



APPLIED DATA SCIENCE CAPSTONE MICHIGAN MICROBREWERY

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I. INTRODUCTION

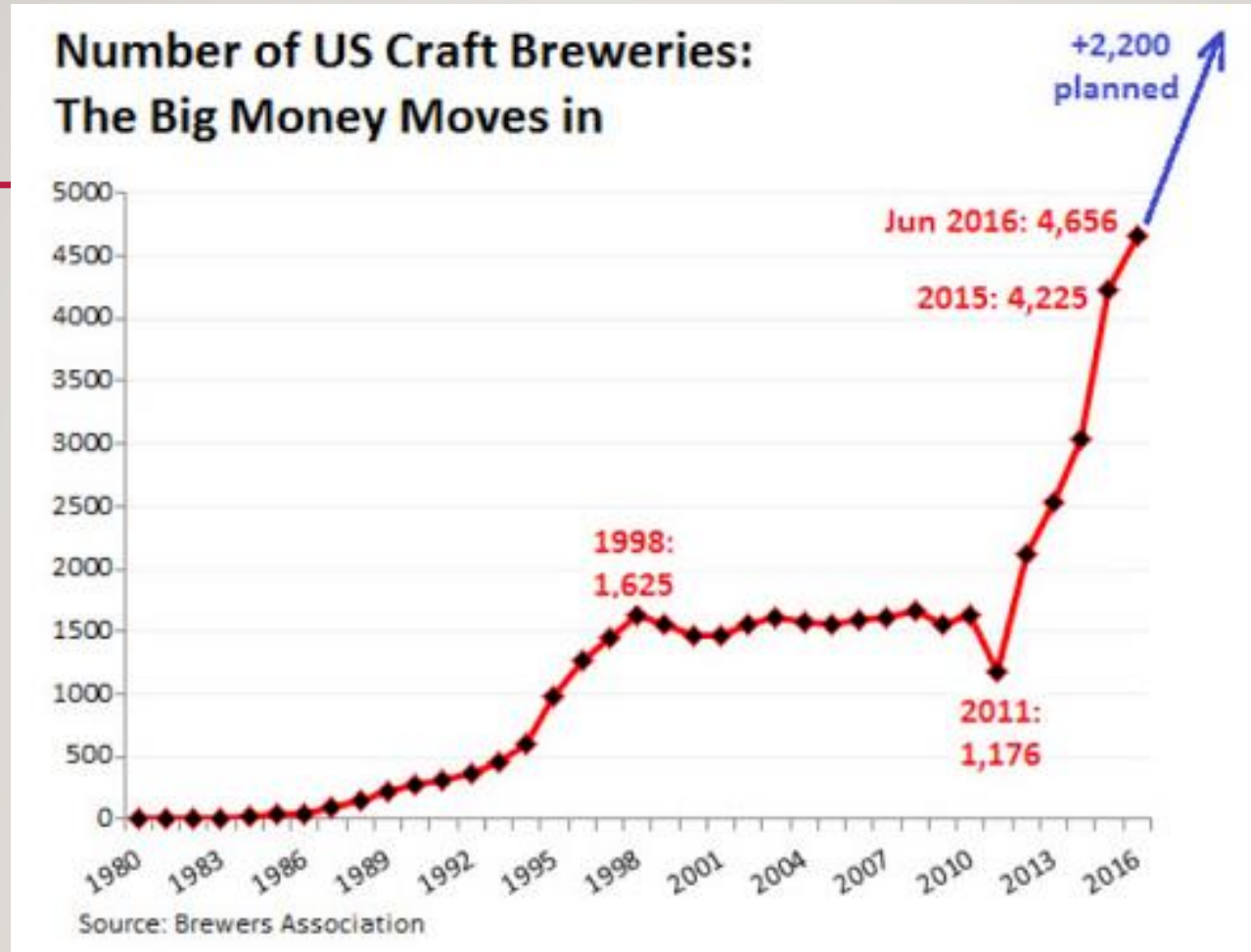
- Craft Beer is popular in the United States, with a rapid expansion of Microbreweries across the Northeast, Michigan, and Northwest.
- As of Calendar Year end 2017, there were over 6,200 Craft Breweries (Table I).
- Craft Brewing is potentially very profitable, especially once establishing distribution.
- 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.



I. INTRODUCTION

(Table I – Craft Breweries in the United States)



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

I. INTRODUCTION

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- 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 $\geq \$75k$, pop $\geq 15,000$, and minimum Bar/Brewery density.

2. DATA

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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 $> \$75k/\text{year}$.
 - 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. https://en.wikipedia.org/wiki/Kent_County,_Michigan
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

- I. Counties in Michigan that have for Household Income >\$75k/year.
 - Kent 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	Kent	\$56,138	\$85,991	\$94,783	1,202,362	483,698
1	2	Leelanau	\$32,194	\$56,527	\$65,342	21,708	9,255
2	3	Livingston	\$31,609	\$72,129	\$82,637	180,967	67,380
3	4	Washtenaw	\$31,316	\$59,065	\$82,184	344,791	137,193
4	5	Charlevoix	\$28,403	\$48,704	\$57,022	25,949	10,882

4. RESULTS

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

	Neighborhood	Type	County	Population 2010
0	Grand Rapids	City	Kent	188040.0
1	Wyoming	City	Kent	72125.0
2	Kentwood	City	Kent	48707.0
3	Plainfield	Charter Township	Kent	30952.0
4	Gaines	Charter Township	Kent	25146.0
5	Walker	City	Kent	23537.0
6	Byron	Township	Kent	20317.0
7	Cascade	Charter Township	Kent	17134.0
8	Grand Rapids	Charter Township	Kent	16661.0
9	Grandville	City	Kent	15378.0

4. RESULTS

3. Popular Venues per Foursquare.

- Grand Rapids looks promising as its Top5 most popular spots are all Eateries.

----Byron----	venue	freq	----Grand Rapids----	venue	freq	----Plainfield----	venue	freq
0	Pizza Place	0.11	0	Coffee Shop	0.08	0	Bar	0.11
1	Pharmacy	0.07	1	Café	0.04	1	Liquor Store	0.11
2	Bank	0.07	2	American Restaurant	0.03	2	Bakery	0.05
3	American Restaurant	0.04	3	Bakery	0.03	3	Nightlife Spot	0.05
4	High School	0.04	4	Pizza Place	0.03	4	Food	0.05
----Cascade----	venue	freq	----Grandville----	venue	freq	----Walker----	venue	freq
0	River	0.17	0	Mexican Restaurant	0.06	0	Discount Store	0.06
1	Park	0.17	1	Discount Store	0.06	1	Golf Course	0.06
2	Soccer Field	0.08	2	Baseball Field	0.04	2	American Restaurant	0.03
3	Insurance Office	0.08	3	Ice Cream Shop	0.04	3	Fast Food Restaurant	0.03
4	Intersection	0.08	4	Antique Shop	0.04	4	Coffee Shop	0.03
----Gaines----	venue	freq	----Kentwood----	venue	freq	----Wyoming----	venue	freq
0	Construction & Landscaping	0.50	0	Bank	0.09	0	Pizza Place	0.13
1	Park	0.25	1	Pizza Place	0.06	1	Park	0.08
2	Golf Course	0.25	2	Chinese Restaurant	0.06	2	Gas Station	0.08
3	Multiplex	0.00	3	Supermarket	0.06	3	Sandwich Place	0.06
4	Museum	0.00	4	Discount Store	0.06	4	Liquor Store	0.04

4. RESULTS

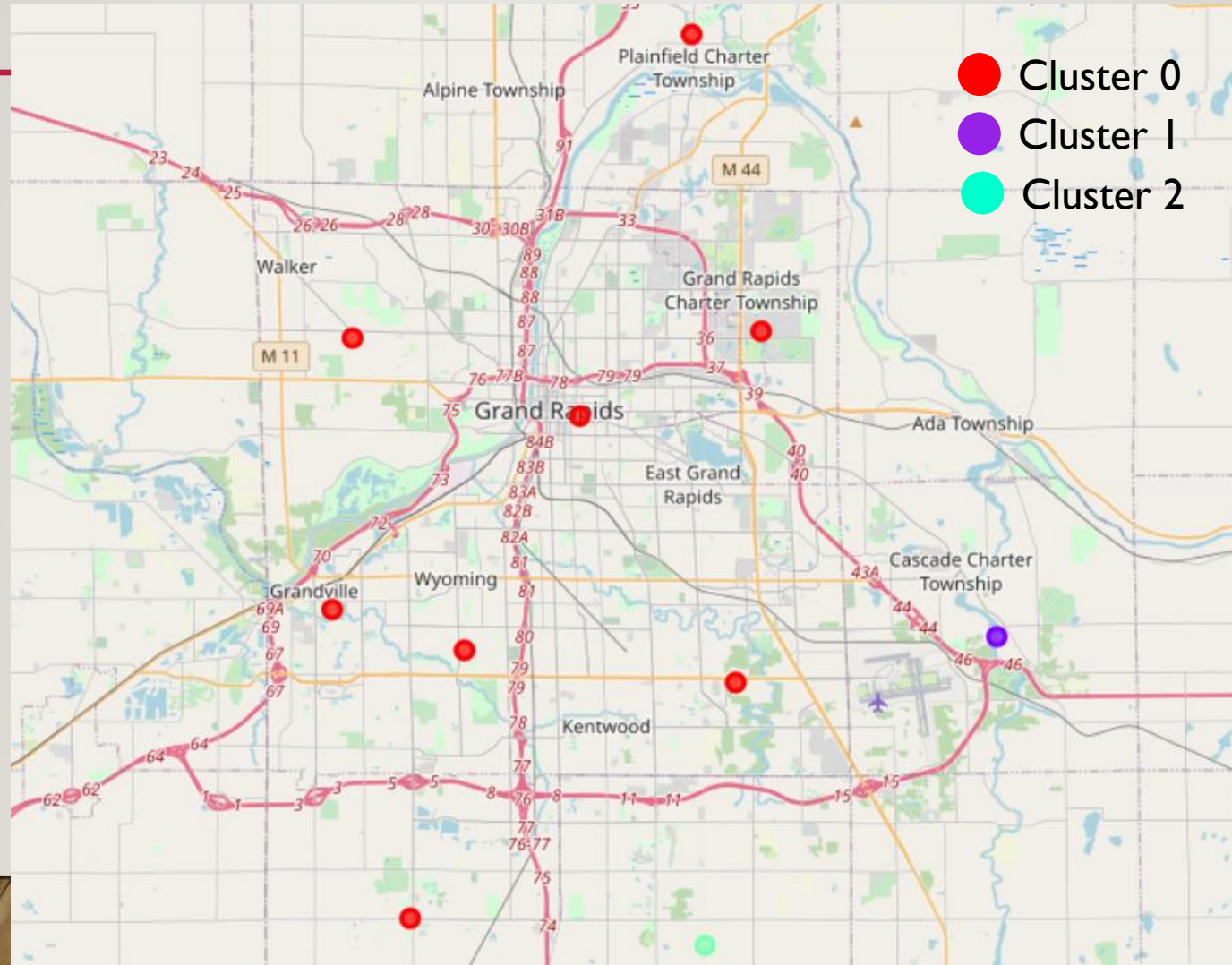
3. Use One Hot encoding to analyze each neighborhood and group then rank by Category prevalence.
- With a quick inspection, looks like Plainfield wouldn't be a good choice due to Bars being the 2nd most common venue.

	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	Byron	Pizza Place	Bank	Pharmacy	Ice Cream Shop	Chinese Restaurant	Cafeteria	Business Service	Fast Food Restaurant	Liquor Store	Brewery
1	Cascade	River	Park	Insurance Office	Mobile Phone Shop	Home Service	Golf Course	Disc Golf	Soccer Field	Intersection	Dog Run
2	Gaines	Construction & Landscaping	Park	Golf Course	Dog Run	Factory	Fabric Shop	Ethiopian Restaurant	Electronics Store	Dry Cleaner	Donut Shop
3	Grand Rapids	Coffee Shop	Café	Pizza Place	Bakery	Bar	American Restaurant	Hotel	Sandwich Place	Italian Restaurant	Cosmetics Shop
4	Grandville	Discount Store	Mexican Restaurant	Ice Cream Shop	Pizza Place	Baseball Field	Sporting Goods Shop	American Restaurant	Antique Shop	Electronics Store	Miscellaneous Shop
5	Kentwood	Bank	Discount Store	Supermarket	Pizza Place	Intersection	Park	Chinese Restaurant	Pharmacy	Golf Course	Coffee Shop
6	Plainfield	Liquor Store	Bar	Cosmetics Shop	Bakery	Ice Cream Shop	Food	Nightlife Spot	Disc Golf	Pizza Place	Gym / Fitness Center
7	Walker	Golf Course	Discount Store	American Restaurant	Electronics Store	Bus Stop	Butcher	Sandwich Place	Chinese Restaurant	Coffee Shop	Pizza Place
8	Wyoming	Pizza Place	Park	Gas Station	Sandwich Place	Liquor Store	Grocery Store	Pharmacy	Motorsports Shop	Business Service	Brewery

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 cafe's and restaurants in the top 3 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	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	Grand Rapids	42.961416	-85.655863	0	Coffee Shop	Café	Pizza Place	Bakery	Bar	American Restaurant	Hotel	Sandwich Place	Italian Restaurant	Cosmetics Shop
1	Wyoming	42.892250	-85.702530	0	Pizza Place	Park	Gas Station	Sandwich Place	Liquor Store	Grocery Store	Pharmacy	Motorsports Shop	Business Service	Brewery
2	Kentwood	42.882529	-85.592247	0	Bank	Discount Store	Supermarket	Pizza Place	Intersection	Park	Chinese Restaurant	Pharmacy	Golf Course	Coffee Shop
3	Plainfield	43.074193	-85.610032	0	Liquor Store	Bar	Cosmetics Shop	Bakery	Ice Cream Shop	Food	Nightlife Spot	Disc Golf	Pizza Place	Gym / Fitness Center
5	Walker	42.984747	-85.747812	0	Golf Course	Discount Store	American Restaurant	Electronics Store	Bus Stop	Butcher	Sandwich Place	Chinese Restaurant	Coffee Shop	Pizza Place
6	Byron	42.812529	-85.723917	0	Pizza Place	Bank	Pharmacy	Ice Cream Shop	Chinese Restaurant	Cafeteria	Business Service	Fast Food Restaurant	Liquor Store	Brewery
8	Grand Rapids Township	42.986416	-85.582250	0	Coffee Shop	Café	Pizza Place	Bakery	Bar	American Restaurant	Hotel	Sandwich Place	Italian Restaurant	Cosmetics Shop
9	Grandville	42.903915	-85.756144	0	Discount Store	Mexican Restaurant	Ice Cream Shop	Pizza Place	Baseball Field	Sporting Goods Shop	American Restaurant	Antique Shop	Electronics Store	Miscellaneous Shop

4. RESULTS

4. Cluster 1.

- Cluster 1 appears to be nature and commercial related. There would probably not be much demand or zoning for a brewery here.

	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
7	Cascade	42.895864	-85.486688	1	River	Park	Insurance Office	Mobile Phone Shop	Home Service	Golf Course	Disc Golf	Soccer Field	Intersection	Dog Run

4. RESULTS

4. Cluster 2.

- Cluster 2 has appears to be recreation and industrial related. There would probably not be much demand or zoning for a brewery here either.

	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
4	Gaines	42.804475	-85.605024	2	Construction & Landscaping	Park	Golf Course	Dog Run	Factory	Fabric Shop	Ethiopian Restaurant	Electronics Store	Dry Cleaner	Donut Shop

5. CONCLUSIONS

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

- Kent County met the Household Income >\$75K Criteria, coming in at approx. \$86k/year.
- Within Kent County, there are several Neighborhoods that meet the >15K population criteria as well.
- These Neighborhoods when Clustered into 3 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 3 venues.
- Within Cluster 0, Both Grand Rapids, and Grand Rapids Township appear the most promising, with 4 out 5 most prevalent 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.

