# Investment Property in Minneapolis Neighborhood

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06/02/20

## Introduction

### DESCRIPTION & DISCUSSION OF THE BACKGROUND

Minneapolis is a city located in Hennepin County, Minnesota along the bank of the Mississippi River. It is the largest city in Minnesota with a 2020 population of 437,069, and the 45th largest city in the U.S. Also, it is the 16th largest metropolitan area in the U.S. Minneapolis is currently growing at a rate of 1.35% annually. Spanning over 58 square miles, Minneapolis has a population density of 8,094 per square mile. The 2020 census information shows that the Twin Cities area has gained another 60,000 people since 2010 where Minneapolis is leading the growth.

Minneapolis is surrounded by lakes, creeks and waterfalls, which of many connected by parkways in the chain of lakes and the grand rounds national scenic byway. Due to its ease access, the city is ranked as having the best park system in U.S., also, known to be the best bike-friendly city in the U.S. The city hosts various arts scene, performing arts venues and sports events via three stadiums. The variety of options for cuisine, fine dining and local foods are available. Minneapolis is the major financial center. It is the 3rd largest economic center in Midwest. The twin city metropolitan area has the 5th highest concentration of major corporate headquarters in the country which makes the 15th richest city in the U.S. (See Wikipedia: https://en.wikipedia.org/wiki/Minneapolis)

The fact that the Minneapolis is a home of big cooperation presents various employment opportunities in the city. Besides, its rich environment makes a desirable place to work and live. Consequently, the Minneapolis housing market is very competitive which attracts many investors to own investment property, such as a rental unit. The problem is that Minneapolis has 87 neighborhoods and is known to be the 3rd most expensive city in North America. From the investors point of view, it is desired to own a rental property with the following characteristics: Firstly, the location of the property is in a safe neighborhood where a reasonable commute to the center of the city is expected. Next, the property is priced reasonably. Lastly, it would be a plus if a neighborhood is comprised of assorted venues to accommodate various lifestyle. Many websites offer different aspects about Minneapolis neighborhoods, but it takes a long time for investors to review, analyze and summarize them. Therefore, this research is an attempt to solve a problem for investors to identify the best Minneapolis neighborhood to own a rental property. The Foursquare location data is utilized to

examine the proximity to the center of the city and the venues of each neighborhood in Minneapolis in conjunction with crime data and home price data obtained from Open Minneapolis and Zillow, respectively.

## Data

Four different data sources are used in this study.

1. The data containing name and geographical coordinates of Minneapolis neighborhoods is retrieved from Open Minneapolis site: https://opendata.arcgis.com/datasets/055ca54e5fcc47329f081c9ef51d038e_0.geojson
2. The crime data per Minneapolis neighborhood in 2018 is retrieved from Open Minneapolis site: http://opendata.minneapolismn.gov/datasets/police-incidents-2018-pims/data
3. The median home price in Minneapolis data in 2020 is obtained from Zillow site: https://www.zillow.com/minneapolis-mn/home-values/
4. Foursquare location data of Minneapolis is retrieved from the site: https://foursquare.com/developers/apps

The official name and geographical location of neighborhoods are obtained via Open Minneapolis site. The official names of 87 Minneapolis neighborhoods in this file are used to combine the data.

In order to measure the safety of neighborhoods, the crime data is retrieved from Open Minneapolis site. The year 2018 version is the most current data. The crime data is cleaned to include only the necessary information, i.e., description of the offense, longitude, latitude, and the name of the neighborhoods. During the data inspection, it is found that one neighborhood name in crime data still contains its formal name, CARAG, so it is updated. 11,604 reported incidents across 33 different crime types are observed across Minneapolis neighborhoods in 2018. It is found that three cases have a missing neighborhood name. Since a missing neighborhood name cannot be identified, these three cases are dropped from further analysis. Therefore, 11,601 incidents across 33 different crime types are included in the study.

The median home price data in 2020 is retrieved from Zillow site to understand the housing market across Minneapolis neighborhoods. The home price of all types is used in this study. In Zillow data, some mismatches of neighborhood names are noticed. Most of them are due to typo. The data is cleaned to match the official Minneapolis neighborhood names. It is noted that three industrial areas in the city, i.e., Mid-City Industrial, Camden Industrial and Humboldt Industrial Area, do not have any home price information which is expected. These areas are excluded from home price analysis.

The cleaned data includes 11,601 total number of incidents dealing with 33 different crime types across 87 Minneapolis neighborhoods and the home prices across 84 Minneapolis neighborhoods. Next, the cleaned data is combined with Foursquare location data to find the

available venues across 87 Minneapolis neighborhoods. It is found that there are 250 different venue categories, which imply that the city offers diverse venues. Many venues are shown less than ten times across neighborhoods. Since the data seems to be too sparse and some of the similar venues are presented with various names, i.e., Café and Coffee Shop, it is decided to combine features that are similar and to choose them based on the frequency of the popular venues. Subsequently, 29 features are selected. Among them, 11 features are from Foursquare location data as is. They are bookstore, brewery, cosmetics, food truck, salon, spa, video store, hotel, home store, home price and number of crimes. 18 features are combined based on the similarity of the venues. The features with combined venues are listed in Table 1 with the inclusion criteria.

Table 1. Features with combined venues

| Features | Features with combined venues: Inclusion criteria |
|---|---|
| art | Art Gallery, Art Museum |
| bakery | Bakery, Bagel, Donut, Pastry shops |
| deli | Deli, Sandwich place |
| shopping | Clothing, Boutique, Shopping Mall, Dept Store, Discount Store, Toy Store, Optical Store, Shoe Store |
| coffee | Coffee, Café, Tea, Juice |
| fastfood | Fast Food Restaurant, Fried Chicken Joint |
| grocery | Grocery Store, Health Food, Supermarket, Gourmet, Convenience Store, Farmers Market |
| gym | Gym, Fitness Center, Sports Club, Dance, Pilates and Yoga Studios |
| icecream | Ice Cream, Dessert shop, Frozen Yogurt shop |
| music | Concert Hall, Opera House, Rock Club, Music Venue |
| park | Park, Garden, Outdoors & Recreation, Sculpture Garden, Trail, Playground, Lake, Scenic Lookout, Historic Site |
| transit | Bus, Rail, Train |
| theater | Performing Arts Venue, Theater, Comedy Club |
| restaurant | All types of Restaurants |
| arena | Baseball, Football, Soccer Fields, Stadiums, Hokey Arena |
| bar | All types of Bars |
| alcohol | Beer, Wine, Liquor store |
| pet | Pet Store, Dog Run |

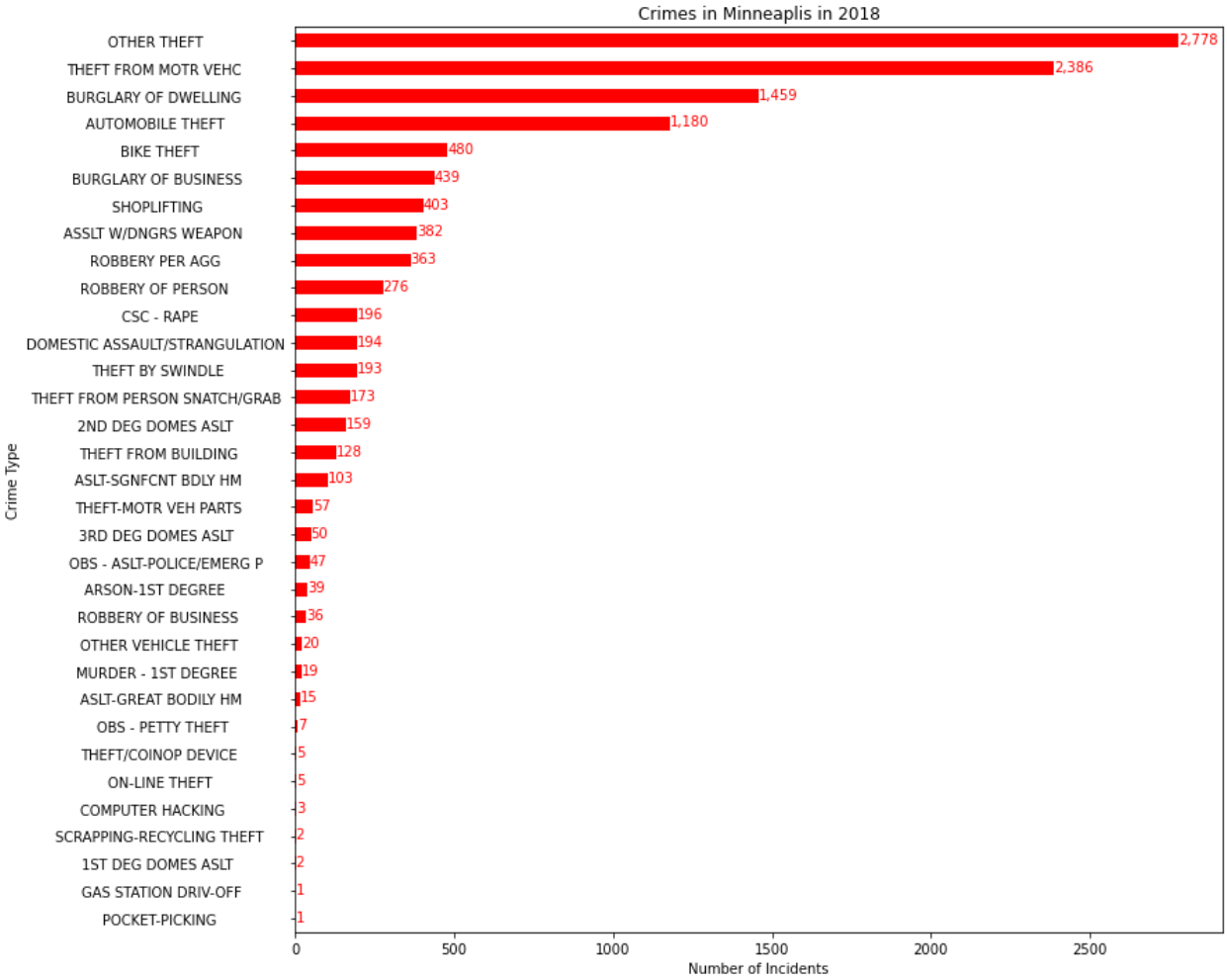
The cleaned data consists of 29 features across 87 Minneapolis neighborhoods.

# Method

### Exploratory data analysis

The reported 11,601 different crimes across 87 Minneapolis neighborhoods are explored by observing the frequency distribution of the 33 different types of various incidents and the frequency of the incidents by neighborhoods (See Figure 1).

Figure 1. Crimes in Minneapolis 2018




Based on the 33 different types of crime frequency distribution in Figure 1, the most frequent crime is other theft, N=2,778. The least frequent crimes are both gas station drive off and pocket picking with N=1, respectively. Most crimes seem to deal with various types of theft, burglary and robbery.

In Figure 2, the incident frequency across Minneapolis neighborhoods is shown. The incidents are most frequently reported in Downtown West neighborhood with N=1,183 and least frequently in the Humboldt industrial area with N=2. Based on the crime frequency, top five relatively unsafe neighborhoods in Minneapolis are Downtown West, Whittier, Marcy Holmes, Lowry Hill East, and Longfellow. It is important to note that the incident reports in Downtown West are far worse than any other Minneapolis neighborhoods. The frequency of incident reports are over two times more than that of the second unsafe neighborhood, Whittier, in the list. About half of the Minneapolis neighborhoods have the reported incidents above 100. 18 out of 87 neighborhoods (20%) have the reported incidents less than 50.

Figure 2. Crime frequency across Minneapolis neighborhood in 2018

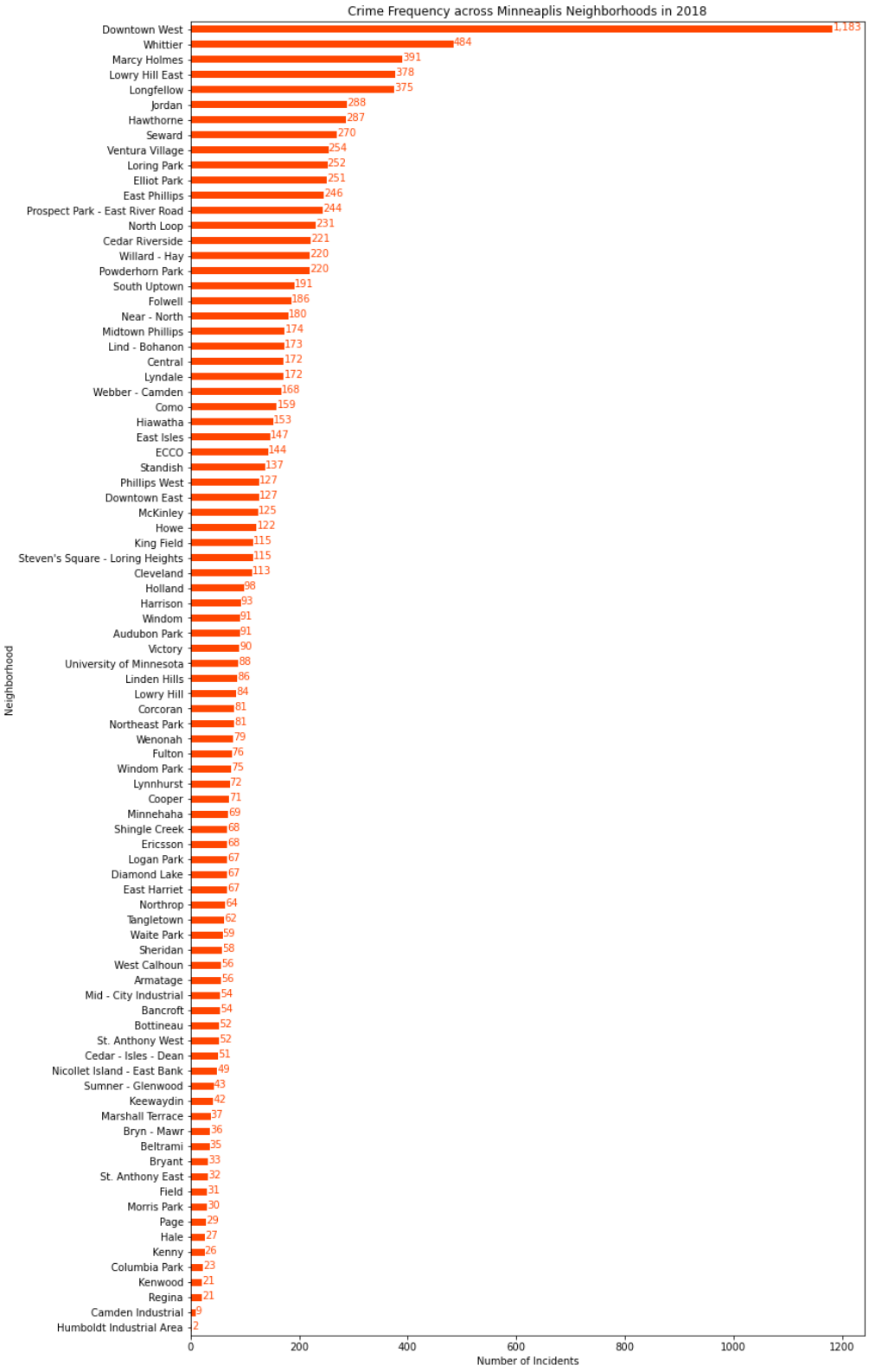
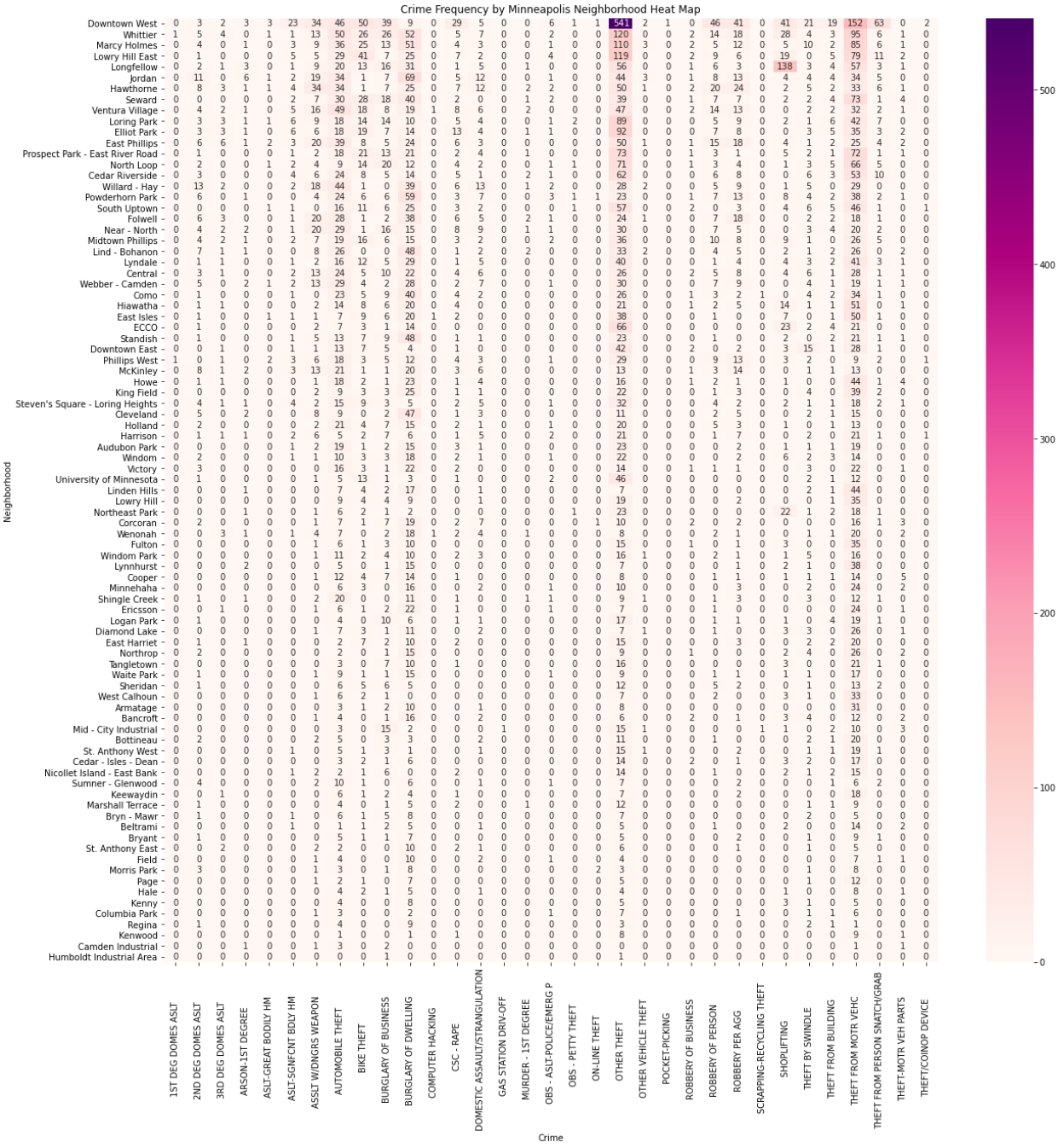


Figure 3. Heat Map: crime frequency by Minneapolis neighborhoods




The heat map in Figure 3 shows that the most frequent crime in Downtown West neighborhood is other theft with N=541 followed by theft from motor vehicle with N=152. The same trend is observed at the first four unsafe neighborhood. The Longfellow neighborhood seems to have shoplifting as the most frequent crime which implies a shopping area. Across Minneapolis neighborhoods, ten frequent crimes observed are theft from motor vehicle, other theft, burglary of dwelling, burglary of business, bike theft, automobile theft, assault with dangerous weapon, robbery of person, robbery per aggression, and shoplifting.

The Minneapolis neighborhoods' geographical information is used to create two maps, i.e., a distribution of the number of crimes by location and another magnitude of crimes per neighborhood.

Figure 4. Crimes by location

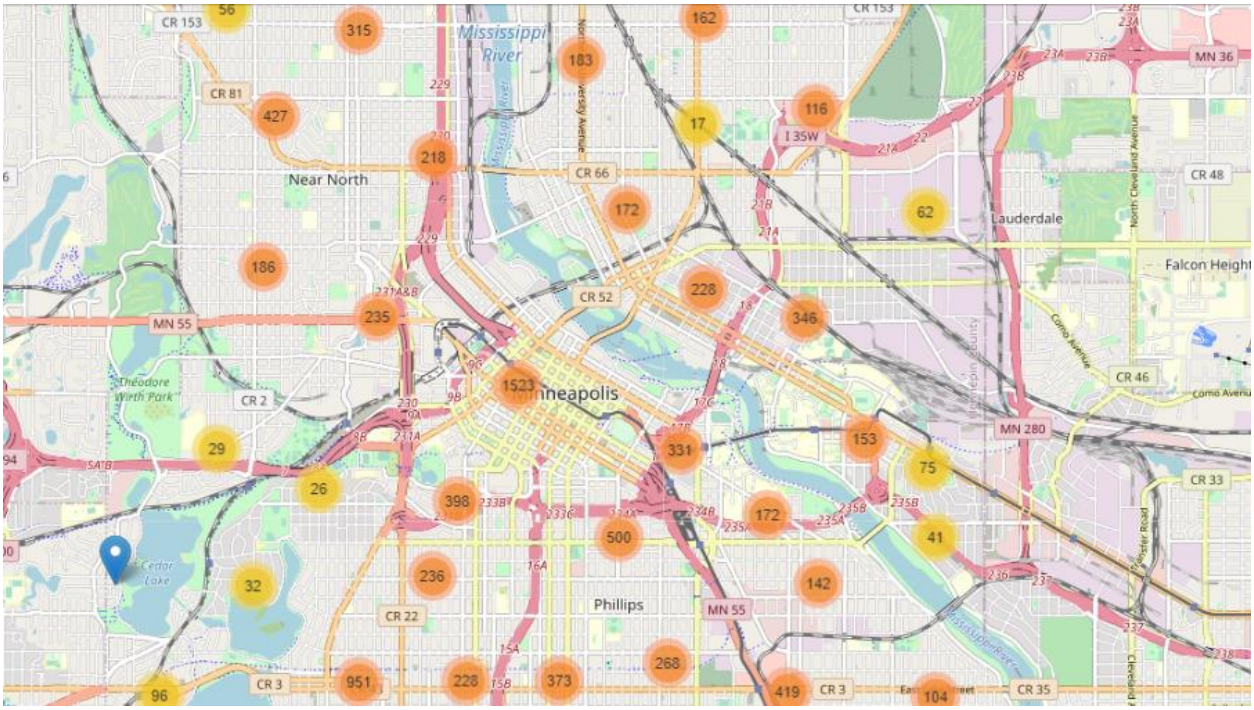
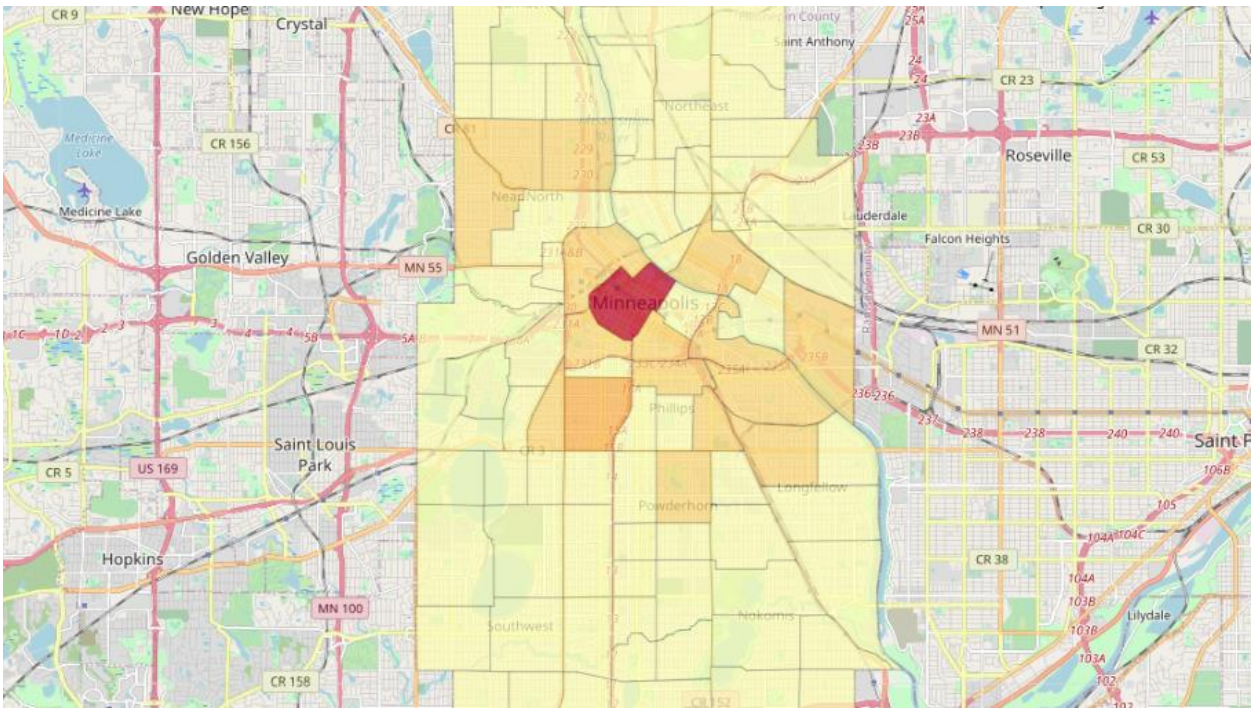



Figure 5. Magnitude of crimes per neighborhood



In Figure 4, the distribution of the number of crimes by location is depicted. The number of crimes seem to be high at the downtown Minneapolis and its adjacent vicinity. In Figure 5, the magnitude of number of crimes at the neighborhood level is shown with the intensity of color spectrum from yellow to red, where yellow represents low number of crimes, i.e. less than 200, and red represents high number of crimes, i.e. more than 986 up to 1,183. The choropleth map shows that Downtown West neighborhood in downtown Minneapolis has the highest number of crimes. One neighborhood located in the south of downtown Minneapolis (orange color on the map), Whittier, shows the second highest number of crimes, around 500. Additional 15 neighborhoods in vicinity of downtown Minneapolis have the number of crimes ranging from 200 to 400. The rest of the Minneapolis neighborhoods seem to have the number of crimes less than 199. It is about 80% (87-17=70) of neighborhoods in Minneapolis.

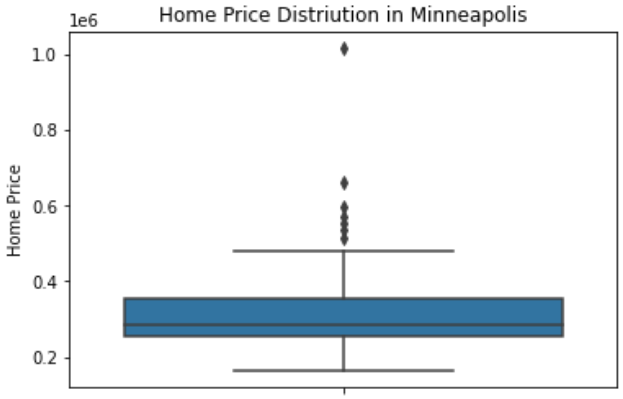
The average home price in 84 Minneapolis neighborhoods is $318,000 (See Table 2). The median home price is $283,000. The home prices in Minneapolis range from $162,000 to over $1 Million. 75% of the homes are less than $353,000.

Table 2. Descriptive statistics on the home price

| Statistics | Home Price |
|---|---|
| Mean | $318,010 |
| Std | $128,357 |
| Min | $162,000 |
| 25% | $253,275 |
| 50% | $283,350 |
| 75% | $352,975 |
| Max | $1,017,600 |

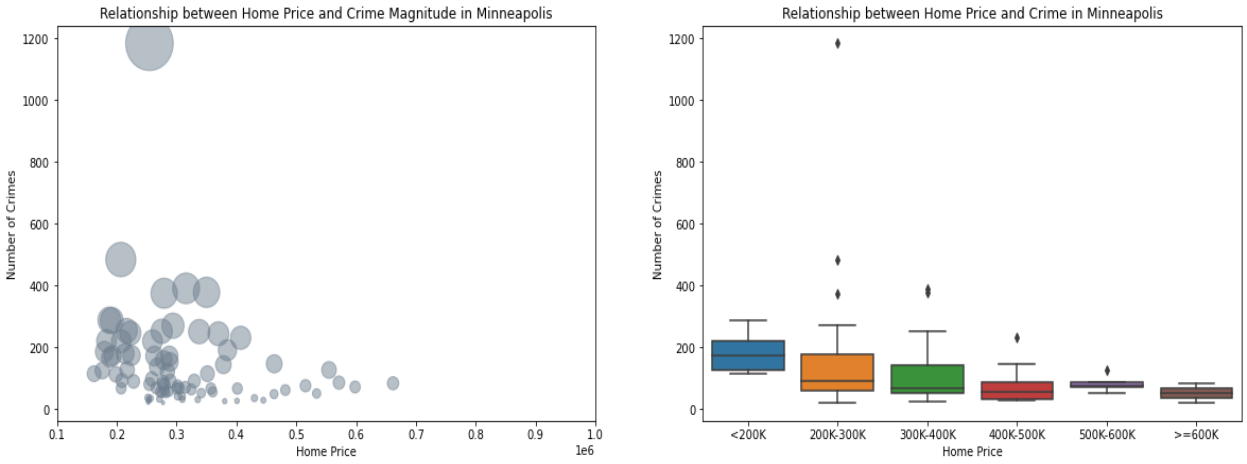
Figure 6 shows that the home price above $500,000 seems to be outliers in Minneapolis neighborhoods.

Figure 6. Home price distribution in Minneapolis



The obtained Pearson correlation coefficient between home price and number of crimes is -.219 with associated p-value of 0.045 (at alpha <.05 level) which indicates a significant negative linear relationship. It means that the neighborhood with a high median home price has less frequent number of crimes. The trend can be visually inspected by the bubble plot and box plot (See Figure 7), and regression plot (See Figure 8).

Figure 7. Bubble plot and Box plot: number of crimes vs home price



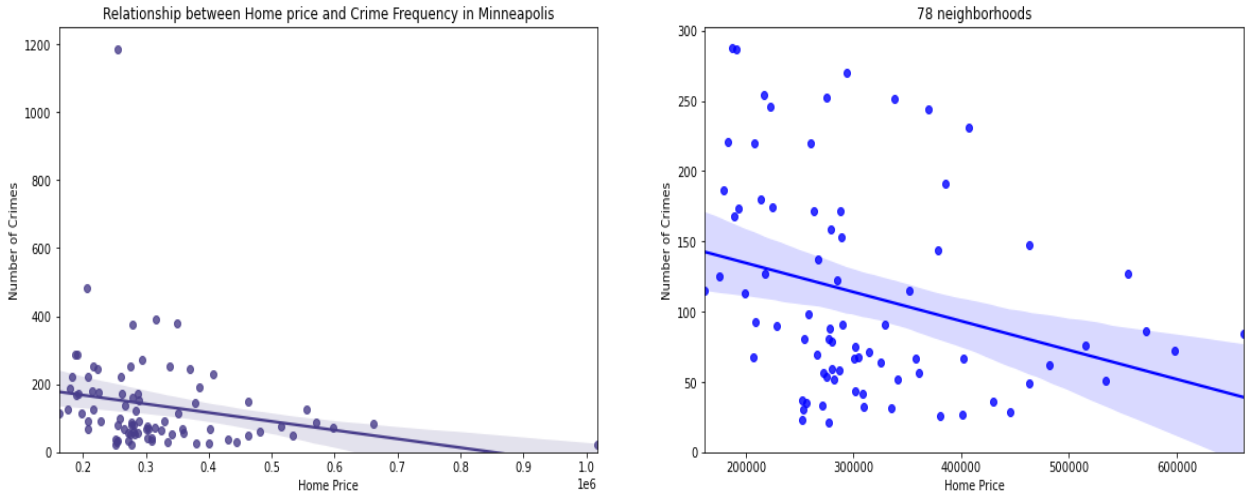

The neighborhoods are grouped by home price into six groups, i.e. less than 200K, 200K-300K, 300K-400K, 400K-500K, 500K-600K and above 600K. The grouped neighborhoods are used in the box plot. Based on bubble plot and box plot, the crime incidents are frequently observed in the neighborhoods with home price less than $300K. The highest median number of crimes seem to be close to 200 for the neighborhoods with home price below $200K, where the number of crimes range from about 150 to 300. The neighborhoods in this group has the highest interquartile range of number of crimes compared with other neighborhoods. It is followed by the neighborhoods with home price between $200K to $300K where reported median number of crimes are around 100. However, the neighborhoods in this group include three neighborhoods with unusually high number of crimes, around 1200, 500 and 380, respectively. The median number of crimes seems to be around 100 for home price between $300K to $400K neighborhoods. However, it also includes a couple of high crime area with number of crimes around 400. The median number of crimes is somewhat similar across the neighborhoods with home price above $400K, which is below 100. The interquartile range of number of crimes is the tightest in the neighborhoods with home price between $500K and $600K. The lowest median number of crimes is observed to the neighborhoods with home price above $600K dollars. The range of the number of crimes seems to be within 100 incidents. Overall, the number of crimes seems to reduce as the home price goes up in Minneapolis neighborhoods. In general, Minneapolis neighborhoods with home price higher than $400K seem to be relatively safe.

The simple regression analysis in Figure 8 (left) shows that there is a negative relationship between number of crimes and home price which is consistent with Pearson correlation coefficent value above. Downtown West with number of crimes, N=1,183, seems to be an outlier. Also, Kenwood neighborhood with the home price over $1 million seem to be an outlier.

In sum, top five unsafe neighborhoods are excluded from further analysis because they are undesirable areas to own a rental property. Three city industrial areas are excluded because they do not have any house for sale. Finally, Kenwood neighborhood is excluded because its high home price is unfavorable for investors. That results in excluding nine neighborhoods in total. Thus, 78 neighbors are included in the further analysis.

After dropping those neighborhoods, the obtained Pearson correlation coefficient between home price and number of crimes is -.294 with associated p-value < 0.01 at alpha <.05 level which indicates a significant negative linear relationship that is a bit stronger than the previous value. The regression plot without those neighbors are depicted in Figure 8 (right).

Figure 8. Relationship between home price and crime frequency in Minneapolis (84 neighborhoods vs 78 neighborhoods)



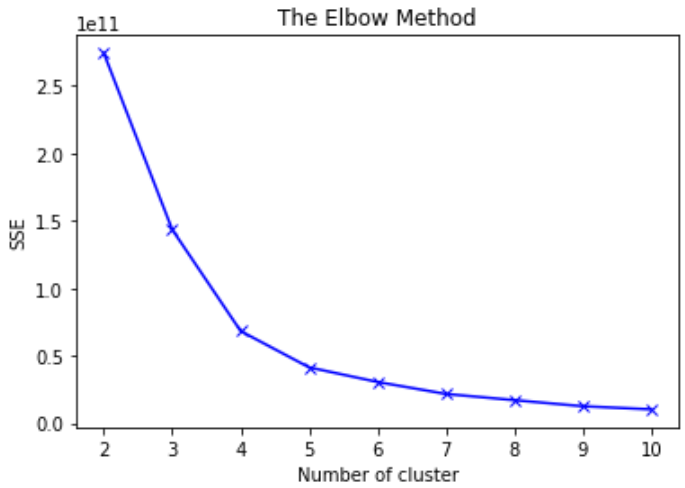

At the exploratory analysis phase, the data is further reduced, and the final data consists of 29 features across 78 neighborhoods.

## K-Means

The decision is made to use the K-means for neighborhood segmentation in this study to discover insights from unlabeled data, i.e. Minneapolis neighborhoods. The crime and home price data along with the Foursquare neighborhood data are used for neighborhood segmentation. As mentioned, the final data is used in K-Means.

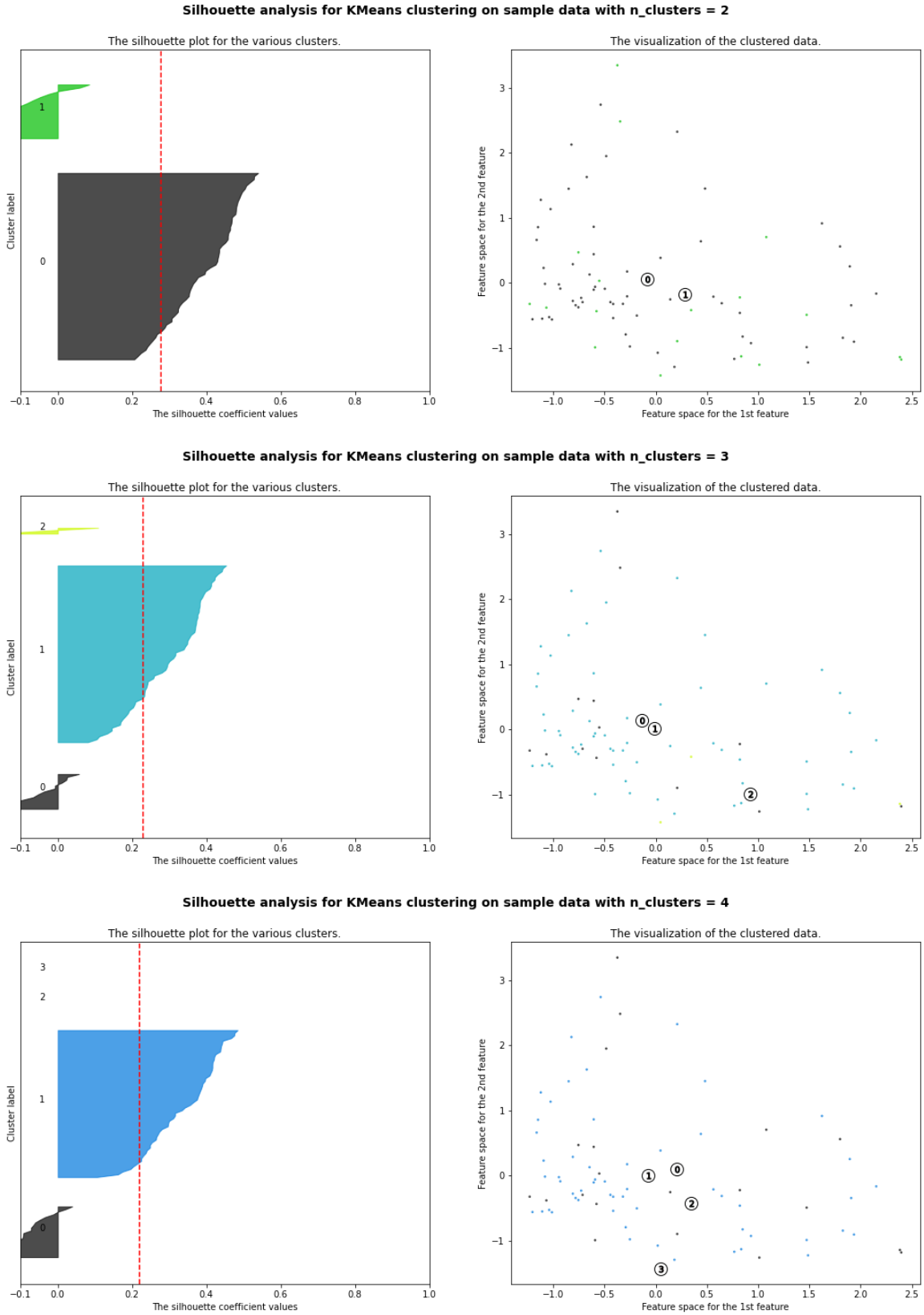
In order to find the optimal number of clusters, two methods are used, i.e., the Elbow method, and Silhouette analysis. The Elbow method is to help select the optimal number of clusters by fitting the model with a range of values for K. It is a judgmental call to determine the elbow of the curve, which indicates the best fit of the underlying model at that point. Silhouette analysis shows the separation distance between the resulting clusters. The silhouette plot displays a measure of how close each point in one cluster is to points in the neighboring clusters and thus provides a way to assess parameters like number of clusters visually. The Silhouette coefficient value ranges from -1 to 1. The value near 1 indicates that the sample is far away from the neighboring clusters. A value of 0 indicates that the sample is on or very close to the decision boundary between two neighboring clusters and negative values indicate that those samples might have been assigned to the wrong cluster.

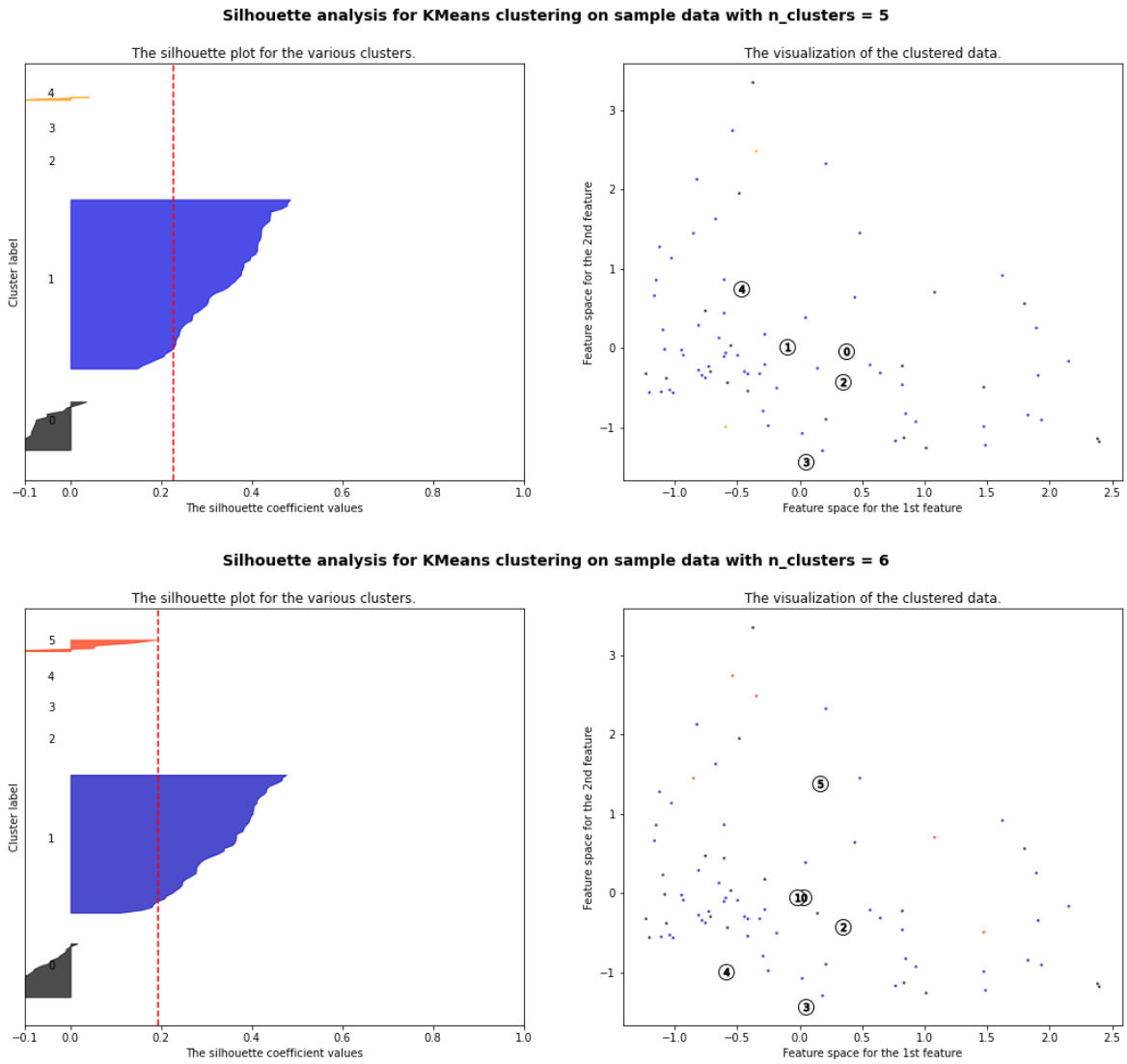
Figure 9. The Elbow method




Based on the visual inspection in Figure 9, the optional K based on the Elbow method seems to suggest K=3. N clusters ranging from 2 to 6 are used in Silhouette method. The obtained average Silhouette scores are, .28, ,23,.22, .23 and .19, respectively. According to the Silhouette method, K=2 clusters seems to be the best fit for the underlying model with the average Silhouette score of .28 (See Figure 10).

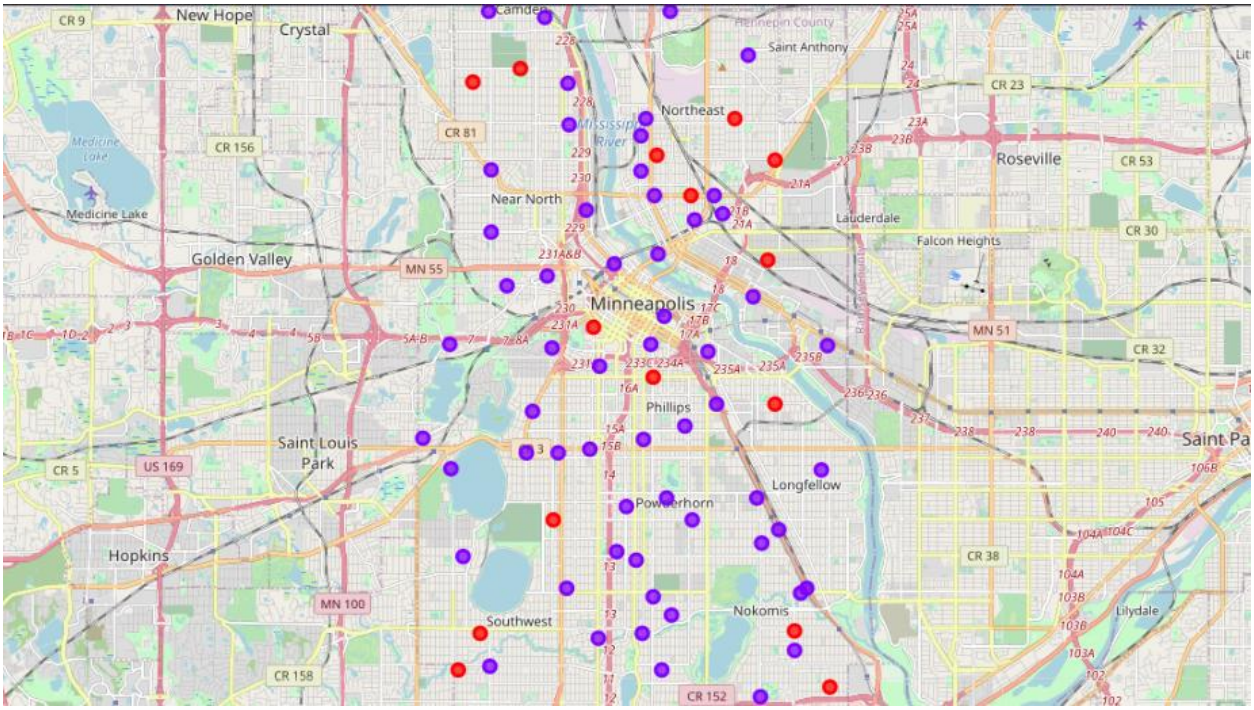
Figure 10. Silhouette analysis






The K-Means clustering is performed using K=2. The neighborhoods are divided into two groups of 59 and 19, respectively. After the clustering labels are applied to the data, two clustered neighborhoods are illustrated in Figure 11.

Figure 11. Two clusters of Minneapolis neighborhoods




## Results

### VENUES IN TWO CLUSTERS: A & B

Each cluster is examined and determined the discriminating venue categories that distinguish each cluster using the top ten common venues retrieved from Foursquare API. For convenience, two clustered areas are called as A and B areas. The frequency of common venues per area show that A (N=15) and B (N=63) areas share several common venues, such as restaurants, coffee shops, grocery stores, park, and yoga studios. Compared to area A, area B seems to present more restaurant options including fast food, pizza and food truck, which are desirable for a rental property.

### POTENTIAL NEIGHBORHOODS FOR A RENTAL PROPERTY

The distance from the center of the Minneapolis to each neighborhood is computed using its latitude and longitude to find out the proximity of every neighborhoods. First, the neighborhoods are sorted by the distance from the center of the city. Then, potential neighborhoods for a rental property are selected based on two criteria: distance from the center of the city <= 1.5 miles and number of the crimes <=50.

Table 3. Potential neighborhoods for rental property

| Neighborhood | Home Price | No of Crime | Distance from Downtown (in miles) |
|---|---|---|---|
| Nicollet Island - East Bank | $462,900 | 49 | 0.72 |
| St. Anthony East | $309,600 | 32 | 1.35 |
| Sumner - Glenwood | $302,000 | 43 | 1.37 |

The results show that there is no neighborhood in area A that meets the criteria but three in area B, namely, St. Anthony East, Sumner-Glenwood and Nicollet Island-East Bank (See Table 3). Among them, Nicollet Island-East Bank neighborhood is the closest from the downtown (less than 1 mile). However, the home price in Nicollet Island-East Bank neighborhood, $462,900, is higher than the other two, so it is eliminated from the potential neighborhoods for a rental property.

The surrounding neighborhoods around these two neighborhoods are further examined to determine whether these areas are safe in general. The distances are computed using the latitudes and longitudes of two neighborhoods, St. Anthony East and Sumner-Glenwood, respectively, to identify the adjacent neighborhoods.

Table 4. Adjacent neighborhoods: St. Anthony East vs Sumner-Glenwood

| | St. Anthony East | | Sumner - Glenwood | |
|---|---|---|---|---|
| Statistics | Number of Crime | Distance (in miles) | Number of Crime | Distance (in miles) |
| N | 5 | 5 | 5 | 5 |
| mean | 57 | 0.50 | 176 | 0.89 |
| std | 18 | 0.16 | 81 | 0.18 |
| min | 35 | 0.34 | 84 | 0.57 |
| 25% | 49 | 0.40 | 93 | 0.94 |
| 50% | 52 | 0.42 | 220 | 0.95 |
| 75% | 67 | 0.66 | 231 | 0.98 |
| max | 81 | 0.69 | 252 | 0.99 |

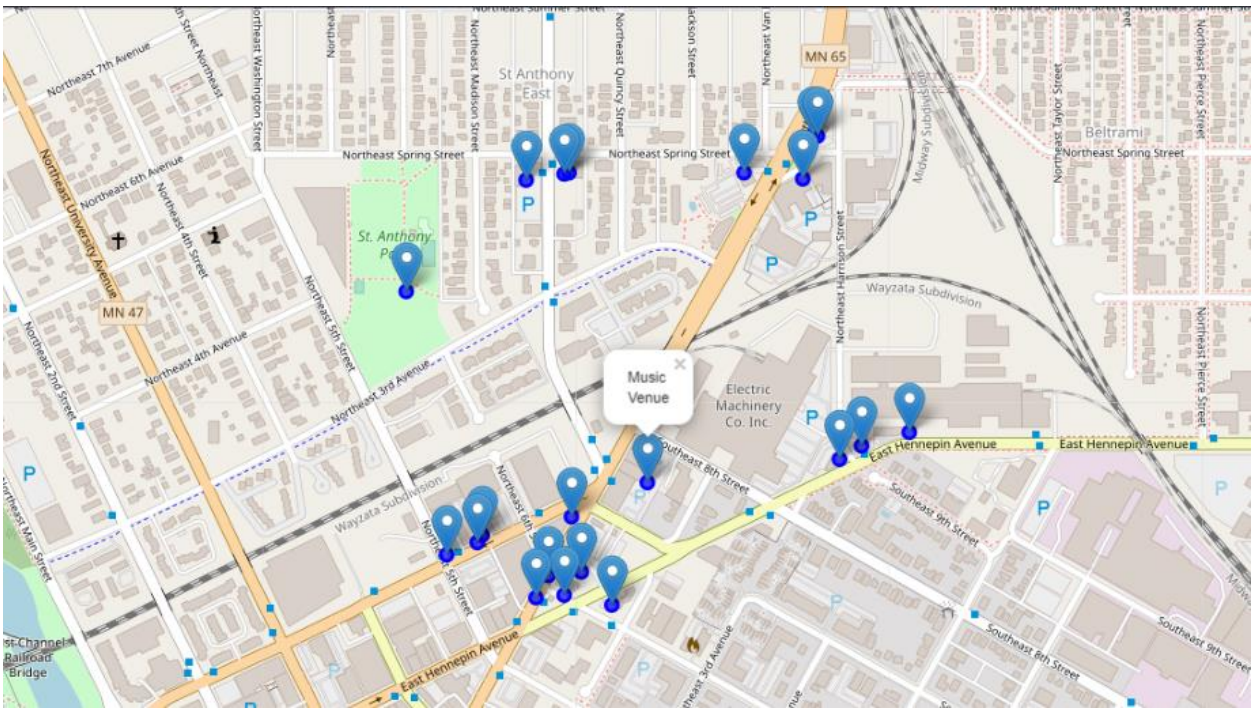
Within 1-mile distance from St. Anthony East, there are 5 adjacent neighborhoods. The number of crimes ranges from 35 to 81 where the median crime frequency is 52. It is concluded that the whole neighborhoods are safe. Within 1-mile distance from Sumner - Glenwood, there are 5 adjacent neighborhoods. The number of crimes ranges from 84 to 252 where the median crime frequency is 220. This neighborhood is not as safe as St. Anthony East neighborhood (See Table 4). Therefore, the best neighborhood to own a rental property in Minneapolis neighborhood is St. Anthony East neighborhood.

# Discussion

## ST. ANTHONY EAST NEIGHBORHOOD

According to Foursquare location data, St. Anthony East neighborhood contains 21 different venues. As seen in Figure 12, many of venues are close each other. The neighborhood offers seven different restaurants including one fast food restaurant, 3 bars, 2 music venues, 2 karaoke bars, a donut shop, a butcher, a park and a skate park. It is surprising to find that the neighborhood has low crime rates even though it has 3 bars and 2 music venues. However, the neighborhood seems to be suited for a young adult or visitors rather than a family.

Figure 12. St. Anthony East neighborhood venues




The overall ratings of the restaurants in St. Anthony East neighborhood are reviewed via Foursquare API. The ratings are 8.8 for Brasa Premium Rotisserie, 6.9 for Beast Barbecue, 6.7 for Domo Gastro, 8.8 for Lu's sandwich, 8.4 for Red Stag Supper club, and 7.8 for Glam Doll Donuts. This area offers two good breakfast options as well as nice restaurants with high ratings. It concludes that it is a nice place to be.

As a final point, it is recommended to own a rental property in St. Anthony East neighborhood which is away from bars, music venues, train, roads, commercial properties and electric machinery due to noise and traffic (see Figure 12). If possible, it would be best that a rental property can be located in a residential area.

## Conclusion

This study is an attempt to identify the best neighborhood in Minneapolis to own a rental property among 87 neighborhoods. The safety measure via crime rates, home price in each neighborhood, and proximity to the downtown are the main characteristics to pinpoint the best neighborhood to invest, namely, St. Anthony East neighborhood. St. Anthony East neighborhood is close to downtown (about 1.35 miles from downtown). The home price in this neighborhood is around $300K which is the lower end of the price point in Minneapolis. It is one of the safest neighborhoods in Minneapolis. In addition, it offers various venues to accommodate the different lifestyle. Indeed, it is nice place to live. It is the best Minneapolis neighborhood for investors to own a rental property.

It is noted that the neighborhood clustering results via K-Means clustering are rather ambiguous. It is hard to uncover what are the deciding factors for two clustered areas. It is possible that the Minneapolis neighborhoods are very similar indeed so it may be difficult to sort it out. It is suggested that the future study can be done including more data, such as ethnicity, gender, employment status, and school performance, to distinguish the neighborhoods better.