New Business Location Selection in Seattle

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Introduction

Background

Seattle has been one of the fastest growing large American cities for nearly a decade. According to a Washington Office of Financial Management (OFM) survey, Seattle's population grew by 22.78% between 2010 and 2019. There is no doubt that more people are attracted to this booming city to establish their own businesses.

Problem

As the 15th largest city in the United States, Seattle is made up of over 30 neighborhoods. Each neighborhood has its own unique characteristics and the demographics of each neighborhood can also be very different. Therefore, it is difficult to determine where is the ideal location for a new business without an understanding of this fast-growing market.

Interest

The main goal of this analysis is to provide essential data and assist a new business's location selection process. For illustration purposes, a new bakery is used as an example. This new bakery features top quality bread and pastries that are made with trendy ingredients. Its store environment is Instagram-worthy. Its target market is composed of young and educated individuals or families under the age of 35 who have medium to high income level. This analysis goes through the data of each Seattle neighborhood from the following aspects:

1. median age
2. annual household income
3. crime rate
4. current market saturation

Data Acquisition and Cleaning

1. Median age by Seattle neighborhoods – link

When I was looking for demographic related information like median age, I first thought about the U.S. Census data that is available to the public. The City of Seattle organizes the U.S. Census data by neighborhood. However, different city departments and non-city entities define

neighborhoods differently based on many factors. Some districts and neighborhoods are informal with varying boundaries and names. Some neighborhoods may overlap and be referred to by different names by community members. For this analysis, I chose the 2010 U.S. Census full report by Seattle Community Reporting Area ("CRAs"). The CRAs were established for the U.S. Census purpose specifically. The city is divided into 53 CRAs whose name and boundaries are the closest to what are commonly referred to as Seattle neighborhoods. Also, compared to the other definitions, CRAs provide the proper level of detail for this analysis.

The full report is in Excel format, but it includes a lot of formatting such as title rows, spacing rows/columns, merged cells, etc. The data for each CRA is shown in columns and different demographic data such as ethnicity, age and sex are shown in rows. The data cleaning process mostly involves removing the formatting rows and columns and extracting the one row of data that represents the median age for both sexes using the Python Pandas module. The dataframe is then transposed to show the CRAs as rows and median age as the only feature.

Community Reporting Areas	Median age
Madison Park	46.3538
Pioneer Square/International District	46.3125
Downtown Commercial Core	45.6827
Alki/Admiral	45.2893
Broadview/Bitter Lake	43.7719

Figure 1: first 5 row of median age by neighborhood dataframe

2. Annual Household Income - link

I could not find a dataset that includes annual household income by Seattle neighborhood. The closest data I could find was the Individual Income Tax Statistics by zip code in the State of Washington disclosed by the Internal Revenue Service. The latest data available was from 2017. One of the features included in this dataset is Adjusted Gross Income ("AGI") which is defined as gross income minus adjustments to income. Gross income includes wages, dividends, capital gains, business income, retirement distributions as well as other income. Adjustments to income include educator expenses, student loan interest, alimony payments or contributions to a retirement account. Depends on how the returns were filed, the AGI can be a fair representation of an individual or a married couple's annual income level, i.e. annual household income.

The rows of the dataset are organized by zip code and each zip code is further divided into 6 buckets based on the AGI range in 1 total row. The original dataset also includes 151 columns,

but only the zip code, size of adjusted gross income and number of returns columns are relevant to this analysis. To clean up the data, the following steps are performed:
Step 1: the total row for each zip code is removed and columns other than the relevant columns are dropped.
Step 2: a U.S. zip code database is downloaded which includes all U.S. zip codes and their corresponding primary cities. The zip code database is merged with the AGI dataframe so that the zip codes in AGI dataframe can be associated with a city. Any city other than Seattle is then dropped.
Step 3: Pandas.pivot_tab is then used to convert the size of adjusted gross income from rows to features. The Seattle zip codes stay as the rows.
Step 4: The number of returns for each AGI range is converted to percentage.
Step 5: Certain features are further grouped into 3 features.

Size of adjusted gross income	1*under*25,000	100, 200,000 000*under*	$200,000 or more	25, 50,000 000*under*	50, 75,000 000*under*	75, 100,000 000*under*	Total Number of Return
Zip Code							
98101	0.138158	0.265351	0.180921	0.175439	0.134868	0.105263	1.0
98102	0.156156	0.195195	0.122523	0.225225	0.189189	0.111712	1.0
98103	0.172840	0.202202	0.136803	0.213881	0.167501	0.106773	1.0
98104	0.276565	0.151383	0.091703	0.257642	0.136827	0.085881	1.0
98105	0.340690	0.132428	0.149972	0.215054	0.104697	0.057159	1.0

Figure 2: first 5 rows of dataframe for percentage of returns filed in six AGI buckets by Seattle zip code

Size of adjusted gross income	$1 under $50,000	$50,000 under $100,000	$100,000 under $200,000
Zip Code			
98164	0.250000	0.000000	0.750000
98105	0.555744	0.161856	0.282400
98177	0.356731	0.206731	0.436538
98199	0.326087	0.214783	0.459130
98112	0.338942	0.217147	0.443910

Figure 3: first 5 rows of dataframe for percentage of returns filed in three AGI buckets by Seattle zip code

3. Crime Data - link

Seattle Police Department shares Seattle crime data from 2008 through the present. The dataset includes 17 features such as incident date and time, crime type, neighborhood, longitude and latitude information. The neighborhoods in this dataset are referred to as Micro-Community Policing Plans (MCPP) neighborhoods which are very similar to the neighborhoods

defined for the U.S. Census. For this analysis, I am interested in the number of incidents by Offense Parent Group in each MCPP because the Offense Parent Group provides enough detail on the types of crimes. Since this feature contains categorical data, I used Pandas One Hot Encoding to convert the Offense Parent Group into dummy numerical values for each incident and its corresponding MCPP where the incident happened.

	MCPP	ANIMAL CRUELTY	ARSON	ASSAULT OFFENSES	BAD CHECKS	BRIBERY	BURGLARY/BREAKING&ENTERING	COUNTERFEITING/FORGERY	CURFEW/LOITERING /VAGRANCY VIOLATIONS
0	ALASKA JUNCTION	0	0	0	0	0	0	0	0
1	ALASKA JUNCTION	0	0	0	0	0	0	0	0
2	ALASKA JUNCTION	0	0	0	0	0	0	0	0
3	ALASKA JUNCTION	0	0	0	0	0	0	0	0
4	ALASKA JUNCTION	0	0	0	0	0	0	0	0

Figure 4: sample data of the crime rate dataframe after one hot encoding

The resulting dataframe is then grouped by MCPP so that the number of incidents occurred in each MCPP can be counted by the type of offense. Last but not least, certain financial crimes such as embezzlement and fraud offenses are dropped from the dataframe.

MCPP	ANIMAL CRUELTY	ARSON	ASSAULT OFFENSES	BAD CHECKS	BRIBERY	BURGLARY/BREAKING&ENTERING	COUNTERFEITING/FORGERY	CURFEW/LOITERING /VAGRANCY VIOLATIONS
INTERNATIONAL DISTRICT - EAST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COMMERCIAL HARBOR ISLAND	0.0	0.0	41.0	2.0	0.0	42.0	0.0	0.0
COMMERCIAL DUWAMISH	0.0	2.0	66.0	2.0	0.0	41.0	2.0	0.0
PIGEON POINT	0.0	0.0	141.0	12.0	0.0	149.0	9.0	0.0
EASTLAKE - EAST	0.0	3.0	89.0	4.0	0.0	177.0	4.0	0.0

Figure 5: sample data of the final crime rate dataframe

4. Foursquare REST API

The last data source used for this analysis is from the Foursquare REST API. To measure the current market saturation of bakeries in each neighborhood, location data is pulled for bakeries within a 600 km radius of Seattle. The resulting data is transformed into a dataframe and summarized into the number of bakeries by Seattle zip code.

location.postalCode	Bakery Count	name	categories	referralId	hasPerk	location.address	location.crossStreet	location.lat	location.lng	location.labeledLatLngs
98005	1	1	1	1	1	1	0	1	1	1
98008	1	1	1	1	1	1	1	1	1	1
98052	2	2	2	2	2	2	0	2	2	2
98101	10	10	10	10	10	8	6	10	10	10
98102	1	1	1	1	1	1	1	1	1	1

Figure 6: first five rows of bakery count by zip code dataframe

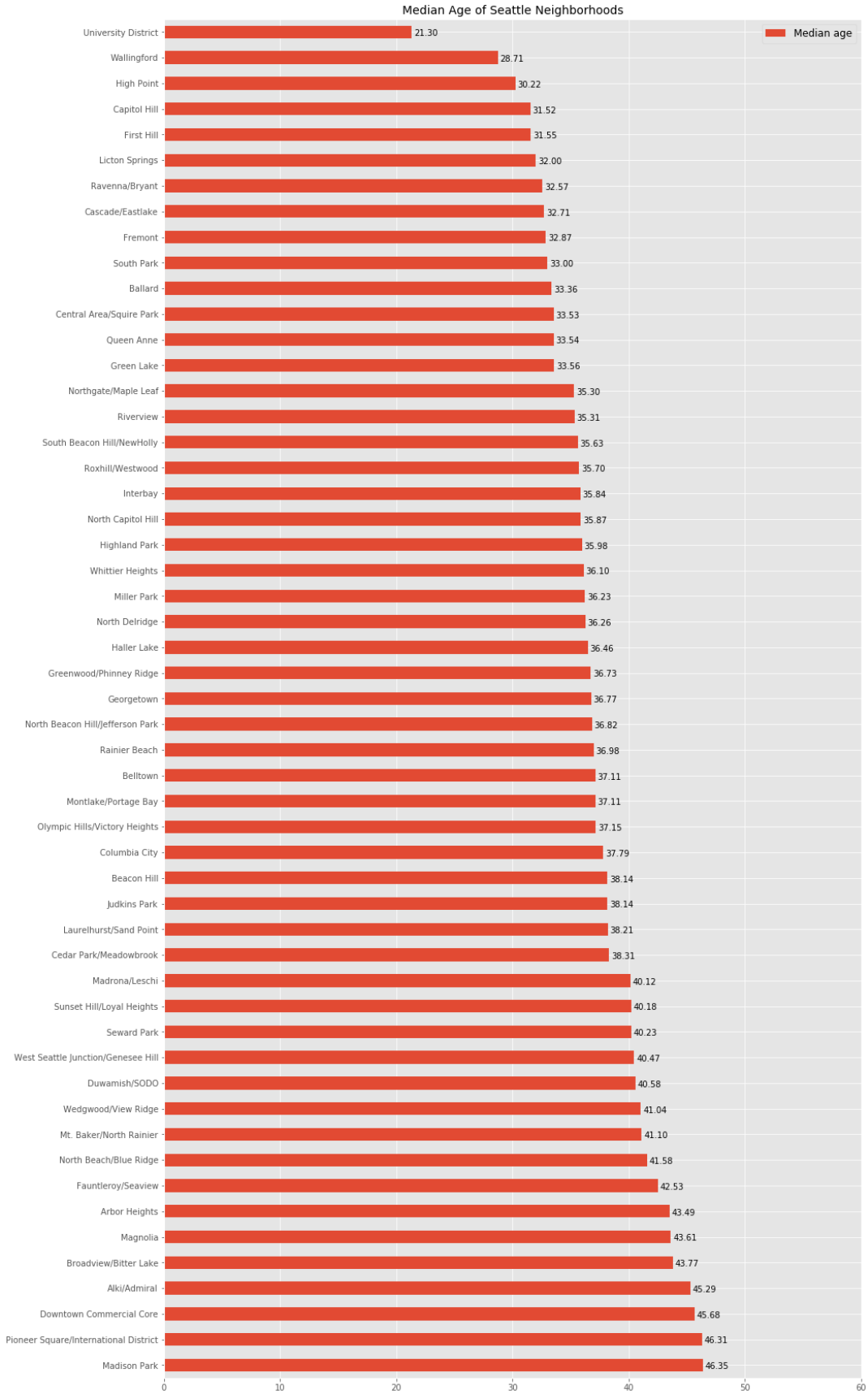
Methodology

The goal of this analysis is to find the Seattle neighborhoods where the defined target market resides judging from four criteria. In the end, neighborhoods that meet at least three of these criteria if not all four can be recommended to a new business. However, as I have discussed in the previous sections, the datasets used for each criteria are from different sources and the neighborhood boundaries are drawn differently by various city agencies. In addition, I could not find a dataset that includes all the neighborhoods with corresponding zip codes. Luckily, I found geojson files for Seattle zip code and MCPP, so I utilize bar charts and the Python Folium module to visualize the four datasets so that the equivalent neighborhood areas can be compared.

Data Visualization

1. Median Age

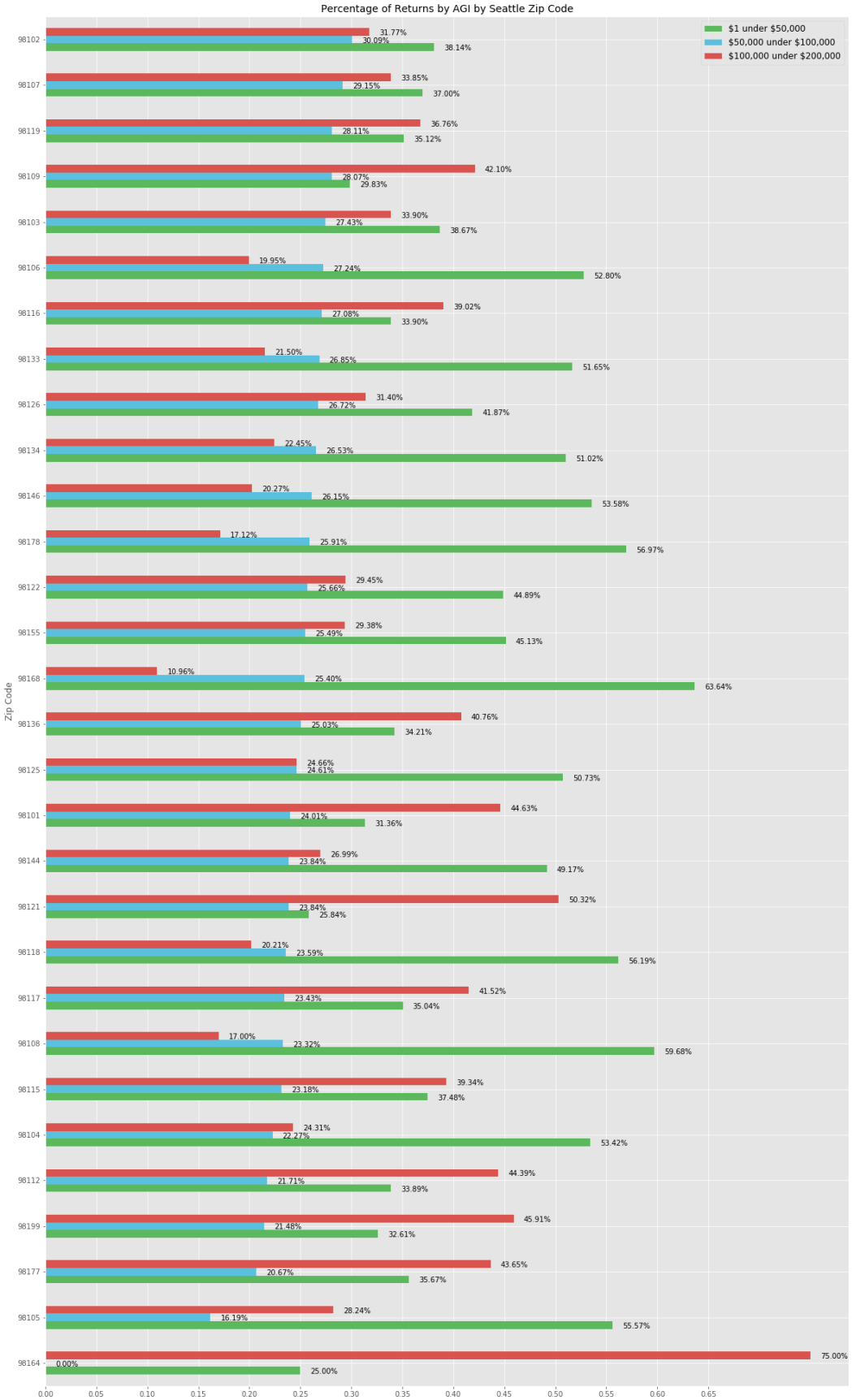
The bar chart below shows the median age for each CRA in ascending order. The University District is the youngest neighborhood with a median age of 21.3 since most of its residents are students at the University of Washington. The chart also shows Seattle neighborhoods can be divided into 4 groups: median age under 30, median age between 30 and 34, median age between 35 and 40, and median age above 40. The new bakery's target market are young individuals and families under the age of 35, so I will focus on the neighborhoods within the first two groups.

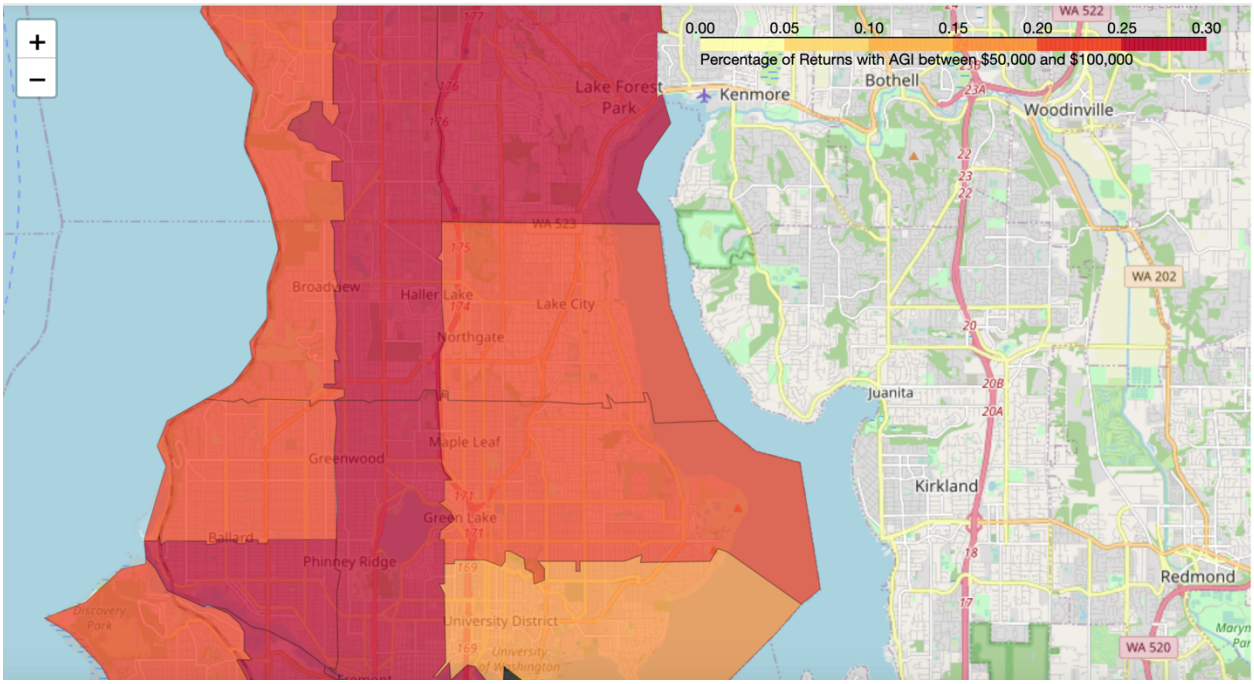

Median Age of Seattle Neighborhoods
Median age
University District 21.30
Wallingford 28.71
High Point 30.22
Capitol Hill 31.52
First Hill 31.55
Licton Springs 32.00
Ravenna/Bryant 32.57
Cascade/Eastlake 32.71
Fremont 32.87
South Park 33.00
Ballard 33.36
Central Area/Squire Park 33.53
Queen Anne 33.54
Green Lake 33.56
Northgate/Maple Leaf 35.30
Riverview 35.31
South Beacon Hill/NewHolly 35.63
Roxhill/Westwood 35.70
Interbay 35.84
North Capitol Hill 35.87
Highland Park 35.98
Whittier Heights 36.10
Miller Park 36.23
North Delridge 36.26
Haller Lake 36.46
Greenwood/Phinney Ridge 36.73
Georgetown 36.77
North Beacon Hill/Jefferson Park 36.82
Rainier Beach 36.98
Belltown 37.11
Montlake/Portage Bay 37.11
Olympic Hills/Victory Heights 37.15
Columbia City 37.79
Beacon Hill 38.14
Judkins Park 38.14
Laurelhurst/Sand Point 38.21
Cedar Park/Meadowbrook 38.31
Madrona/Leschi 40.12
Sunset Hill/Loyal Heights 40.18
Seward Park 40.23
West Seattle Junction/Genesee Hill 40.47
Duwamish/SODO 40.58
Wedgwood/View Ridge 41.04
Mt. Baker/North Rainier 41.10
North Beach/Blue Ridge 41.58
Fauntleroy/Seaview 42.53
Arbor Heights 43.49
Magnolia 43.61
Broadview/Bitter Lake 43.77
Alki/Admiral 45.29
Downtown Commercial Core 45.68
Pioneer Square/International District 46.31
Madison Park 46.35
0
10
20
30
40
50
60

2. Annual Household Income

As previously discussed, I use Adjusted Gross Income (AGI) as the measurement of an individual or married couple's annual household income. For this analysis, I set the target market of the bakery as individuals and married couples with AGI between $50,000 and $100,000. In the bar chart, the percentage of returns with AGI between $50,000 and $100,000 are shown by blue colored bars and the zip codes are organized in descending order of this feature. I also included the percentage of returns in the other two AGI categories in the bar chart as well. This is to help further distinguish neighborhoods in the case of similar percentage of returns with AGI between $50,000 and $100,000. For example, zip code 98103 and 98106 have very similar percentage of returns between $50,000 and $100,000 AGI, 27.43% vs. 27.24%. However, zip code 98106 has 14.13% more returns with AGI above $100,000. Depending on the new bakery's specific target market, zip code 98106 might be more favorable.

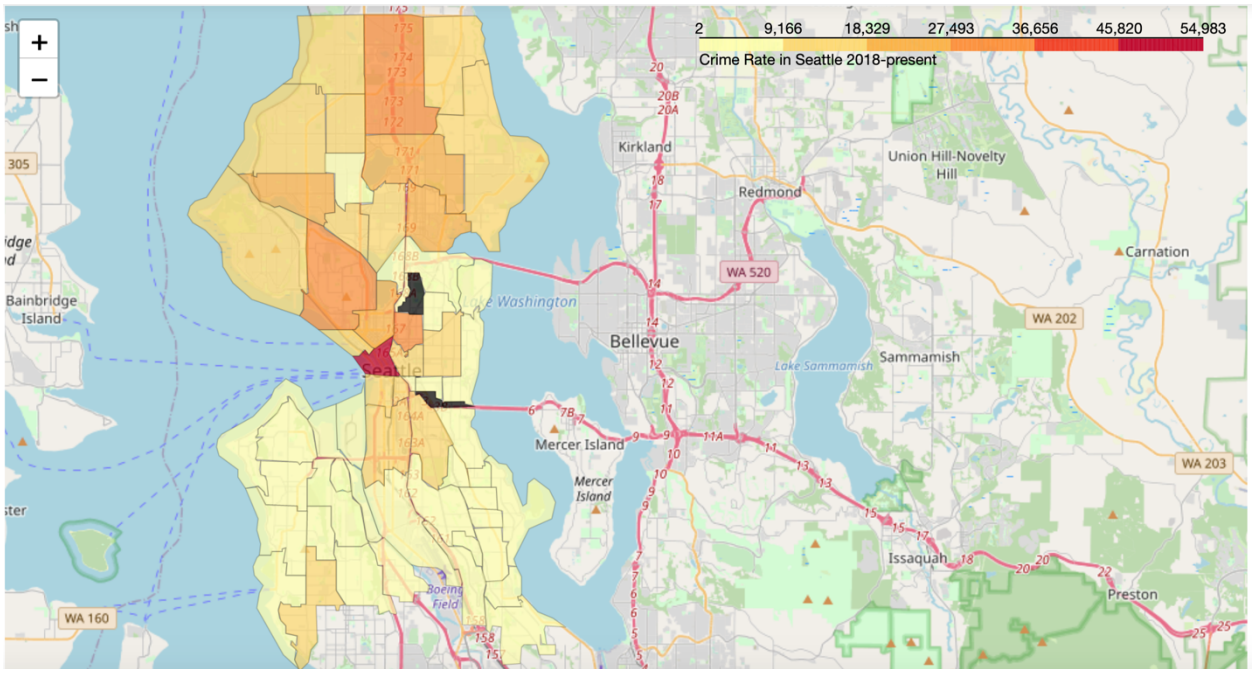
Next, the percentage of returns with AGI between $50,000 and $100,000 is visualized over an interactive Seattle map using Folium so that each zip code's data can be seen at a glance. The neighborhoods I will consider based on annual household income are Queen Anne, Fremont, Wallingford, South Ballard, West Seattle, Delridge, to name a few.


Percentage of Returns by AGI by Seattle Zip Code
$1 under $50,000
$50,000 under $100,000
$100,000 under $200,000
Zip Code
98102 31.77% 30.09% 38.14%
98107 33.85% 29.15% 37.00%
98119 36.76% 28.11% 35.12%
98109 42.10% 28.07% 29.83%
98103 33.90% 27.43% 38.67%
98106 19.95% 27.24% 52.80%
98116 39.02% 27.08% 33.90%
98133 21.50% 26.85% 51.65%
98126 31.40% 26.72% 41.87%
98134 22.45% 26.53% 51.02%
98146 20.27% 26.15% 53.58%
98178 17.12% 25.91% 56.97%
98122 29.45% 25.66% 44.89%
98155 29.38% 25.49% 45.13%
98168 10.96% 25.40% 63.64%
98136 40.76% 25.03% 34.21%
98125 24.66% 24.61% 50.73%
98101 44.63% 24.01% 31.36%
98144 26.99% 23.84% 49.17%
98121 50.32% 23.84% 25.84%
98118 20.21% 23.59% 56.19%
98117 41.52% 23.43% 35.04%
98108 17.00% 23.32% 59.68%
98115 39.34% 23.18% 37.48%
98104 24.31% 22.27% 53.42%
98112 44.39% 21.71% 33.89%
98199 45.91% 21.48% 32.61%
98177 43.65% 20.67% 35.67%
98105 28.24% 16.19% 55.57%
98164 75.00% 0.00% 25.00%
0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65



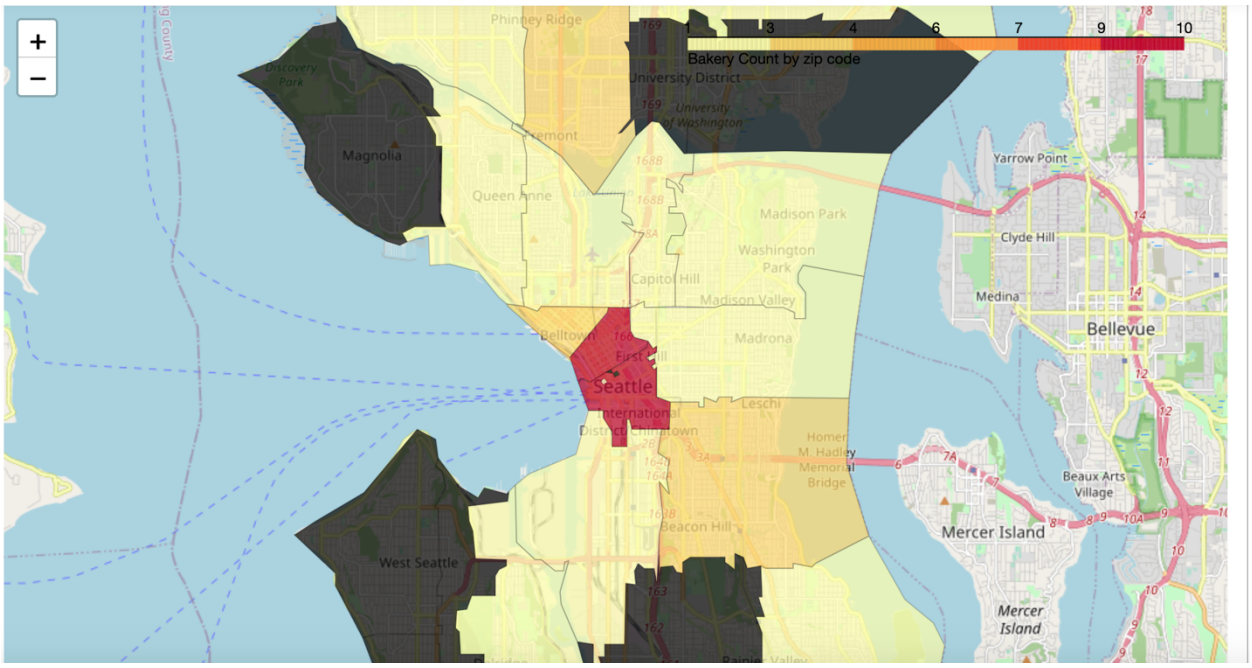
3. Crime Rate

Similarly, the number of crime offenses by MCPP is also visualized on the Seattle map for easy interpretation. The safer neighborhoods include Eastlake, Madison Park, South and North Delridge, South Beacon Hill and Alki to name a few.



5. Current Market Saturation

Last but not the least, the bakery count by zip code based on Foursquare's location data is also visualized on a Seattle map. The neighborhoods with few or no bakeries based on Foursquare data are Ballard, Magnolia, Queen Anne, University District, and Delridge.



Conclusion and future directions

After evaluating the median age, annual income (AGI), crime rate, and current market saturation of each Seattle neighborhood using Pandas dataframes, bar charts and choropleth maps, the general recommendation for a new bakery will be in Ballard, Queen Anne, Alki, Green Lake and Delridge because they meet three or more target market criteria of the bakery.

However, this conclusion is drawn based on the available data I could find on the Internet and it is just a general overview of the Seattle market. With more and better data, I would like to improve the accuracy of the analysis and further narrow down the location selection by doing the following:

- Consider the population size of each neighborhood and look at crime rate per capita and number of bakeries per capita.
- Factor in average/median rental cost of each neighborhood since it is usually the biggest cost item of a new business.
- Research on zoning and permit requirements of each neighborhood. The low market saturation in some of the neighborhoods could be caused by zoning rules. Then such limitation can be considered by the new business.
- Update the median age and AGI analysis using more recent U.S. Census and IRS data.
- Improve the data availability of current market saturation by using a different API such as Yelp.