type, and neighborhoods

Recommendations on new restaurant locations based on clustering results

❑ Shake Shack:

- Two out of their three locations lie in our neighborhood data area. Their neighborhoods are in cluster 3 and 4.
- A few example of Pittsburgh neighborhood in cluster 3 are: **Bloomfield, Shadyside, Squirrel Hill North, Squirrel Hill South,** and **Strip District.** A few examples of Pittsburgh neighborhood in cluster 4 are: **Beechview, Garfield, Highland Park, Lower Lawrenceville,** and **Swisshelm Park**

❑ BIBIBOP Asian Grill:

- One out of five stores in Cleveland locates in the cluster 3 neighborhood.
- Therefore, the recommended neighborhoods in Pittsburgh are: **Bloomfield, Shadyside, Squirrel Hill North, Squirrel Hill South,** and **Strip District.**

❑ Potbelly Sandwich Shop:

- Four our of five stores lie inside our neighborhoods. Two of the stores locate in cluster 3 neighborhood, one in cluster 4, and one in cluster 0.
- For those neighborhoods in cluster 3 & 4, they are listed in the discussion of Shake Shack locations. For cluster 0, some neighborhoods include**: Allentown, Crawford Roberts,** and **Knoxville**.

❑ Krispy Krunchy Chicken:

- Two out of ten stores lie within our Cleveland neighborhoods. They are all within cluster 0, and some of the Pittsburgh cluster 0 neighborhood are: **Allentown, Crawford Roberts,** and **Knoxville**, as discussed in Potbelly locations.

Conclusion and future directions

- Although these two cities have some fundamental differences, such as average income, population, and race percentage, clustered neighborhoods share many similar features.
- Make meaningful recommendations to new restaurant locations at Pittsburgh based on their locations in Cleveland
- This analysis can be applied to any other store types, and it can also be used to make recommendations to new locations in Cleveland as well.
- To improve:
  - Include more features, (school districts, store rental price, etc)
  - Refine the venue categories (remove redundant categories or those are not relevant to the research targets, etc)