APPLIED DATA SCIENCE CAPSTONE
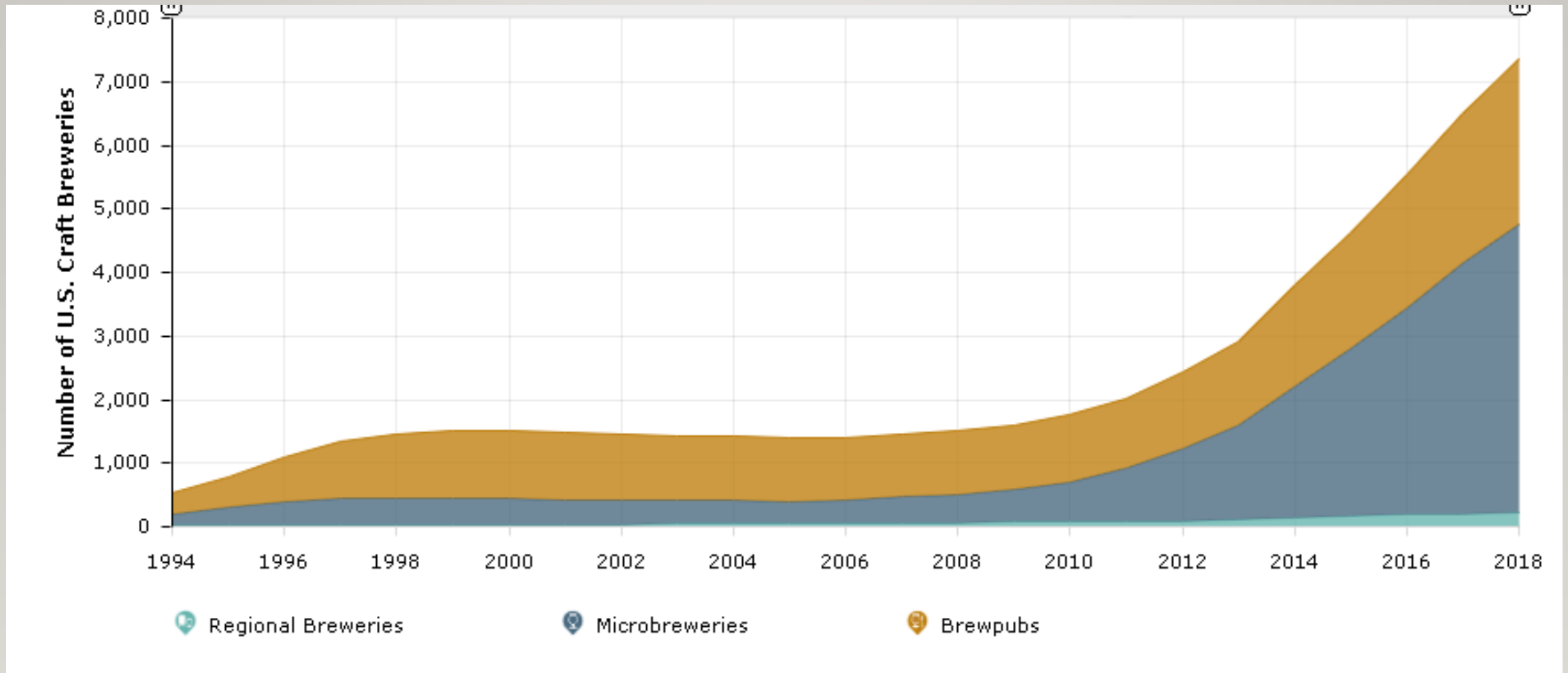# MICHIGAN MICROBREWERY

1. INTRODUCTION

- Craft Beer is popular in the United States, with a rapid expansion of Microbreweries across the Northeast, Michigan, and Northwest.
- As of Calendar Year end 2017, there were over 6,200 Craft Breweries (Table 1).
- Craft Brewing is potentially very profitable, especially once establishing distribution.
- However, due to the expansion of Craft Brewing, new startups need to choose location wisely as the density of breweries increase in residential areas.

Key Point: If opening a Microbrewery, need to choose carefully to avoid jumping into a saturated market.

1. INTRODUCTION

(Table 1 – Craft Breweries in the United States)

Key Point: If opening a Microbrewery, need to choose carefully to avoid jumping into a saturated market.

1. INTRODUCTION

- Great Divide Brewing is hoping to expand into Michigan with a brewery and taproom.
- Great Divide sells well with Household incomes over $75,000.
  - It offers a lineup of premium Microbrew styles, ranging from Bold IPAs to Easy Drinking Pilsners that appeal to more affluent and established professionals.
- Find a Neighborhood in Michigan that meets these criteria but also has a low density of Breweries and Bars.
- Neighborhoods should have a population greater than 15,000 to ensure sufficient sales demand.

Key Point: Find a Neighborhood with Income ≥$75k, pop ≥15,000, and minimum Bar/Brewery density.

2. DATA

1. Scrape or load Census data for Counties in Michigan that have for Household Income >$75k/year.
2. Scrape or load Census data for Neighborhoods within County that have Population >15K.
3. Use Foursquare to obtain Venue information for Neighborhoods.
4. Rank Venues based on prevalence for each Neighborhood, to understand types of venues are popular.
5. Cluster related Neighborhoods to look for areas with various types of eateries, social gathering places, that have a low density of Bars and Breweries.

Key Point: Scrape or load Census Data to get Demographic info. Use Foursquare to obtain Venues and popularity for Cities of interest. Cluster Cities to look for areas that have low occurrence of Bars/Breweries.

3. METHODOLOGY

1. Scrape or load Census data for Counties in Michigan that have for Household Income >$75k/year.
   - Reviewing US Census data, there was not readily locatable information that isolated Household Incomes by County.
   - As a result, Beautiful Soup was used to scrape Household Income by County. https://en.wikipedia.org/wiki/List_of_Michigan_locations_by_per_capita_income.html
   - Resulting Data was cleaned and sorted by Income to isolate Counties with Median Household income that met the criteria.
2. Scrape or load Census data for Neighborhoods within County that have Population >15K.
   - Again, US Census data was not readily available locatable information that isolated Population by City.
   - Population data was instead scraped from Wikipedia. List_of_municipalities_in_Michigan.html
3. Use Foursquare to obtain Venue information for Neighborhoods.
   - For Neighborhoods that have a population >15K, use Foursquare API to request popular venues.
4. Use One Hot encoding to analyze each neighborhood and group then rank by Category prevalence.
5. Cluster related Neighborhoods.
   - Used K-Means clustering to look for areas with various types of eateries, social gathering places, that have a low density of Bars and Breweries

Key Point: Scrape data to determine income and population. Use Foursquare to obtain and rank prevalence of venue categories. Use K-Means clustering Machine Learning to group neighborhoods. Review Clusters, looking for areas with eateries and social gathering places, but a low density of Bars and Breweries.

4. RESULTS

1. Counties in Michigan that have for Household Income >$75k/year.
   - Oakland County was determined to meet the Income Criteria.

	Rank	County	Per Capita Income	Median Household Income	Median Family Income	Population	Number of Households
0	1	Oakland	$56,138	$85,991	$94,783	1,202,362	483,698
1	3	Livingston	$31,609	$72,129	$82,637	180,967	67,380
2	4	Washtenaw	$31,316	$59,065	$82,184	344,791	137,193
3	8	Clinton	$27,223	$58,016	$69,611	75,382	28,766
4	2	Leelanau	$32,194	$56,527	$65,342	21,708	9,255

4. RESULTS

2. Neighborhoods within Oakland County that have Population >15K.
   - The Neighborhoods below met the population criteria

|	Neighborhood	Type	County	Population 2010		Neighborhood	Type	County	Population 2010
0	Troy	City	Oakland	80980.0	13	White Lake	Charter Township	Oakland	30019.0
1	Farmington Hills	City	Oakland	79740.0	14	Madison Heights	City	Oakland	29694.0
2	Southfield	City	Oakland	71739.0	15	Oak Park	City	Oakland	29319.0
3	Waterford	Charter Township	Oakland	71707.0	16	Auburn Hills	City	Oakland	21412.0
4	Rochester Hills	City	Oakland	70995.0	17	Oxford	Charter Township	Oakland	20526.0
5	West Bloomfield	Charter Township	Oakland	64690.0	18	Birmingham	City	Oakland	20103.0
6	Pontiac	City	Oakland	59515.0	19	Ferndale	City	Oakland	19900.0
7	Royal Oak	City	Oakland	57236.0	20	Highland	Charter Township	Oakland	19202.0
8	Novi	City	Oakland	55224.0	21	Oakland	Charter Township	Oakland	16779.0
9	Bloomfield	Charter Township	Oakland	41070.0	22	Hazel Park	City	Oakland	16422.0
10	Commerce	Charter Township	Oakland	40186.0	23	Milford	Charter Township	Oakland	15736.0
11	Orion	Charter Township	Oakland	35394.0	24	Brandon	Charter Township	Oakland	15175.0
12	Independence	Charter Township	Oakland	34681.0					

4. RESULTS

3. Use One Hot encoding to analyze each neighborhood and group then rank by Category prevalence.
   - With a quick inspection, looks like Ferndal and Hazel Parl wouldn't be a good choice due to Bars being the most common venue.

	Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Auburn Hills	Sandwich Place	Hotel	Pizza Place	American Restaurant	Coffee Shop
1	Birmingham	American Restaurant	Coffee Shop	Spa	Steakhouse	Salon / Barbershop
2	Bloomfield	Pizza Place	Frozen Yogurt Shop	Bagel Shop	Pharmacy	Supermarket
3	Brandon	Flower Shop	Yoga Studio	Gas Station	Furniture / Home Store	Frozen Yogurt Shop
4	Commerce	Convenience Store	Liquor Store	Ice Cream Shop	Lake	Park
5	Farmington Hills	Park	Hotel	Bank	Sandwich Place	Theater
6	Ferndale	Bar	Coffee Shop	Sandwich Place	Sushi Restaurant	Pizza Place
7	Hazel Park	Bar	Pizza Place	Sandwich Place	Fast Food Restaurant	Diner
8	Highland	Grocery Store	Pizza Place	Bank	Chinese Restaurant	Martial Arts Dojo
9	Independence	Fast Food Restaurant	Pharmacy	Pizza Place	Intersection	Bar
10	Madison Heights	Coffee Shop	Fast Food Restaurant	American Restaurant	Pizza Place	Vietnamese Restaurant
11	Milford	Sandwich Place	Pizza Place	American Restaurant	Coffee Shop	Burger Joint
12	Novi	Sandwich Place	Furniture / Home Store	Mobile Phone Shop	Mexican Restaurant	Pizza Place
13	Oak Park	Pizza Place	Discount Store	Pharmacy	Cosmetics Shop	Sandwich Place
14	Oakland	Golf Course	Farmers Market	Restaurant	Garden Center	Fish & Chips Shop
15	Orion	Dog Run	Park	Gift Shop	Boutique	Construction & Landscaping
16	Oxford	Pizza Place	Sandwich Place	Bank	Chinese Restaurant	Gym / Fitness Center
17	Pontiac	Pizza Place	Fast Food Restaurant	Diner	Nightclub	Music Venue
18	Rochester Hills	Furniture / Home Store	Yoga Studio	Sporting Goods Shop	Intersection	Fast Food Restaurant
19	Royal Oak	Grocery Store	Gym / Fitness Center	American Restaurant	Sandwich Place	Pizza Place
20	Southfield	Pharmacy	American Restaurant	Sandwich Place	Intersection	Mobile Phone Shop
21	Troy	Seafood Restaurant	Hotel	Department Store	Burger Joint	Italian Restaurant
22	Waterford	American Restaurant	Pizza Place	Gas Station	Coffee Shop	Sporting Goods Shop
23	West Bloomfield	Golf Course	Middle Eastern Restaurant	Pharmacy	Trail	Dessert Shop
24	White Lake	American Restaurant	Cosmetics Shop	Department Store	Construction & Landscaping	Pet Store

4. RESULTS

4. Cluster related Neighborhoods.

   - Due to smaller dataset, created 3 Clusters using K-Means.
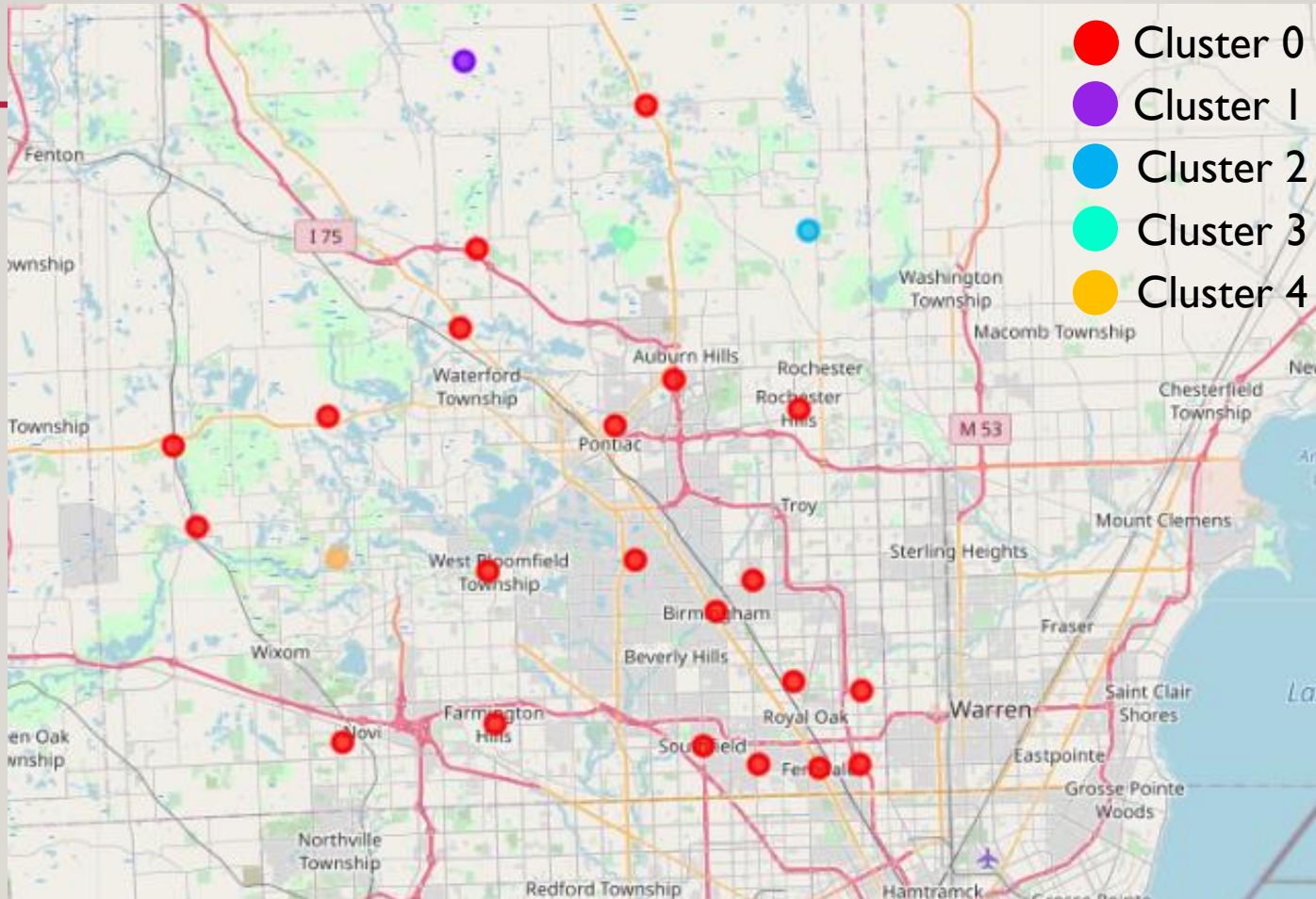
4. RESULTS

4. Cluster 0.
   - Cluster 0 has a variety of cafes and restaurants in the top 5 venues. This would be a good place to look for locating the Brewery, so long as bars and breweries are not common in the Neighborhood.

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Troy	0	Seafood Restaurant	Hotel	Department Store	Burger Joint	Italian Restaurant
1	Farmington Hills	0	Park	Hotel	Bank	Sandwich Place	Theater
2	Southfield	0	Pharmacy	American Restaurant	Sandwich Place	Intersection	Mobile Phone Shop
3	Waterford	0	American Restaurant	Pizza Place	Gas Station	Coffee Shop	Sporting Goods Shop
4	Rochester Hills	0	Furniture / Home Store	Yoga Studio	Sporting Goods Shop	Intersection	Fast Food Restaurant
5	West Bloomfield	0	Golf Course	Middle Eastern Restaurant	Pharmacy	Trail	Dessert Shop
6	Pontiac	0	Pizza Place	Fast Food Restaurant	Diner	Nightclub	Music Venue
7	Royal Oak	0	Grocery Store	Gym / Fitness Center	American Restaurant	Sandwich Place	Pizza Place
8	Novi	0	Sandwich Place	Furniture / Home Store	Mobile Phone Shop	Mexican Restaurant	Pizza Place
9	Bloomfield	0	Pizza Place	Frozen Yogurt Shop	Bagel Shop	Pharmacy	Supermarket
12	Independence	0	Fast Food Restaurant	Pharmacy	Pizza Place	Intersection	Bar
13	White Lake	0	American Restaurant	Cosmetics Shop	Department Store	Construction & Landscaping	Pet Store
14	Madison Heights	0	Coffee Shop	Fast Food Restaurant	American Restaurant	Pizza Place	Vietnamese Restaurant
15	Oak Park	0	Pizza Place	Discount Store	Pharmacy	Cosmetics Shop	Sandwich Place
16	Auburn Hills	0	Sandwich Place	Hotel	Pizza Place	American Restaurant	Coffee Shop
17	Oxford	0	Pizza Place	Sandwich Place	Bank	Chinese Restaurant	Gym / Fitness Center
18	Birmingham	0	American Restaurant	Coffee Shop	Spa	Steakhouse	Salon / Barbershop
19	Ferndale	0	Bar	Coffee Shop	Sandwich Place	Sushi Restaurant	Pizza Place
20	Highland	0	Grocery Store	Pizza Place	Bank	Chinese Restaurant	Martial Arts Dojo
22	Hazel Park	0	Bar	Pizza Place	Sandwich Place	Fast Food Restaurant	Diner
23	Milford	0	Sandwich Place	Pizza Place	American Restaurant	Coffee Shop	Burger Joint

4. RESULTS

4. Cluster 1.
   - Cluster 1 appears to not be an area of dining or nightlife. This cluster would probably not be a good place for a brewery.

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
24	Brandon	1	Flower Shop	Yoga Studio	Gas Station	Furniture / Home Store	Frozen Yogurt Shop

4. Cluster 2.
   - Cluster 2 is primarily related to recreation and shopping. This cluster would also not be a good place for a brewery if looking for high foot traffic.

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
21	Oakland	2	Golf Course	Farmers Market	Restaurant	Garden Center	Fish & Chips Shop

4. RESULTS

4. Cluster 3.
- Cluster 3 appears to be an area of recreation, shopping, and commercial. This cluster would probably not be a good place for a brewery.

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
11	Orion	3	Dog Run	Park	Gift Shop	Boutique	Construction & Landscaping

4. Cluster 4.
- Cluster 4 is primarily related to shopping and recreation. This would not be a good area to locate a brewery either.

	Neighborhood	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
10	Commerce	4	Convenience Store	Liquor Store	Ice Cream Shop	Lake	Park

5. CONCLUSIONS

Michigan does have a region that would meet Great Divide's Criteria for locating a Brewery and Tap Room.

- Oakland County met the Household Income >$75K Criteria, coming in at approx. $86k/year.
- Within Oakland County, there are several Neighborhoods that meet the >15K population criteria as well.
- These Neighborhoods when Clustered into 5 groups, show Cluster 0 as the most likely group to for a brewery location. This is due a variety of cafe's and restaurants in the top 5 venues.
- Within Cluster 0, Troy, Waterford, Pontiac, Madison Heights, Auburn Hills, and Milford have at least 4 out of 5 top Venues being related to Cafes, Eateries, but not Bars or Breweries.
- It is recommended that Great Divide focus on these Neighborhoods for locating a brewery.

5. FUTURE DIRECTION

As Great Divide focuses on the before mentioned neighborhoods, there are some additional potential considerations.

- It would be worth looking into Population Density as well as consideration of areas that have both Restaurants and Hotels within walking distance.
- There will be Communities larger than 15,000 people that are spread out over a larger geographical range, potentially making placement of the Brewery less desirable.
- Hotels also generate additional population density that would not be part of census data.