

Opportunity of Opening a Restaurant in Salt Lake City Neighborhoods

Capstone Project of Applied Data Science



Problem Statement and Background

- Problem Statement
 - Understand which neighborhoods of Salt Lake City area are better for opening a restaurant and which type of restaurant (Chinese, Japanese, American, etc.) it should be.
- Background
 - The Salt Lake City area is drawing a lot of people moving into the area which gives a profit opportunity of opening a restaurant. We would like to first understand the current status of the neighborhoods so we know which areas have more restaurants already. We would also like to understand if demographic factors such as population, household, income, etc. can explain the difference among neighborhoods. Such understanding may give us insights on which neighborhood we should open the restaurant.



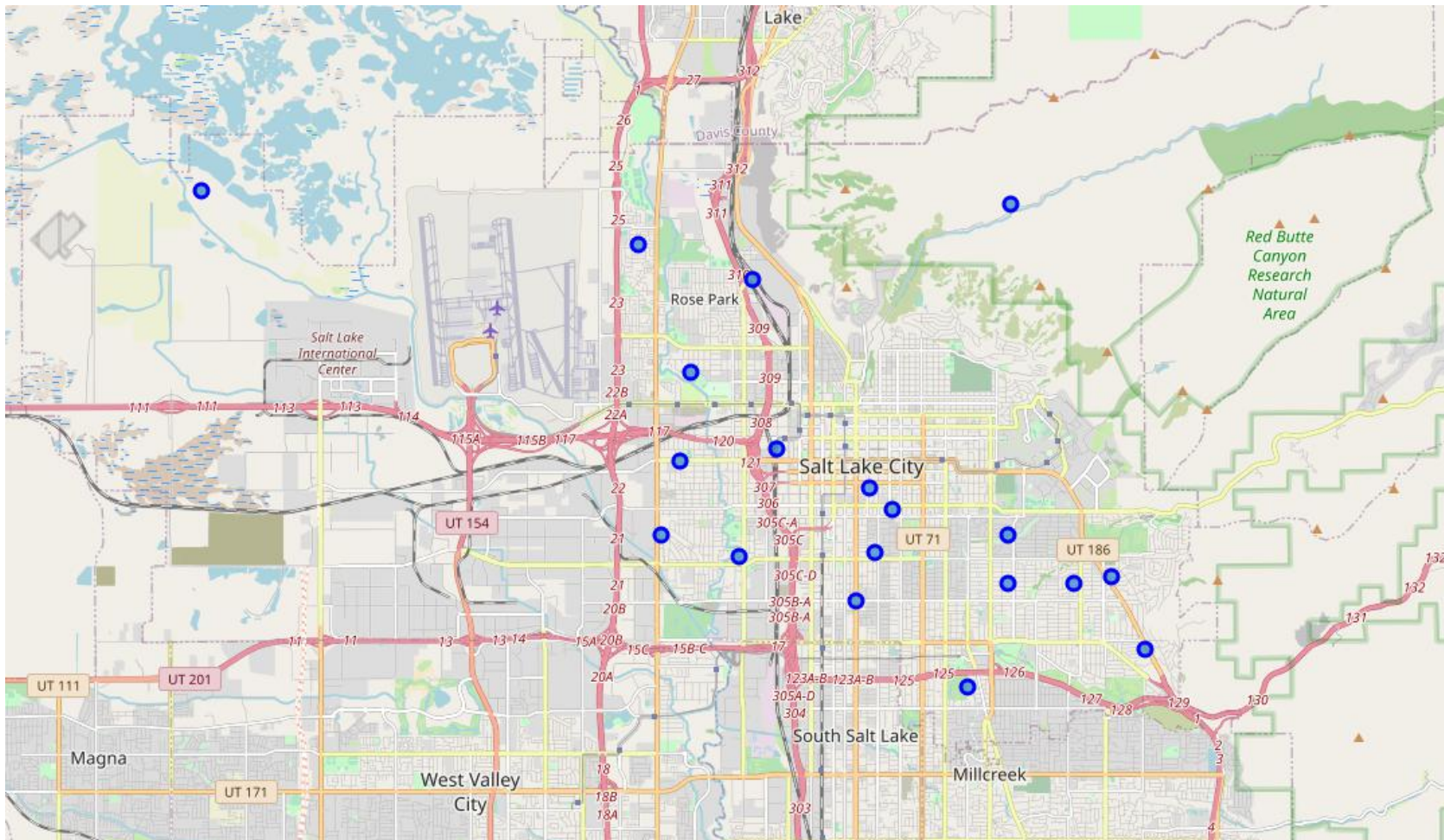
Data Sources

- **Neighborhood data for the Salt Lake City area:** Neighborhood data is taken from this website: <https://statisticalatlas.com/place/Utah/Salt-Lake-City/Overview>
- **Venue data for each neighborhood:** This data is taken from foursquare using their API.
- **Demographic data for each neighborhood:** This data is taken from a series of websites based on the list of neighborhoods and factors that we are interested in. Examples of factors can be: population, number of household, age and sex, race and ethnicity, household type (married or not), income, etc. We will use these neighborhoods and factors to scan through a series of websites. One example is: <https://statisticalatlas.com/neighborhood/Utah/Salt-Lake-City/Yalecrest/Race-and-Ethnicity>



Data Analysis and Discussion

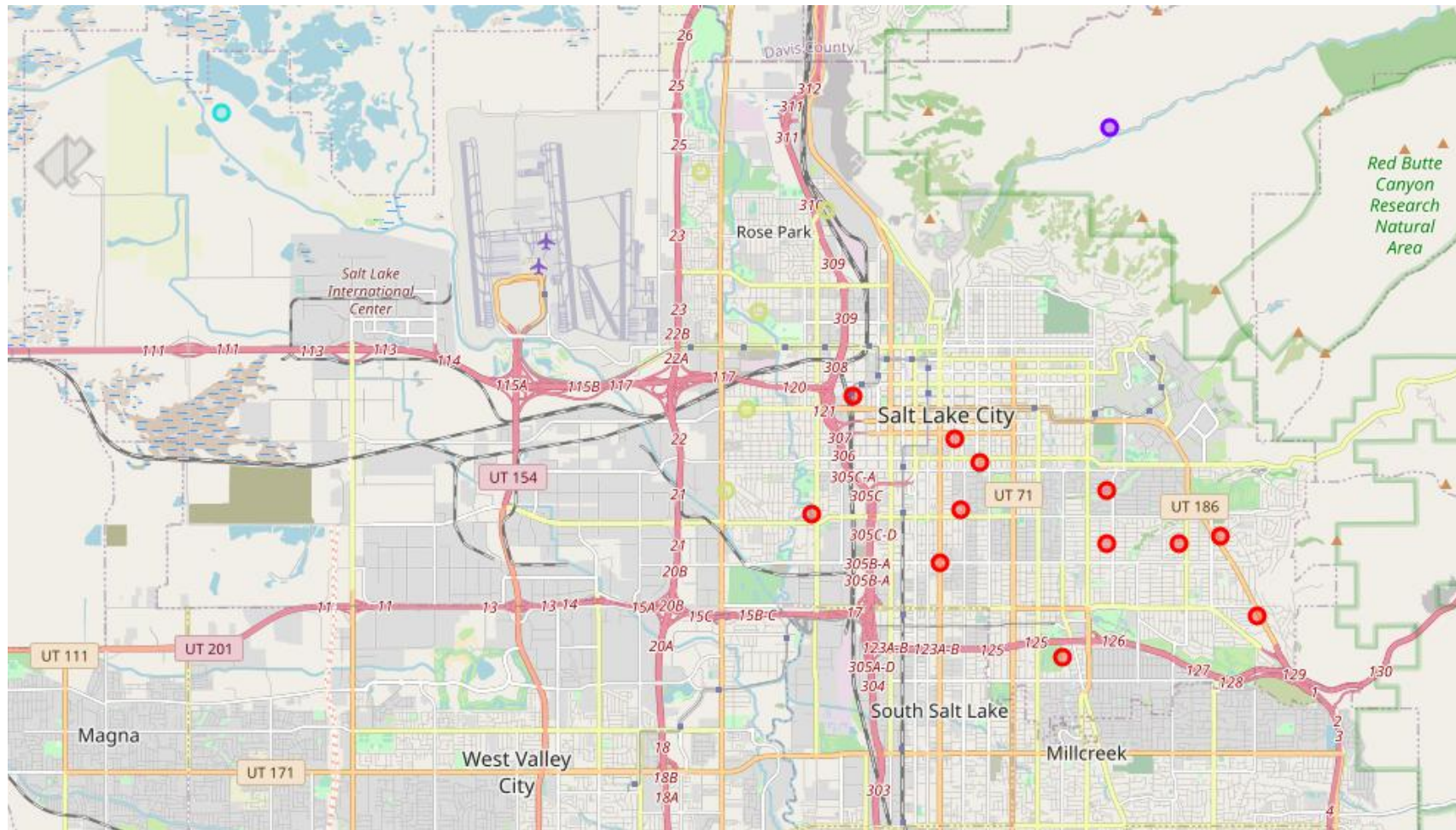
- Visualization of Salt Lake City (SLC) Neighborhoods



	Neighborhood	Latitude	Longitude
0	Arcadia Heights	40.724061	-111.814266
1	Bonneville Hills	40.736822	-111.832721
2	Capitol Hill	40.795715	-111.914489
3	Central City	40.755205	-111.884654
4	Central City-Liberty Wells	40.742818	-111.883353
5	Downtown	40.762823	-111.908463
6	East Bench	40.738281	-111.823032
7	East Central	40.751146	-111.879096
8	Fairpark	40.777661	-111.930275
9	Glendale	40.746247	-111.938072
10	Greater Avenues	40.810052	-111.848884
11	Jordan Meadows	40.609978	-112.020077
12	Liberty Wells	40.733520	-111.888309
13	People's Freeway	40.741981	-111.918079
14	Poplar Grove	40.760501	-111.933048
15	Rose Park	40.802324	-111.943955
16	Sugar House	40.716698	-111.859792
17	Wasatch Hollow	40.736946	-111.849545
18	Westpointe	40.812862	-112.055311
19	Yalecrest	40.746304	-111.849564

Data Analysis and Discussion

- Clustering of SLC Neighborhoods



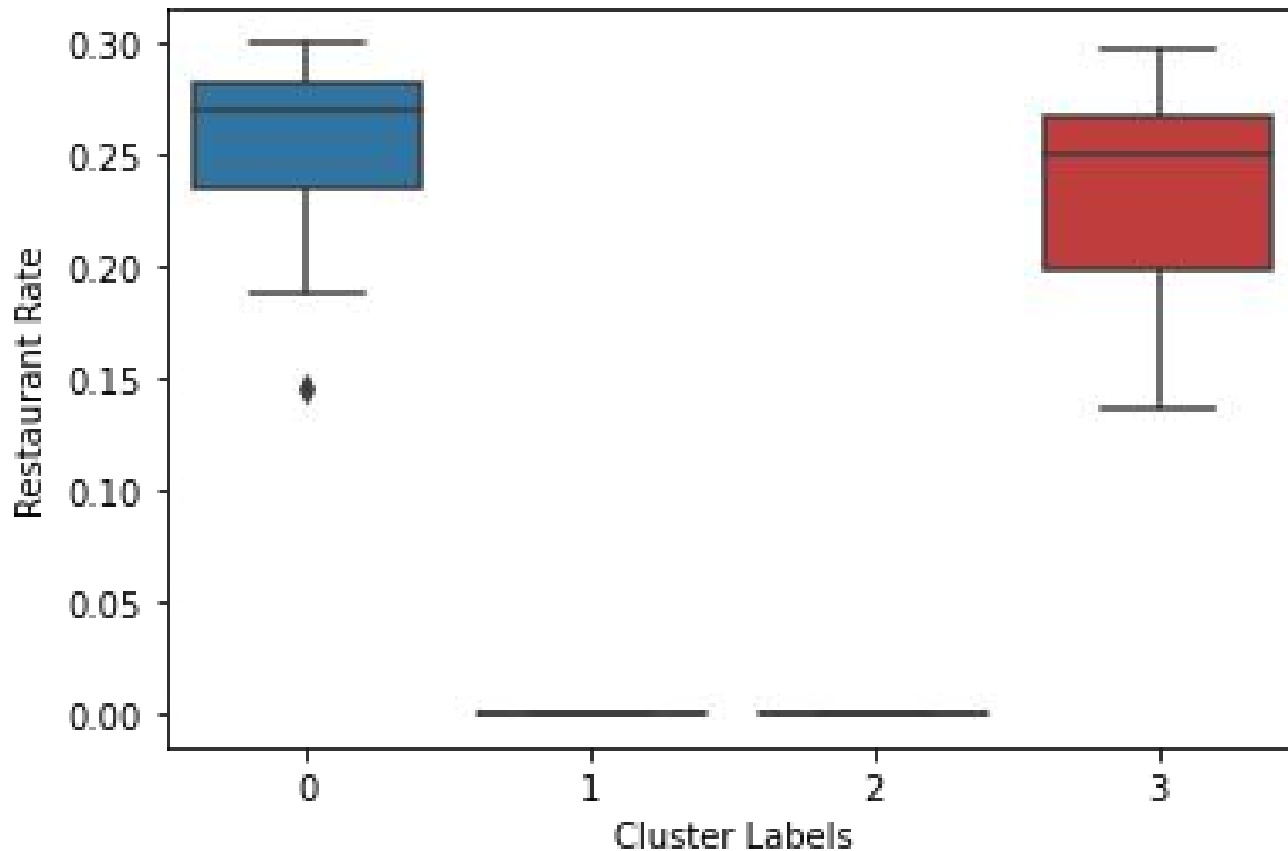
Data Analysis and Discussion

- Clustering of SLC Neighborhoods

	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	Arcadia Heights	40.724061	-111.814266	0	Pizza Place	Video Store	Mexican Restaurant	Zoo Exhibit	Sporting Goods Shop	Bank	Burger Joint	Coffee Shop	Convenience Store	Fast Food Restaurant
1	Bonneville Hills	40.736822	-111.832721	0	Coffee Shop	Video Store	Pizza Place	Shipping Store	Sandwich Place	Mexican Restaurant	Ice Cream Shop	Seafood Restaurant	Salon / Barbershop	Park
2	Capitol Hill	40.795715	-111.914489	3	Mexican Restaurant	Pizza Place	Convenience Store	Park	Grocery Store	Chinese Restaurant	Discount Store	Coffee Shop	Gas Station	Train Station
3	Central City	40.755205	-111.884654	0	Coffee Shop	Bar	Bakery	New American Restaurant	Brewery	Grocery Store	Italian Restaurant	Vegetarian / Vegan Restaurant	Cocktail Bar	Burger Joint
4	Central City-Liberty Wells	40.742818	-111.883353	0	Coffee Shop	Bakery	Bar	Asian Restaurant	Cocktail Bar	Vietnamese Restaurant	Brewery	Vegetarian / Vegan Restaurant	Juice Bar	New American Restaurant
5	Downtown	40.762823	-111.908463	0	Coffee Shop	Mexican Restaurant	Hotel	Brewery	Bakery	Cocktail Bar	Hotel Bar	Bar	New American Restaurant	BBQ Joint
6	East Bench	40.738281	-111.823032	0	Gym / Fitness Center	Park	Video Store	Zoo Exhibit	Trail	American Restaurant	Bakery	Coffee Shop	Deli / Bodega	Pizza Place
7	East Central	40.751146	-111.879096	0	Coffee Shop	Bar	Bakery	New American Restaurant	Burger Joint	Brewery	Cocktail Bar	Grocery Store	Vegetarian / Vegan Restaurant	Asian Restaurant
8	Fairpark	40.777661	-111.930275	3	Mexican Restaurant	Convenience Store	Pizza Place	Gas Station	Hotel	Fast Food Restaurant	Airport Service	Airport Terminal	Burger Joint	Discount Store
9	Glendale	40.746247	-111.938072	3	Fast Food Restaurant	Convenience Store	Gas Station	Mexican Restaurant	Sandwich Place	Bank	Indian Restaurant	Discount Store	Pizza Place	Light Rail Station
10	Greater Avenues	40.810052	-111.848884	1	Trail	Mountain	Donut Shop	Food Truck	Food Stand	Fish & Chips Shop	Financial or Legal Service	Fast Food Restaurant	Exhibit	Ethiopian Restaurant
11	Jordan Meadows	40.609978	-112.020077	3	Fast Food Restaurant	Video Store	Pizza Place	Gym	Burger Joint	Convenience Store	Grocery Store	Gas Station	Big Box Store	Construction & Landscaping
12	Liberty Wells	40.733520	-111.888309	0	Coffee Shop	Bar	Brewery	Thai Restaurant	Bakery	BBQ Joint	Vietnamese Restaurant	Breakfast Spot	Pizza Place	Donut Shop
13	People's Freeway	40.741981	-111.918079	0	Mexican Restaurant	Brewery	Bar	Thai Restaurant	Sandwich Place	BBQ Joint	Coffee Shop	Convenience Store	Pizza Place	Hotel
14	Poplar Grove	40.760501	-111.933048	3	Mexican Restaurant	Fast Food Restaurant	Convenience Store	Pizza Place	Hotel	Gas Station	Bank	Sandwich Place	Grocery Store	Discount Store
15	Rose Park	40.802324	-111.943955	3	Pizza Place	Airport Service	Mexican Restaurant	Discount Store	Gas Station	Sandwich Place	Pet Store	Park	Convenience Store	Bank
16	Sugar House	40.716698	-111.859792	0	Coffee Shop	Pizza Place	Mexican Restaurant	Deli / Bodega	Gym / Fitness Center	Grocery Store	American Restaurant	Bagel Shop	Sushi Restaurant	Diner
17	Wasatch Hollow	40.736946	-111.849545	0	Coffee Shop	Video Store	ATM	American Restaurant	Grocery Store	Gym / Fitness Center	Mexican Restaurant	Bookstore	Thai Restaurant	Pizza Place
18	Westpointe	40.812862	-112.055311	2	Sports Club	Zoo Exhibit	Dog Run	Food Stand	Fish & Chips Shop	Financial or Legal Service	Fast Food Restaurant	Exhibit	Ethiopian Restaurant	Donut Shop
19	Yalecrest	40.746304	-111.849564	0	Pizza Place	Coffee Shop	Grocery Store	Yoga Studio	Bookstore	New American Restaurant	Japanese Restaurant	Video Store	Cosmetics Shop	Deli / Bodega

Data Analysis and Discussion

- Restaurant Type / Rate by Cluster

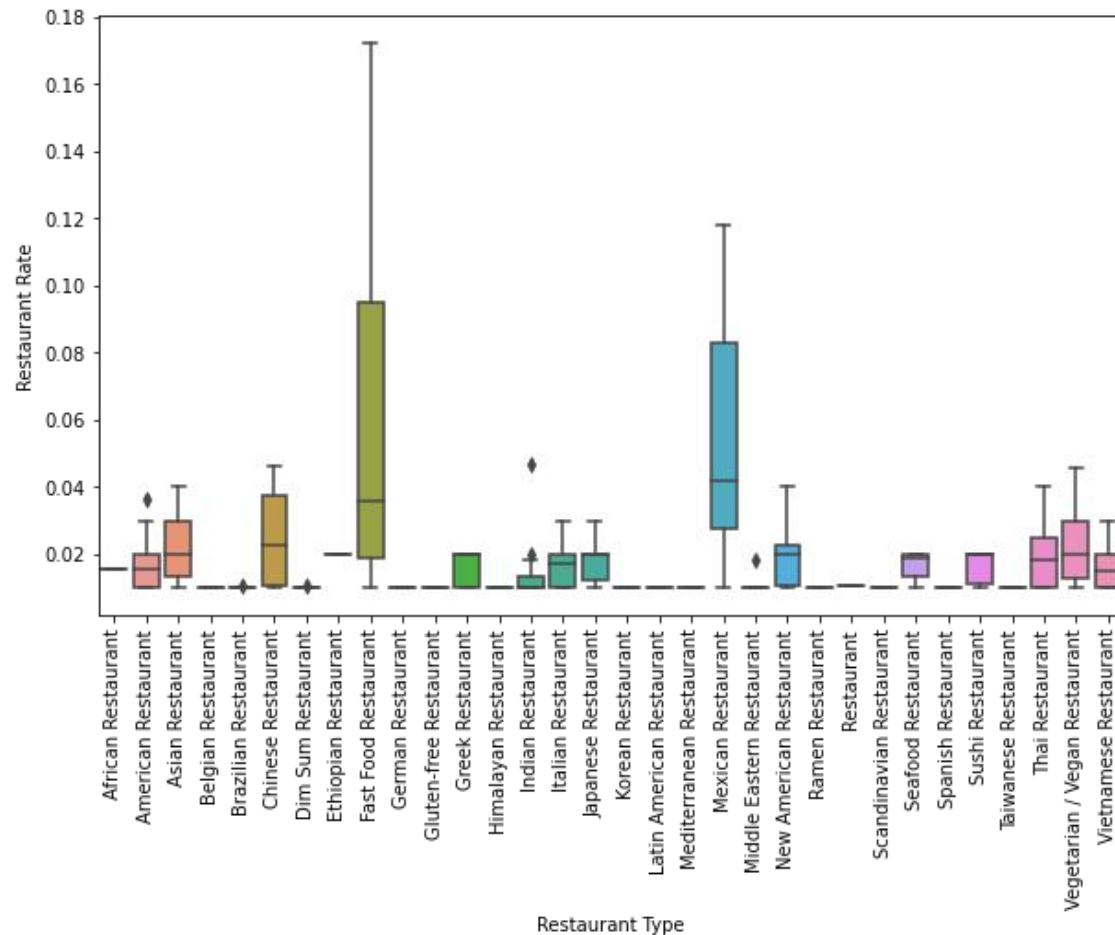


- Cluster 0 / 3 neighborhoods have more restaurants



Data Analysis and Discussion

- Restaurant Type / Rate by Cluster

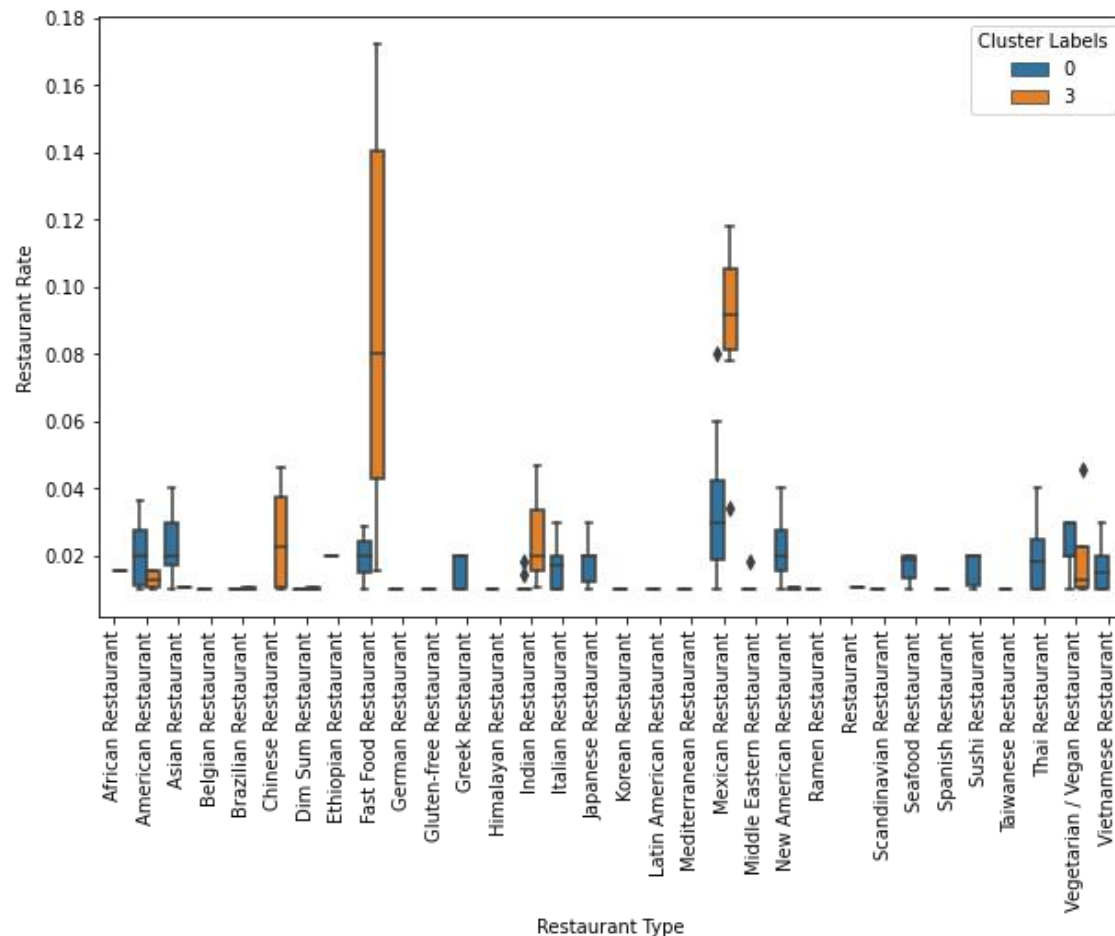


- Fast Food, Mexican, Chinese, Asian, Vegan, Thai are more popular than others



Data Analysis and Discussion

- Restaurant Type / Rate by Cluster

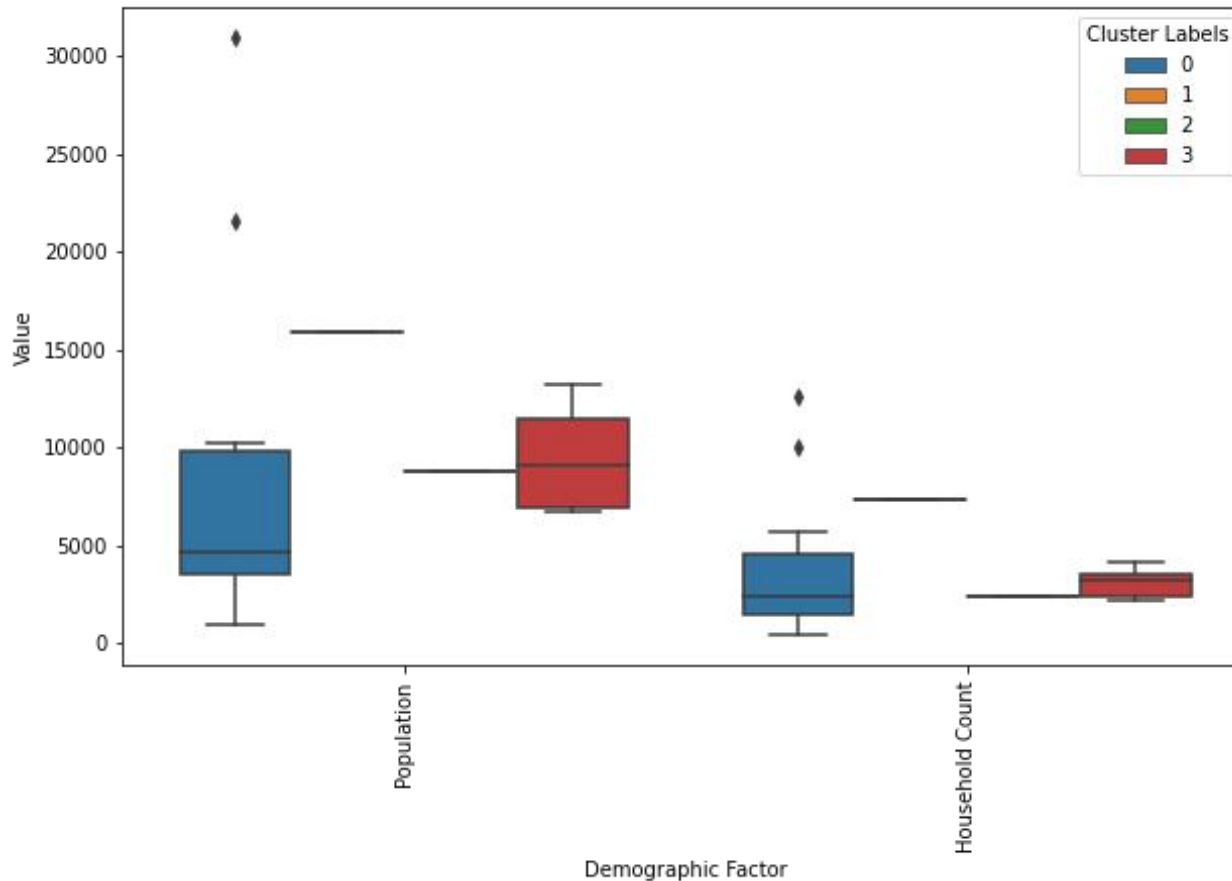


- Cluster 3 neighborhoods have high Fast Food and Mexican restaurants while cluster 0 neighborhoods have more other types of restaurant



Data Analysis and Discussion

- Demographic Factors by Cluster for Feature Selection

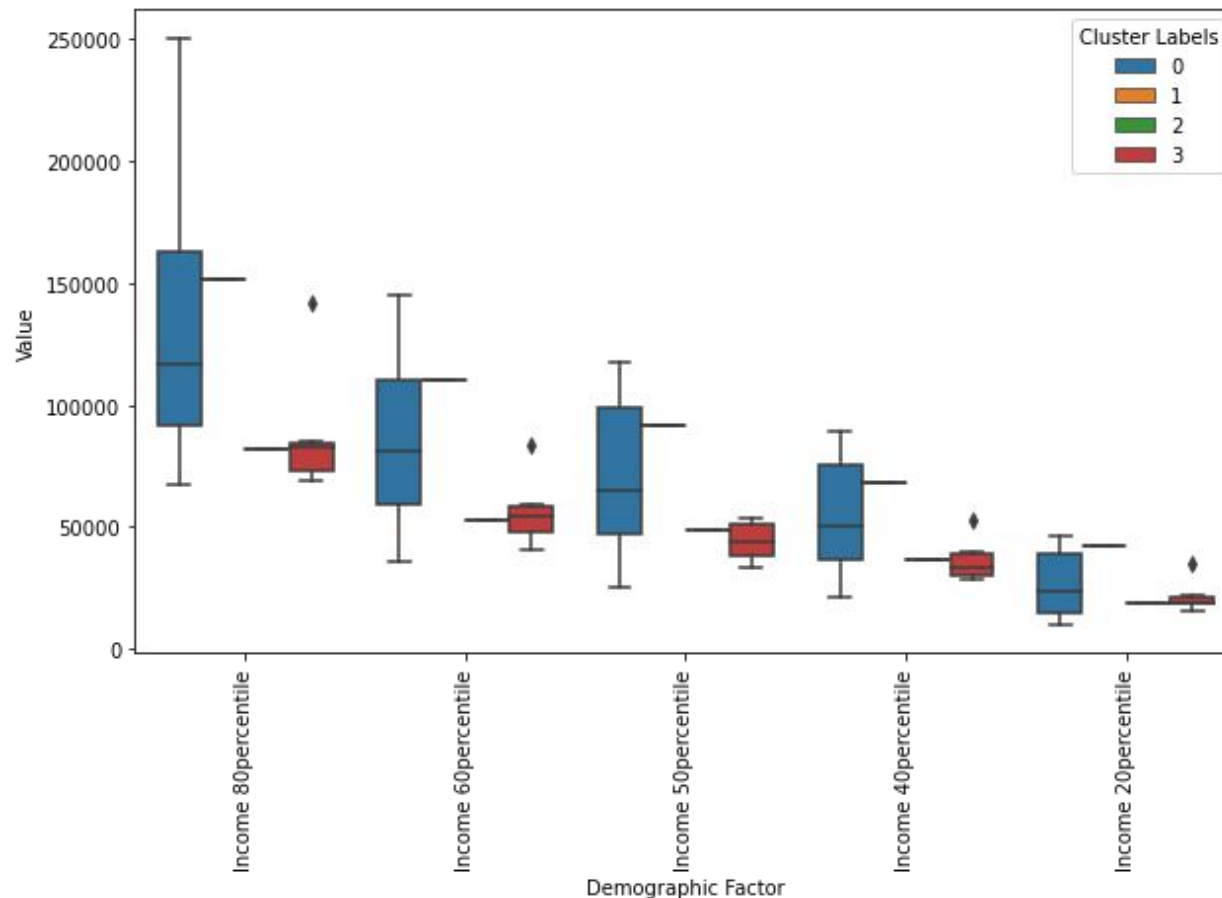


- Population and household count don't show strong cluster difference.



Data Analysis and Discussion

- Demographic Factors by Cluster for Feature Selection

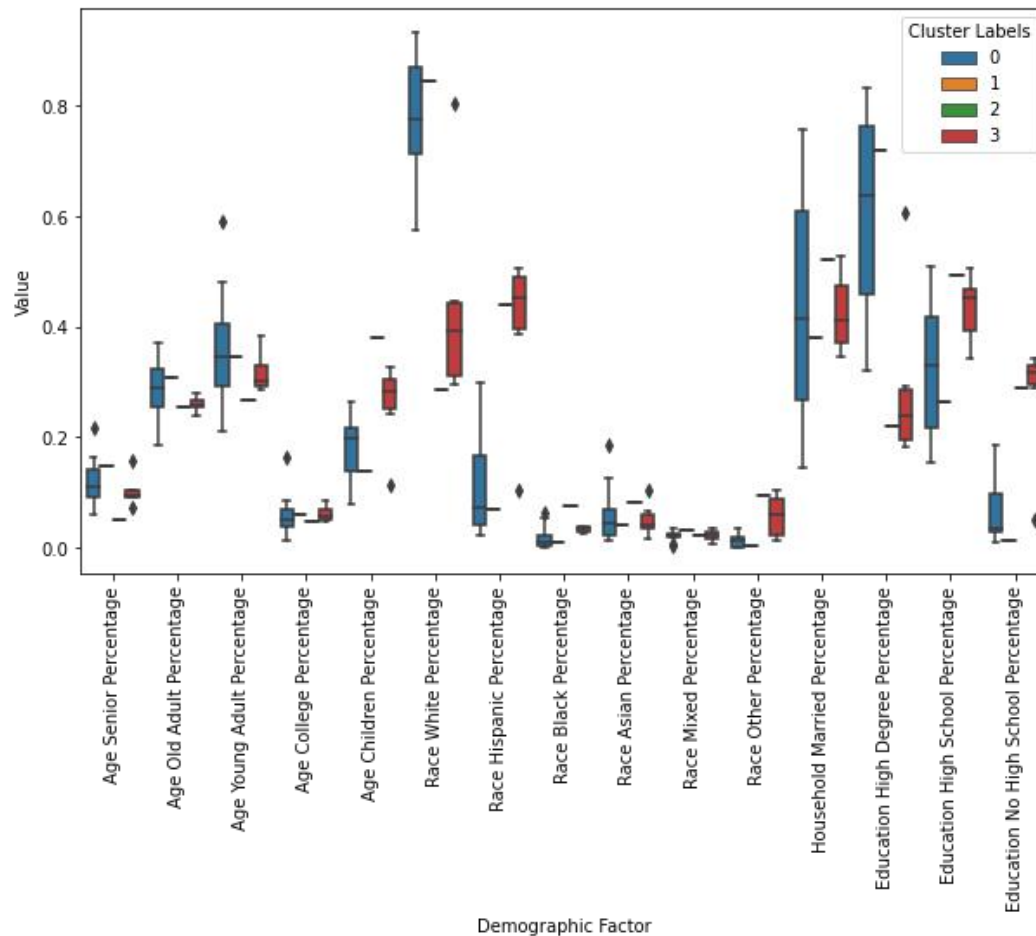


- Cluster 0 neighborhoods show higher income than cluster 3 neighborhoods.



Data Analysis and Discussion

- Demographic Factors by Cluster for Feature Selection



- Cluster 0 neighborhoods show higher adult percentage, white race percentage and high education percentage than cluster 3 neighborhoods.



Data Analysis and Discussion

- **Multivariate Linear Regression Model**
 - Features selected: 'Income 80percentile', 'Income 60percentile', 'Income 50percentile', 'Age Senior Percentage', 'Age Old Adult Percentage', 'Age Young Adult Percentage', 'Race White Percentage', 'Education High Degree Percentage'.
 - Generate model for each restaurant type and the overall restaurant rate average using the features selected. Output fit score for each restaurant type
 - Cross referencing previous observation: Fast Food, Mexican, Chinese, Asian, Vegan, Thai are more popular than others

Conclusion: Thai and Fast Food restaurant are popular and have relatively higher fit score

	Restaurant	Fit Score
0	African Restaurant	0.326475
1	American Restaurant	0.637694
2	Asian Restaurant	0.426773
3	Belgian Restaurant	0.623991
4	Brazilian Restaurant	0.605012
5	Chinese Restaurant	0.266289
6	Dim Sum Restaurant	0.495331
7	Ethiopian Restaurant	0.559323
8	Fast Food Restaurant	0.625155
9	German Restaurant	0.771933
10	Gluten-free Restaurant	0.419568
11	Greek Restaurant	0.707848
12	Himalayan Restaurant	0.404605
13	Indian Restaurant	0.321377
14	Italian Restaurant	0.701652
15	Japanese Restaurant	0.780351
16	Korean Restaurant	0.396128
17	Latin American Restaurant	0.396128
18	Mediterranean Restaurant	0.573126
19	Mexican Restaurant	0.562255
20	Middle Eastern Restaurant	0.861567
21	New American Restaurant	0.513664
22	Ramen Restaurant	0.503452
23	Restaurant	0.104762
24	Scandinavian Restaurant	0.694861
25	Seafood Restaurant	0.801604
26	Spanish Restaurant	0.586915
27	Sushi Restaurant	0.646423
28	Taiwanese Restaurant	0.396128
29	Thai Restaurant	0.720832
30	Vegetarian / Vegan Restaurant	0.392854
31	Vietnamese Restaurant	0.800379
32	Restaurant Rate	0.599236



Data Analysis and Discussion

- Using the multivariate linear regression model to predict Thai / Fast Food restaurant rate for each neighborhood

	Neighborhood	Thai Restaurant Actual	Thai Restaurant Predicted	Fast Food Restaurant Actual	Fast Food Restaurant Predicted	Thai Predicted - Actual	Fast Food Predicted - Actual
0	Arcadia Heights	0.000000	-0.005528	0.028986	0.038636	-0.005528	0.009651
1	Bonneville Hills	0.010000	0.008553	0.000000	0.002135	-0.001447	0.002135
2	Capitol Hill	0.000000	0.008515	0.015385	0.004326	0.008515	-0.011058
3	Central City	0.010000	0.021955	0.000000	0.002097	0.011955	0.002097
4	Central City-Liberty Wells	0.020000	0.018675	0.000000	0.011331	-0.001325	0.011331
5	Downtown	0.010000	0.000884	0.010000	0.016775	-0.009116	0.006775
6	East Bench	0.018182	0.014171	0.000000	0.002845	-0.004011	0.002845
7	East Central	0.010000	0.017578	0.000000	-0.009592	0.007578	-0.009592
8	Fairpark	0.000000	0.001715	0.043011	0.075705	0.001715	0.032694
9	Glendale	0.000000	0.000012	0.140625	0.085555	0.000012	-0.055070
11	Jordan Meadows	0.000000	0.005975	0.172414	0.102288	0.005975	-0.070126
12	Liberty Wells	0.040000	0.024856	0.000000	-0.007126	-0.015144	-0.007126
13	People's Freeway	0.040000	0.029808	0.000000	0.033383	-0.010192	0.033383
14	Poplar Grove	0.000000	-0.003922	0.080000	0.105962	-0.003922	0.025962
15	Rose Park	0.000000	0.005243	0.000000	0.064894	0.005243	0.064894
16	Sugar House	0.010000	0.014041	0.020000	-0.011964	0.004041	-0.031964
17	Wasatch Hollow	0.030000	0.030824	0.000000	-0.013418	0.000824	-0.013418
19	Yalecrest	0.020000	0.024827	0.000000	0.006587	0.004827	0.006587

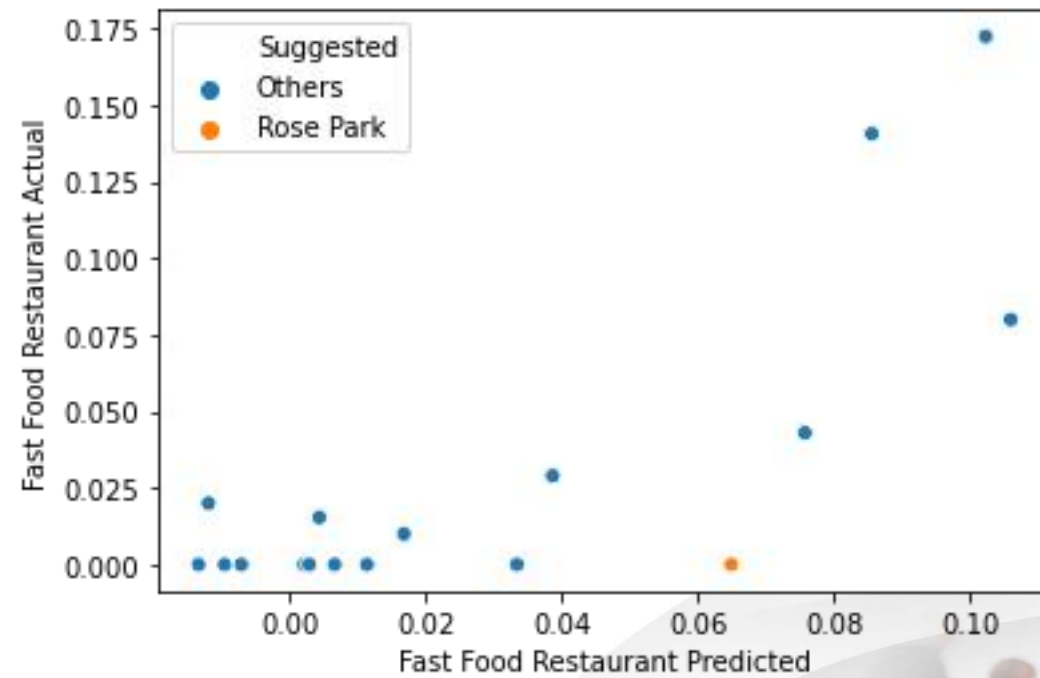
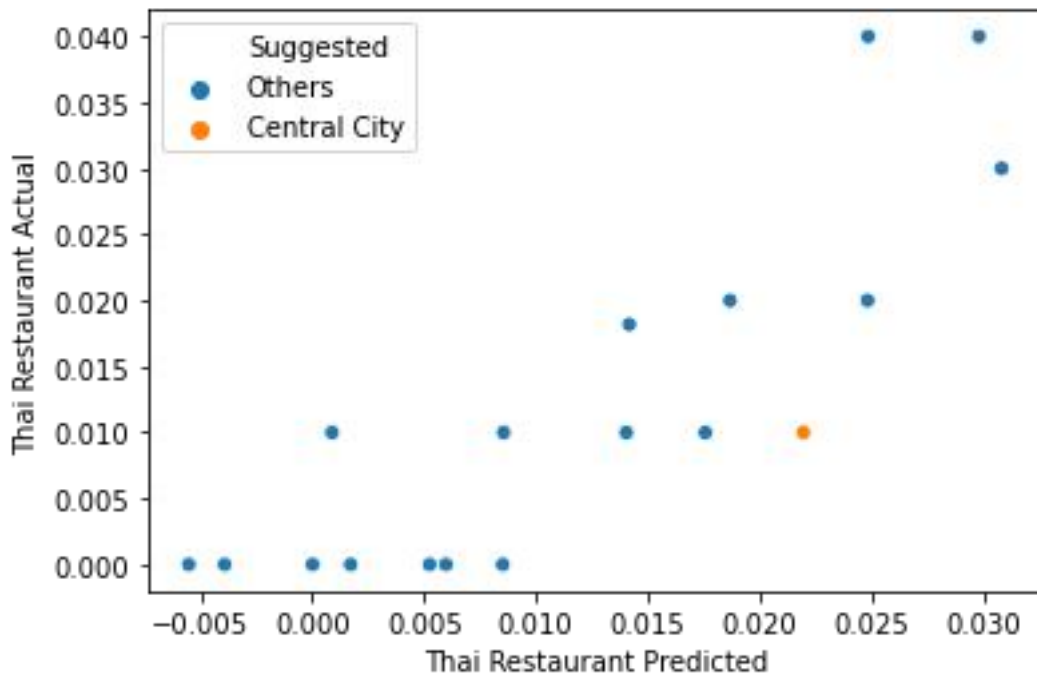
Argument: if predicted restaurant rate value is larger than the actual value, then it may suggest the demographic factors support a higher value and thus it is an opportunity to open new restaurant in this neighborhood

Conclusion: For Thai restaurant, Central City may be a good option to open a new restaurant; for fast food, Rose Park may be a good option.



Data Analysis and Discussion

- Using the multivariate linear regression model to predict Thai / Fast Food restaurant rate for each neighborhood



**Conclusion:
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Conclusion

- This analysis examined the neighborhoods of Salt Lake City for their restaurant rate by type and demographic factors in order to understand the opportunity of opening a new restaurant in one of the neighborhoods
- Thai and Fast Food are the two types of restaurant that are popular and have fit model with reasonable fitting score
- To open a new Thai restaurant, Central City may be a good option
- To open a new fast food restaurant, Rose Park may be a good option

