Entertainment and Safety in Denver Neighborhoods
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April 19, 2021

1 Introduction

1.1 Background

Denver, Colorado is one of the most vibrant and active cities in America. As we move further into the 21st century, it has become clear that regardless of who you are in America, encounters with law enforcement rarely add value to a person's life or day.

1.2 Problem

When it comes to finding entertainment or places to eat, an informative link missing in resources like Yelp, Google and Facebook is the likelihood of having an encounter with law enforcement. These resources do not take into account disruptions related to crime and police. In most cases even if your meal was amazing and your hotel was great, a brief encounter with law enforcement can kill the "*vibe".* Therefore, it is advantageous for citizens or businesses to avoid police in general to ensure a satisfying experience.

Data that might contribute to addressing this problem includes: the variety of options in a particular neighborhood, how many police encounters took place in the neighborhood, what types of venues are in a neighborhood, and how many "safe" neighborhoods are nearby.

1.3 Interest

This analysis will be valuable for many people: minorities are in need of spaces that statistically show there is freedom to enjoy entertainment, many parents would prefer to reduce the chance their children witness crime or police in action, and business people seek to control the environment in which they conduct business.

2 Data acquisition and cleaning

2.1 Data sources

Most crime data for Denver neighborhoods were found in a CSV data set on the city of Denver's website (denvergov.org). A list of neighborhoods in Denver were found on Wikipedia and venue data was found via the FOURSQUARE API.

2.2 Data

Based on definition of our problem, factors that will influence our decisions are:

- number of entertainment venues in the neighborhood
- location of neighborhood
- number of police responses in neighborhood

We decided to use known neighborhood locations to define our neighborhoods.

The Following data sources will be needed to extract/generate the required information:

- neighborhood names will be obtained from **wiki**
- number of venues and their type and location in every neighborhood will be obtained using **Foursquare API**
- Police data from **denvergov.org** will be transformed into a dataframe containing type of activity, and location

2.3 Neighborhood Candidates

- We obtained neighborhood names from **wikipedia** and cleaned it
- We then used geolocator to obtain locations of those neighborhoods

	NBHD_NAME	NEIGHBORHOOD	locationss	latitude	Longitude	city_coord
49	Union Station	Union Station, Denver, Co	(Union Station, 1701, Wynkoop Street, 16th Str...	39.753630	-105.000748	(39.75363, -105.0007481)
64	Windsor	Windsor, Denver, Co	(The Windsor, 1777, Larimer Street, Central Bu...	39.750865	-104.995794	(39.75086545, -104.99579430063064)
33	Overland	Overland, Denver, Co	(Overland Lake, Denver, Denver County, Colorad...	39.690508	-104.995185	(39.6905077, -104.99518474141124)

2.4 **Crime data**

- We used **Web Scraping** to obtain crime data from **denvergov.org**
- We used **pandas** to group frequency of **Police Encounters** by neighborhood

Note: The number of police encounters is designated by the term, “offense_code” in some Visualizations.

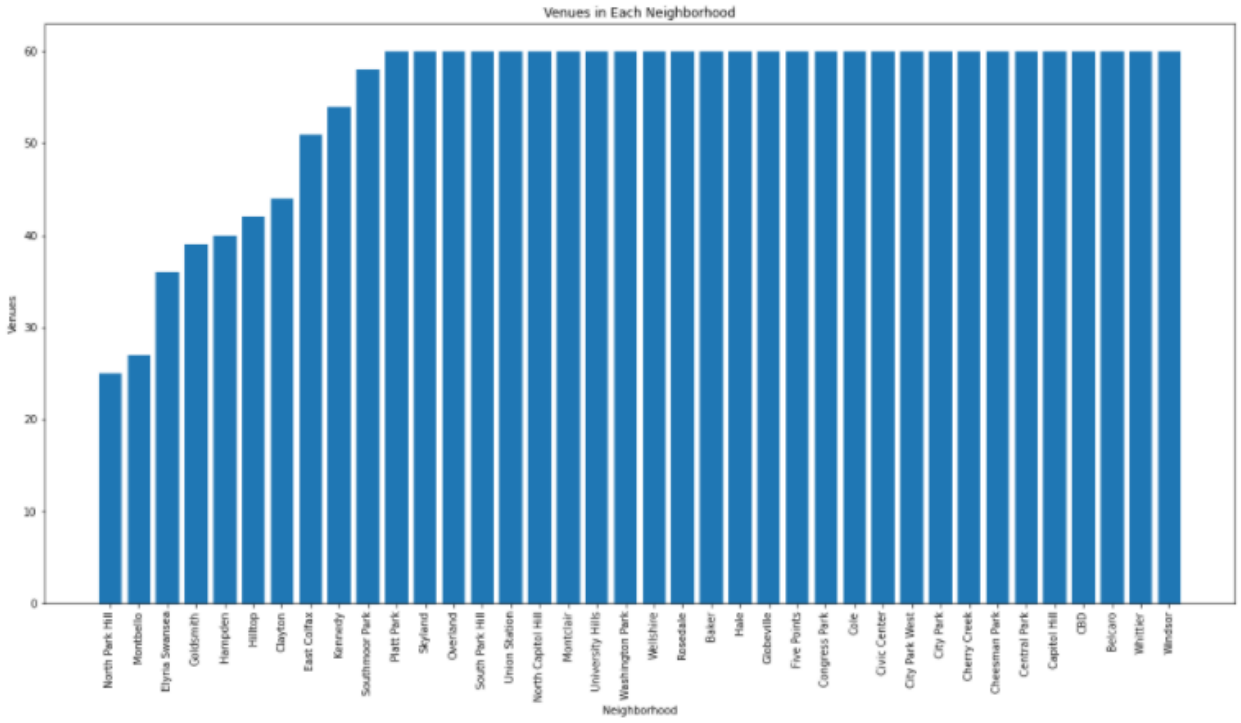
Resulting Data

	OFFENSE_CODE	NEIGHBORHOOD	locationss	latitude	Longitude
Rosedale	1099.0	Rosedale, Denver, Co	(Rosedale, Denver, Denver County, Colorado, Un...	39.671901	-104.980499
Skyland	1291.0	Skyland, Denver, Co	(Skyland, Denver, Denver County, Colorado, Uni...	39.755713	-104.950224
Belcaro	1460.0	Belcaro, Denver, Co	(East Belcaro Drive, Denver, Denver County, Co...	39.702314	-104.947240
Southmoor Park	1725.0	Southmoor Park, Denver, Co	(Southmoor Park, Denver, Denver County, Colora...	39.651121	-104.907154
Washington Park	1736.0	Washington Park, Denver, Co	(Washington Park, Denver, Denver County, Color...	39.702081	-104.971034

2.5 Foursquare API

Now that we have our Neighboorhood and Encounter data, we will use Foursquare API to get number of venues in each neighborhood. We will also group them to ensure there are 10 types of venues in each neighborhood and abundance.

(restricted max to 60)



	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
)	Baker	Bar	Marijuana Dispensary	American Restaurant	Mexican Restaurant	Breakfast Spot	Art Gallery	Salon / Barbershop	Clothing Store	Thrift / Vintage Store	Coffee Shop
I	Belcaro	Coffee Shop	American Restaurant	Sandwich Place	Ice Cream Shop	Bookstore	Italian Restaurant	Marijuana Dispensary	Fast Food Restaurant	Mexican Restaurant	Gym / Fitness Center
?	CBD	Brewery	Bar	Coffee Shop	New American Restaurant	Beer Garden	Seafood Restaurant	BBQ Joint	Burger Joint	Gastropub	Marijuana Dispensary

2.6 Modeling Using *k*-means for Neighborhoods

After cleaning we ran k-means to group neighborhoods into 5 clusters.

	NEIGHBORHOOD	OFFENSE_CODE	latitude	Longitude	Labels
14	Overland	3379.0	39.690508	-104.995185	4
15	Cherry Creek	3648.0	39.693088	-104.916852	2
16	Globeville	4434.0	39.780732	-104.986972	1
17	City Park West	4944.0	39.745376	-104.966577	1
18	Cheesman Park	5244.0	39.732814	-104.966455	1

Methodology

Our master data frame contains neighborhood name, neighborhood location, venue count and number of crimes in each neighborhood.

In this project we will focus on finding neighborhoods that have low police encounters and have a large variety of venue options.

In the first step we have collected the required **data: location** of every neighborhood within Denver, location of every **venue** within each Neighborhood, location of every **arrest** within Denver.

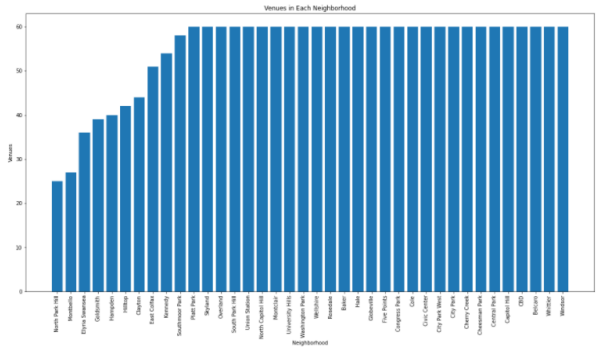
Second step in our analysis will be calculation and exploration of **venue frequency** across different Neighborhoods of Denver - we will use **Charts and Graphs** to identify a few promising areas with **low Police Encounters** in general (*and* **also a variety of venues**) and we focus our attention on those areas.

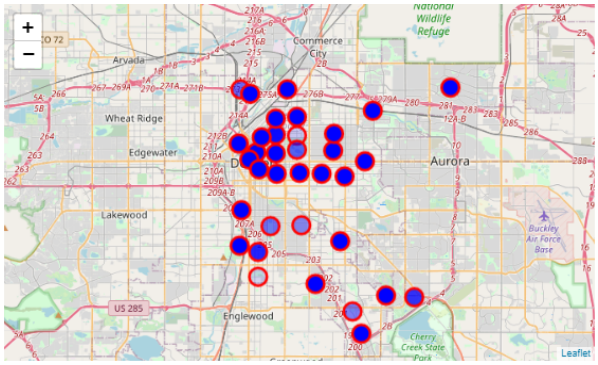
In the third and final step we focus on the most promising areas and within those create **clusters of locations that meet some basic requirements** established in discussion with stakeholders: we will take into consideration locations with **below average police encounters** and neighborhoods **with a large selection of venues**. We will present graphs and maps to

visualize all our data. We will also present clusters (using **k-means clustering**) of those locations to identify general zones which are relatively safe for final decisions on venue.

Venue frequency

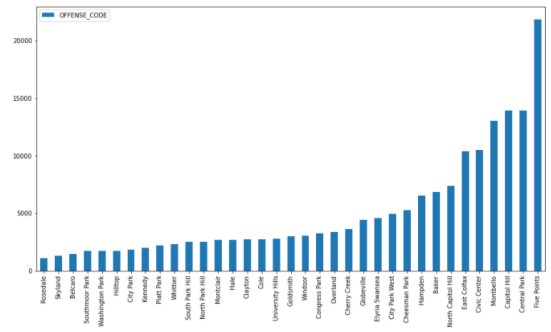
As shown in our master dataset depicted in the figures below, the majority of neighborhoods have at least 60 venues. We decided to remove the neighborhoods that did not meet our criteria.

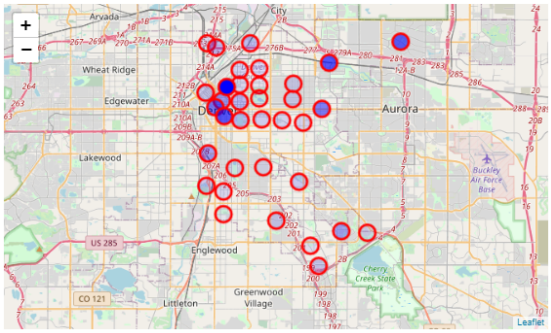


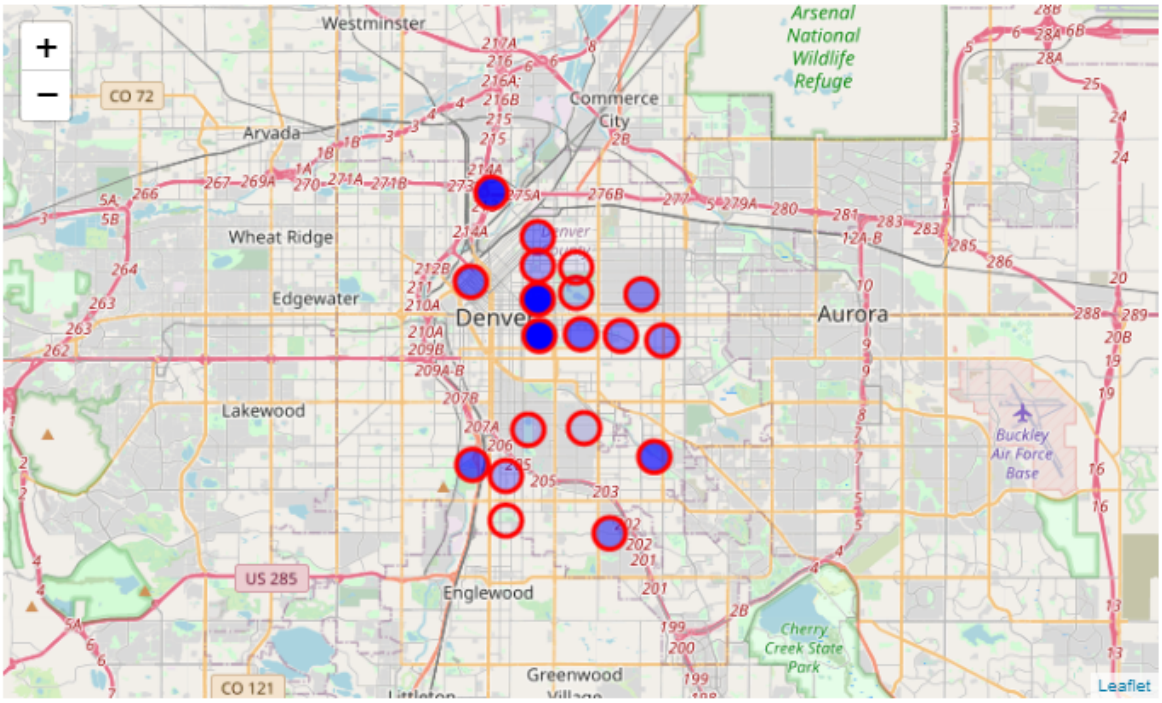


circle(Neighborhoods) opacity(darkness), the darker the circle the more venues

The figures below also depict our master data, and show the amount of police encounters in each neighborhood. You can see that neighborhoods with high encounters have dark circles, and account for a small proportion of our dataset. We took note of their general location, being **downtown** and **north east**. We then filtered out the top quartile (25%). Which resulted in 19 neighborhoods with 60 venues each and less than 5300 police encounters, as seen in the following chart and map.



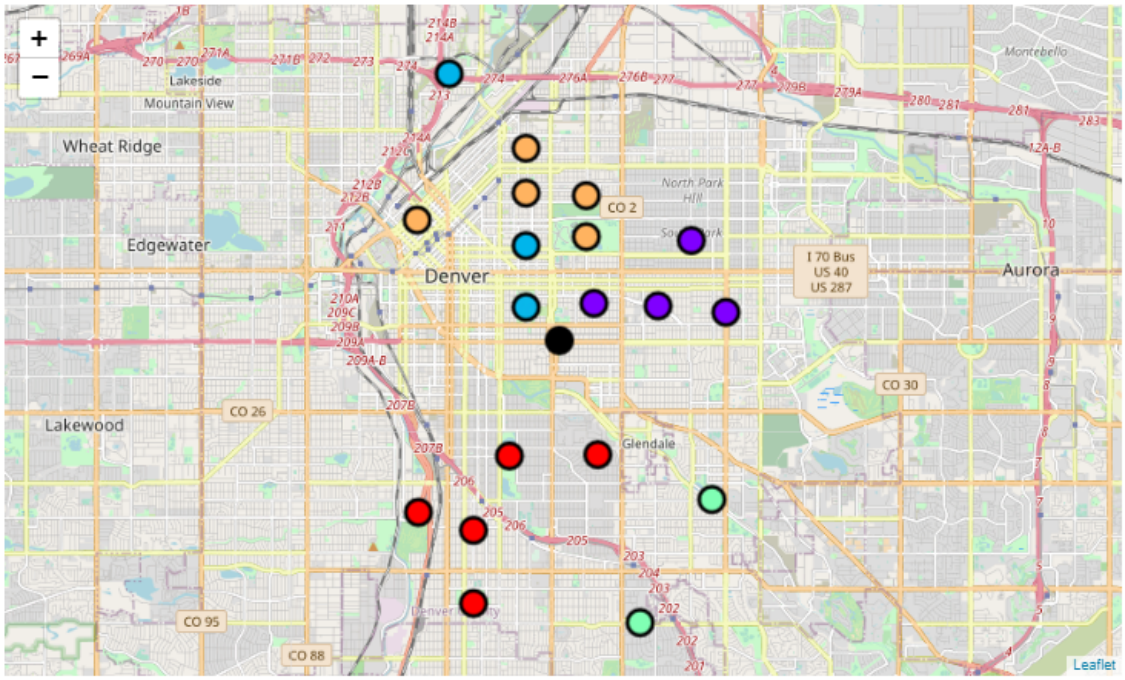




Now that the data looks good,we will cluster them into 5 distinct clusters.

We use the **K-means** clustering algorithm to find groups which have not been explicitly labeled in the data. This can be **used** to identify unknown groups in complex data sets.

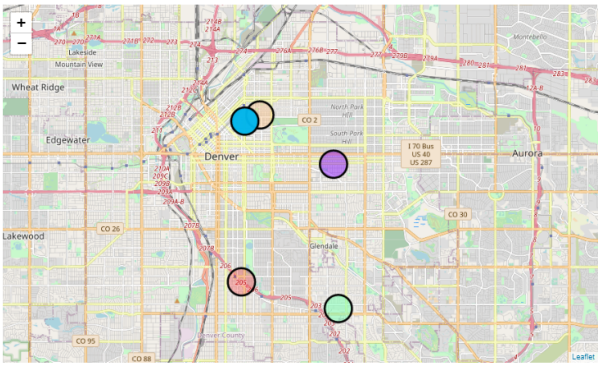
This map shows our resulting clusters with each color marker indicating a different group.



Results

We can examine the values of each cluster.

Labels	OFFENSE_CODE	latitude	Longitude
0	2246.0	39.755182	-104.965884
1	1976.2	39.690717	-104.974892
2	2787.5	39.736282	-104.928622
3	4874.0	39.752974	-104.973335
4	3218.5	39.680431	-104.926443



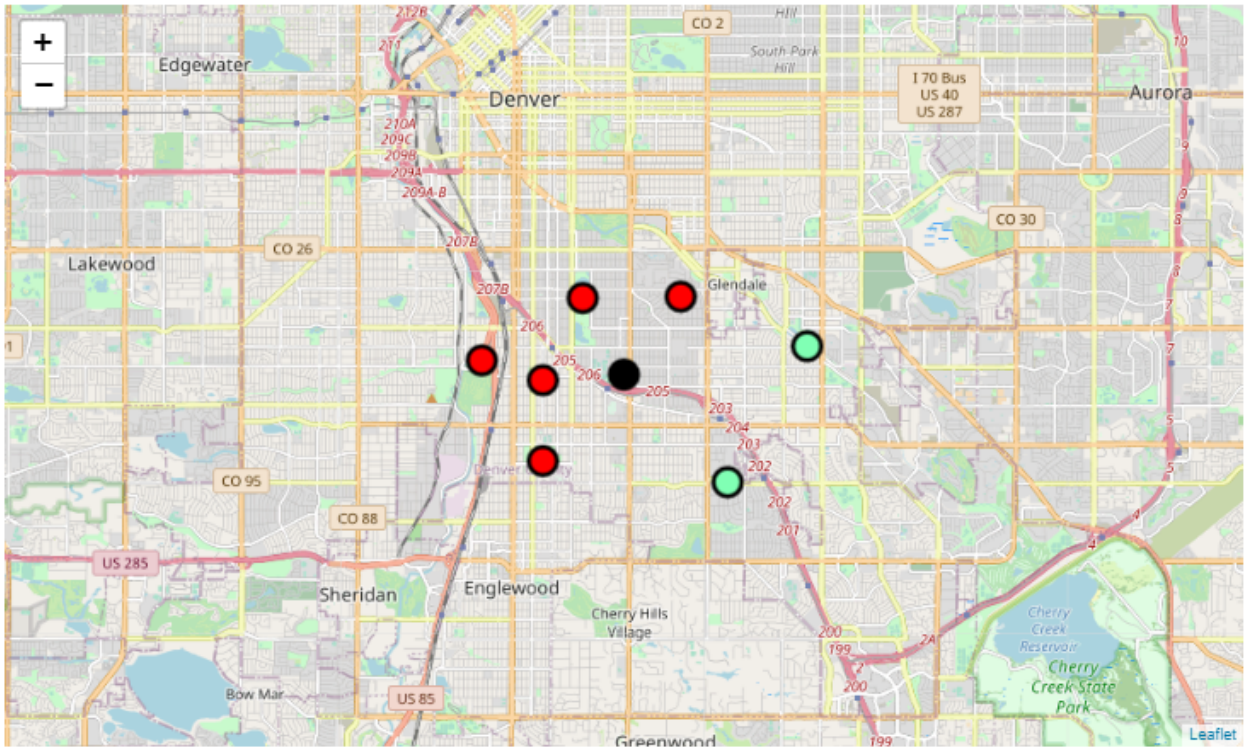
We can see the proximity of cluster three and zero. We took a look at these groups and determined that the police encounters were not identical enough to make one cluster.

Skyland	1291.0	39.755713	-104.950224
City Park	1816.0	39.747340	-104.950285
Whittier	2306.0	39.756363	-104.966558
Windsor	3067.0	39.750865	-104.995794
Cole	2750.0	39.765630	-104.966557

City Park West	4944.0	39.745376	-104.966577
Globeville	4434.0	39.780732	-104.986972
Cheesman Park	5244.0	39.732814	-104.966455

We also took into account Data in the top quartile that we removed early. Data that showed an abnormally large number of police encounters happened downtown and therefore we removed these clusters because of their proximity to downtown.

Inspecting the map we decided to remove the purple cluster because of its lack of access. Also you would have to travel through a high risk area. With that we are left with two clusters.



The center is located at 1585 S York St, Denver, CO 80210. The final 7 neighborhoods have the following venues. The table shows the ten categories of venues found most in each neighborhood.

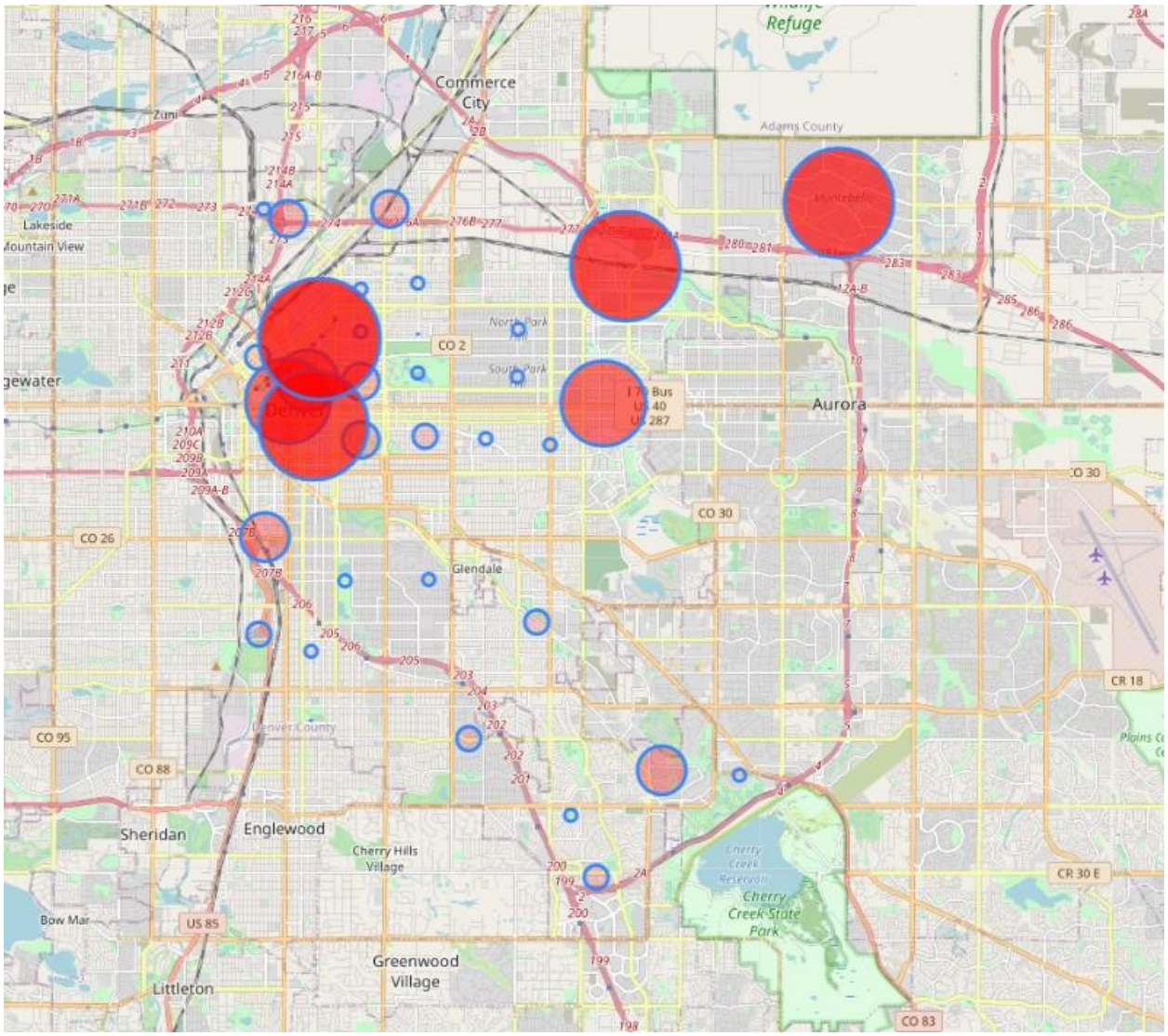
NEIGHBORHOOD	OFFENSE CODE	latitude	Longitude	Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
University Hills	2789.0	39.667773	-104.936034	2	Sandwich Place	Bakery	Pharmacy	Arts & Crafts Store	Coffee Shop	Gym / Fitness Center	Cosmetics Shop	Pizza Place	Pet Store	Bank
Cherry Creek	3648.0	39.693088	-104.916852	2	Park	Pizza Place	Discount Store	Liquor Store	Coffee Shop	Sushi Restaurant	Mexican Restaurant	Residential Building (Apartment / Condo)	Fast Food Restaurant	Salon / Barbershop
Overland	3379.0	39.690508	-104.995185	4	Brewery	Coffee Shop	Mexican Restaurant	Bar	Golf Course	Pizza Place	Park	Marijuana Dispensary	Sushi Restaurant	Grocery Store
Platt Park	2207.0	39.686780	-104.980501	4	Mexican Restaurant	Coffee Shop	Brewery	Bar	Park	Sushi Restaurant	Pizza Place	Fried Chicken Joint	Tea Room	Bakery
Washington Park	1736.0	39.702081	-104.971034	4	American Restaurant	Coffee Shop	Bar	Sandwich Place	Grocery Store	Park	Dive Bar	Liquor Store	Gym	Video Store
Belcaro	1460.0	39.702314	-104.947240	4	Coffee Shop	American Restaurant	Sandwich Place	Ice Cream Shop	Bookstore	Italian Restaurant	Marijuana Dispensary	Fast Food Restaurant	Mexican Restaurant	Gym / Fitness Center
Rosedale	1099.0	39.671901	-104.980499	4	Coffee Shop	Breakfast Spot	Mexican Restaurant	Brewery	Pizza Place	Fried Chicken Joint	Bakery	Hobby Shop	Burger Joint	Fast Food Restaurant

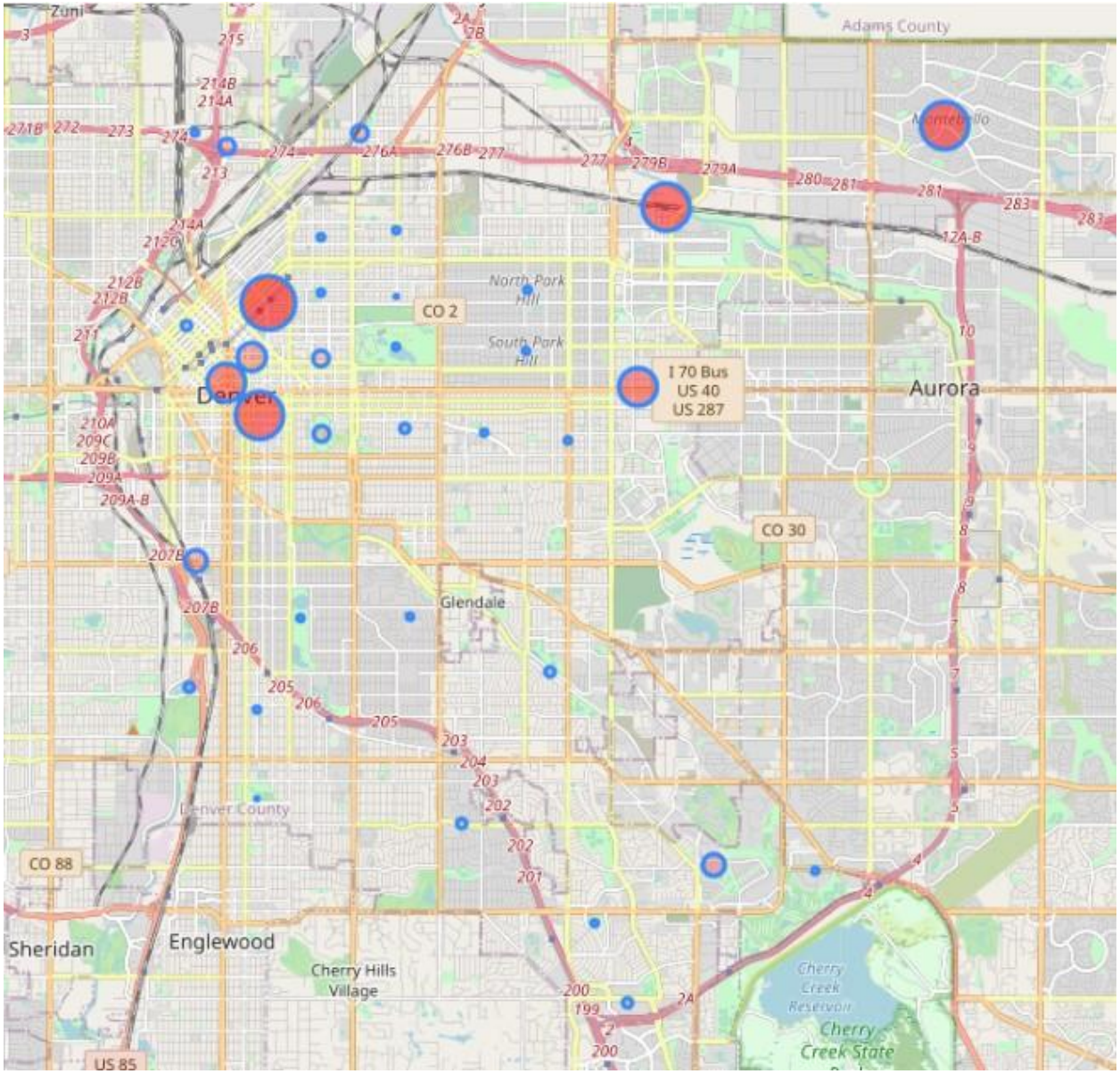
Discussion

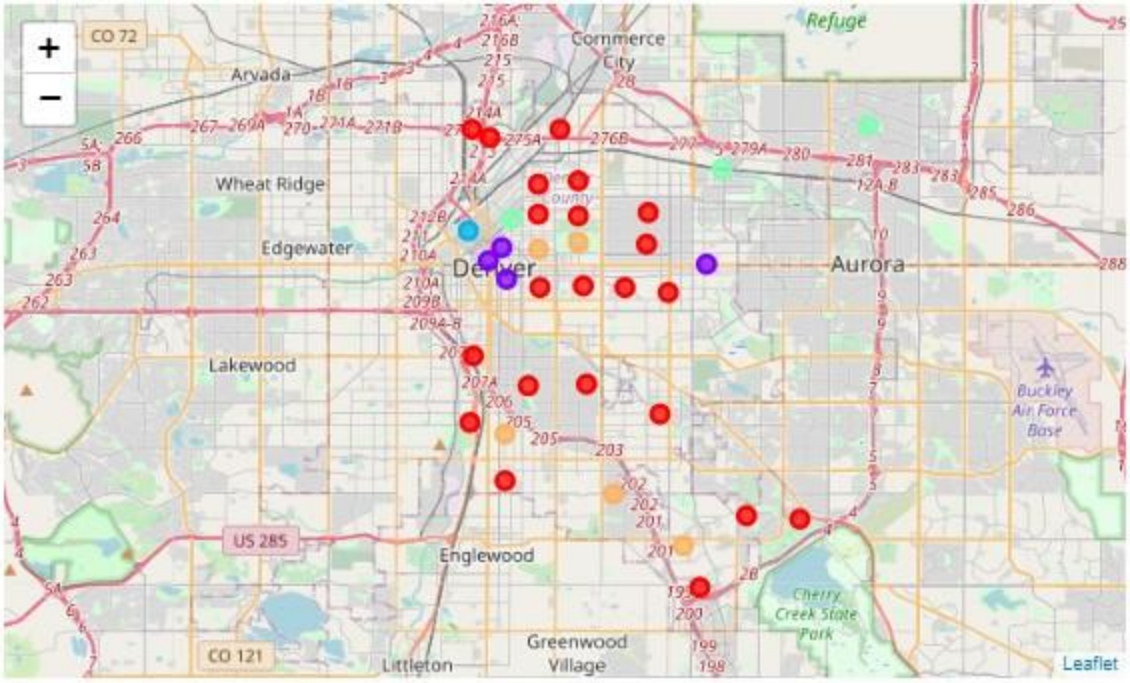
The data analysis indicates the South Denver neighborhoods are the most desired location for safety. Rosedale is an exceptional choice for an outing, with the lowest police encounters at 1100. Rosdale also has a abundance of restaurants choices and plenty of coffeeshops to start your day off right. Another top choice is Washington Park. Washington Park is specifically a strong candidate for somewhere to live, as it has more grocery stores and gyms. Downtown Denver neighborhoods have an unpredictable environment for entertainment or business. Take the neighborhood of Five Points for example, where per capita every person in Five Points has 2 police encounters every month. While Rose Dale has .4 police encounters per resident each month.

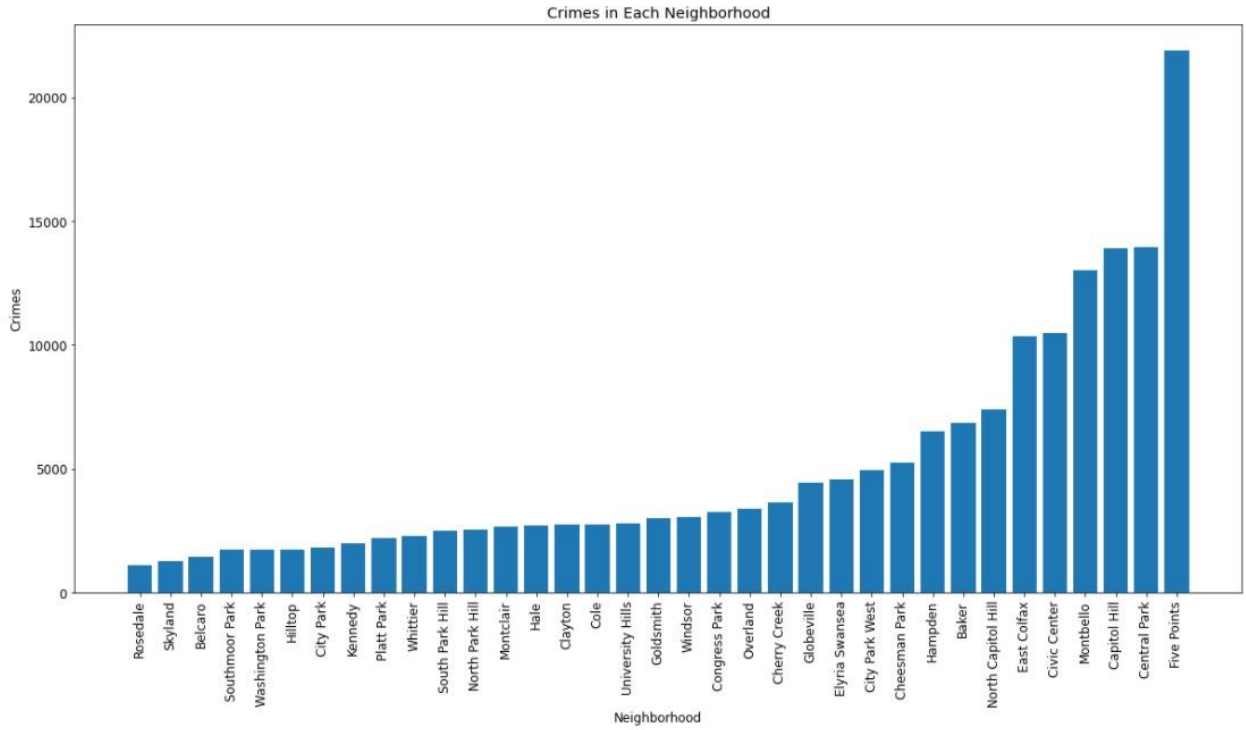
Conclusion

From our analysis of the data we drew the following conclusions. Denver has wide range of venue types spread throughout each neighborhood and choosing a particular neighborhood to spend leisure time or the conducting of business depends on your preferences. It is clear that downtown Denver is a hotbed of police activity. Our analysis shows south Denver to have the variety and environment most suitable to meeting our goal of limited interactions with law enforcement.


Commerce City
Adams County
Aurora
Denver
Glendale
Englewood
Sheridan
Littleton
Greenwood Village
Cherry Hills Village
Bow Mar
Lakeside
Mountain View
Zuni
CO 2
CO 26
CO 30
CO 95
CO 88
US 85
CR 18
CR 30 E
CO 83
Cherry Creek State Park
Cherry Creek Reservoir
Denver County


Adams County
Denver
Aurora
Glendale
Englewood
Sheridan
Cherry Hills Village
Denver County
North Park Hill
South Park Hill
Cherry Creek Reservoir
Cherry Creek State
CO 2
CO 30
CO 88
US 85
I 70 Bus
US 40
US 287


CO 72
Arvada
Commerce City
Refuge
Wheat Ridge
Edgewater
Denver
Aurora
Lakewood
Buckley Air Force Base
US 285
Englewood
Cherry Creek State Park
CO 121
Littleton
Greenwood Village
Leaflet



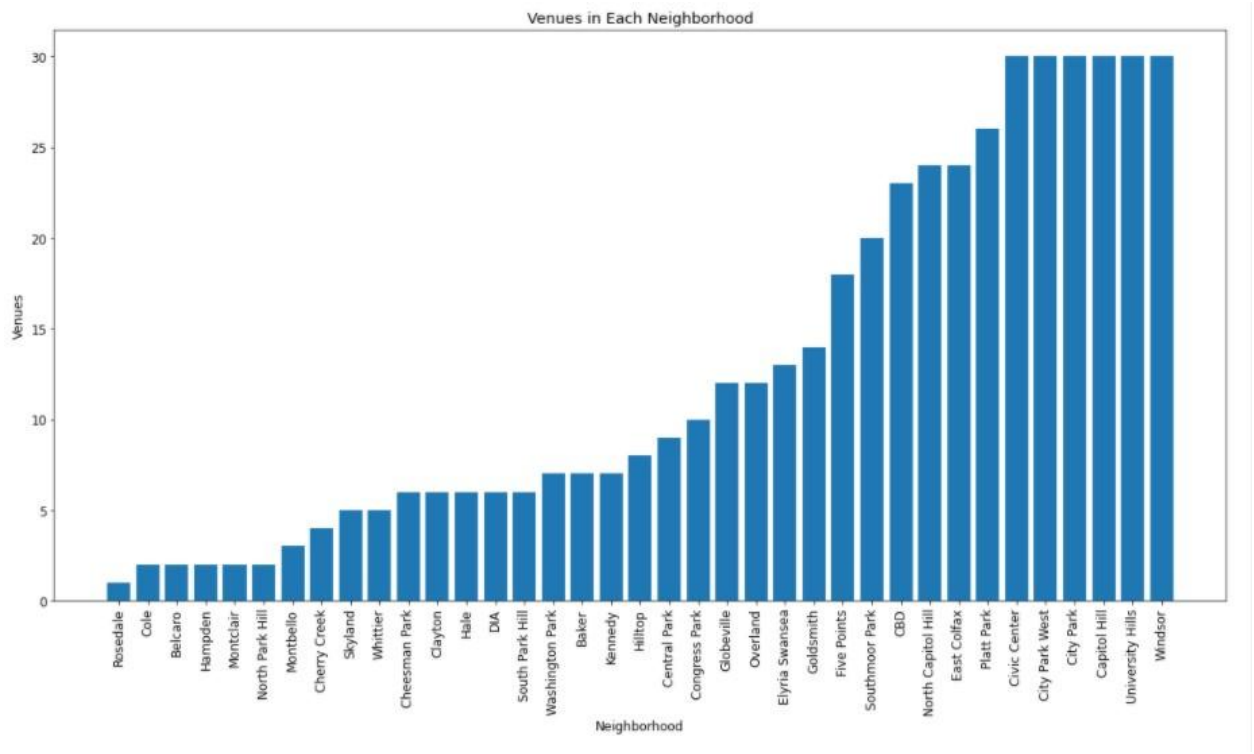
	NBHD_ID	NBHD_NAME	NEIGHBORHOOD	locationss	city_coord
0	2	Auraria	Auraria, Denver, Co	(Auraria, Denver, Denver County, Colorado, 802...	(39.7465219, -105.0067102)
1	21	Cory - Merrill	Cory - Merrill, Denver, Co	None	(44.933143, 7.540121)
2	7	Belcaro	Belcaro, Denver, Co	(East Belcaro Drive, Denver, Denver County, Co...	(39.7023138, -104.9472404)
3	70	Washington Park	Washington Park, Denver, Co	(Washington Park, Denver, Denver County, Color...	(39.7020811, -104.971033692151)
4	71	Washington Park West	Washington Park West, Denver, Co	None	(44.933143, 7.540121)
5	59	Speer	Speer, Denver, Co	(2785 Speer Apartments, Denver, Denver County,...	(39.7568766, -105.01843892601357)
6	13	Cherry Creek	Cherry Creek, Denver, Co	(Cherry Creek, Denver, Denver County, Colorado...	(39.6930882, -104.9168524)
7	22	Country Club	Country Club, Denver, Co	(Country Club, Larimer County, Colorado, 80524...	(40.618963, -105.041214)
8	20	Congress Park	Congress Park, Denver, Co	(Congress Park, Denver, Denver County, Colorad...	(39.7337198, -104.9483668)
9	14	City Park	City Park, Denver, Co	(City Park, Denver, Denver County, Colorado, U...	(39.74734, -104.95028497370055)

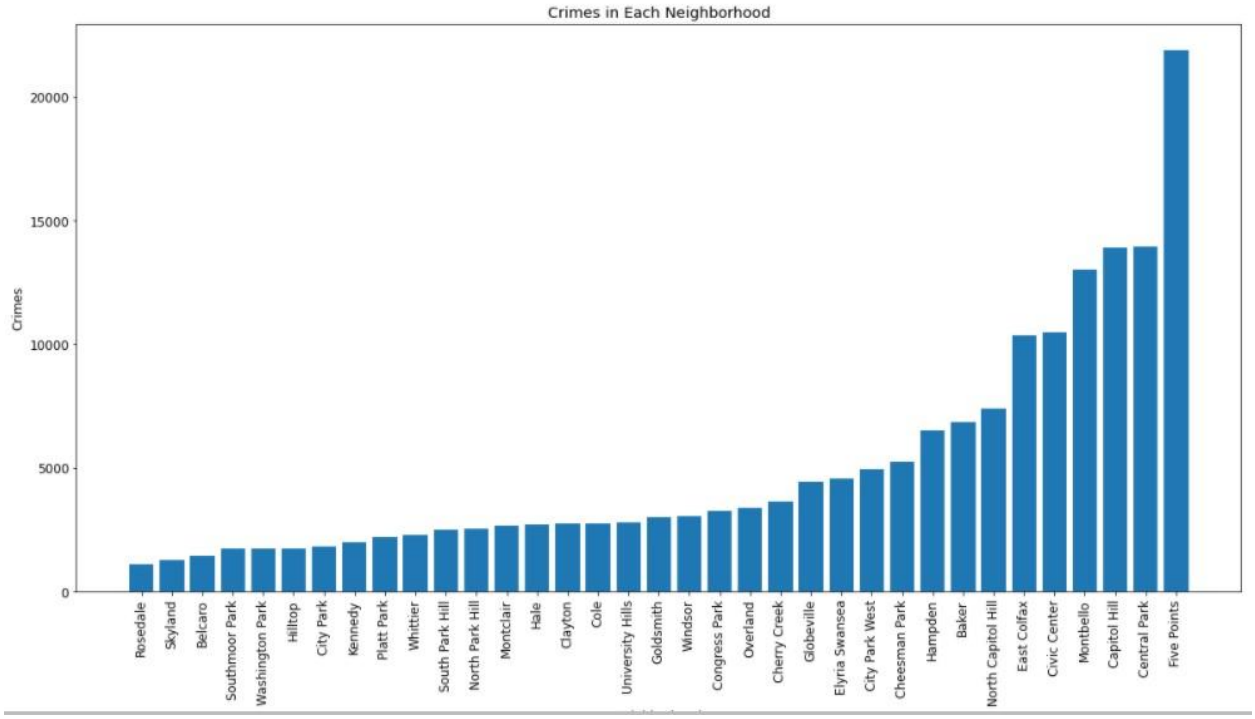
	NBHD_NAME	latitude	longitude	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
64	Windsor	39.750865	-104.995794	3.0	Restaurant	Pizza Place	Hotel	Coffee Shop	Cocktail Bar	Burger Joint	Lounge	Steakhouse	Food	Mexican Restaurant
33	Overland	39.690508	-104.995185	3.0	Coffee Shop	Convenience Store	Golf Course	Fast Food Restaurant	Mexican Restaurant	Furniture / Home Store	Martial Arts School	Gas Station	Bagel Shop	Miscellaneous Shop
26	Hilltop	39.783079	-104.993961	3.0	Sporting Goods Shop	Steakhouse	Hotel	Rental Car Location	Restaurant	Breakfast Spot	Building	Marijuana Dispensary	Donut Shop	Fast Food Restaurant
69	Baker	39.711595	-104.993750	3.0	Paper / Office Supplies Store	Marijuana Dispensary	Intersection	Whisky Bar	Residential Building (Apartment / Condo)	Chinese Restaurant	Distillery	Fast Food Restaurant	Farmers Market	Farm
47	Civic Center	39.741357	-104.987141	3.0	American Restaurant	Hotel	Marijuana Dispensary	Burger Joint	Shopping Mall	Clothing Store	Bookstore	Movie Theater	Candy Store	Residential Building (Apartment / Condo)

	NBHD_NAME	NEIGHBORHOOD	locationss	latitude	Longitude	city_coord
49	Union Station	Union Station, Denver, Co	(Union Station, 1701, Wynkoop Street, 16th Str...	39.753630	-105.000748	(39.75363, -105.0007481)
64	Windsor	Windsor, Denver, Co	(The Windsor, 1777, Larimer Street, Central Bu...	39.750865	-104.995794	(39.75086545, -104.99579430063064)
33	Overland	Overland, Denver, Co	(Overland Lake, Denver, Denver County, Colorad...	39.690508	-104.995185	(39.6905077, -104.99518474141124)

	Police Encounters	latitude	longitude	Venue Count	Labels
Rosedale	1099.0	39.671901	-104.980499	2.0	0
Skyland	1291.0	39.755713	-104.950224	5.0	0
Belcaro	1460.0	39.702314	-104.947240	2.0	0
Southmoor Park	1725.0	39.651121	-104.907154	21.0	2
Washington Park	1736.0	39.702081	-104.971034	5.0	0

Southmoor Park	21
North Capitol Hill	25
Platt Park	27
City Park West	29
University Hills	36
Civic Center	43
Capitol Hill	45
City Park	45
Union Station	89
Windsor	100





tliers, I decided to first max our values at 75 percentile and finally we omitted a few for this reason.

Third , throughout the analysis it becomes clear that more precise analysis would create the actual user value. As the analysis continued the project grew to a level that was not

appropriate for an example, Therefore relevant information WAS omitted to reduce complexity. But should not have a substantial change on the question: Is this neighborhood safe?

2.3 Feature selection

After cleaning our , we examined the value of each feature to our case and it was clear that some things did not appear relevant to our question. For example, in our arrest data, we could have grouped crime by coordinates or neighborhood. In a more extensive analysis it would be valuable to associate police encounters to the venue then to a neighborhood. In our case we were able to group immediately to number of police encounters within a neighborhood.

Therefore, it was not important where individual venues were locoated within in a neighborhood. So we select neighborhoods with at least 60 venues. We also made sure that there was a threshold for distinct types of venues.

	NBHD_NAME	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
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69	Baker	39.711595	-104.993750	3.0	Paper / Office Supplies Store	Marijuana Dispensary	Intersection	Whisky Bar	Residential Building (Apartment / Condo)	Chinese Restaurant	Distillery	Fast Food Restaurant	Farmers Market	Farm
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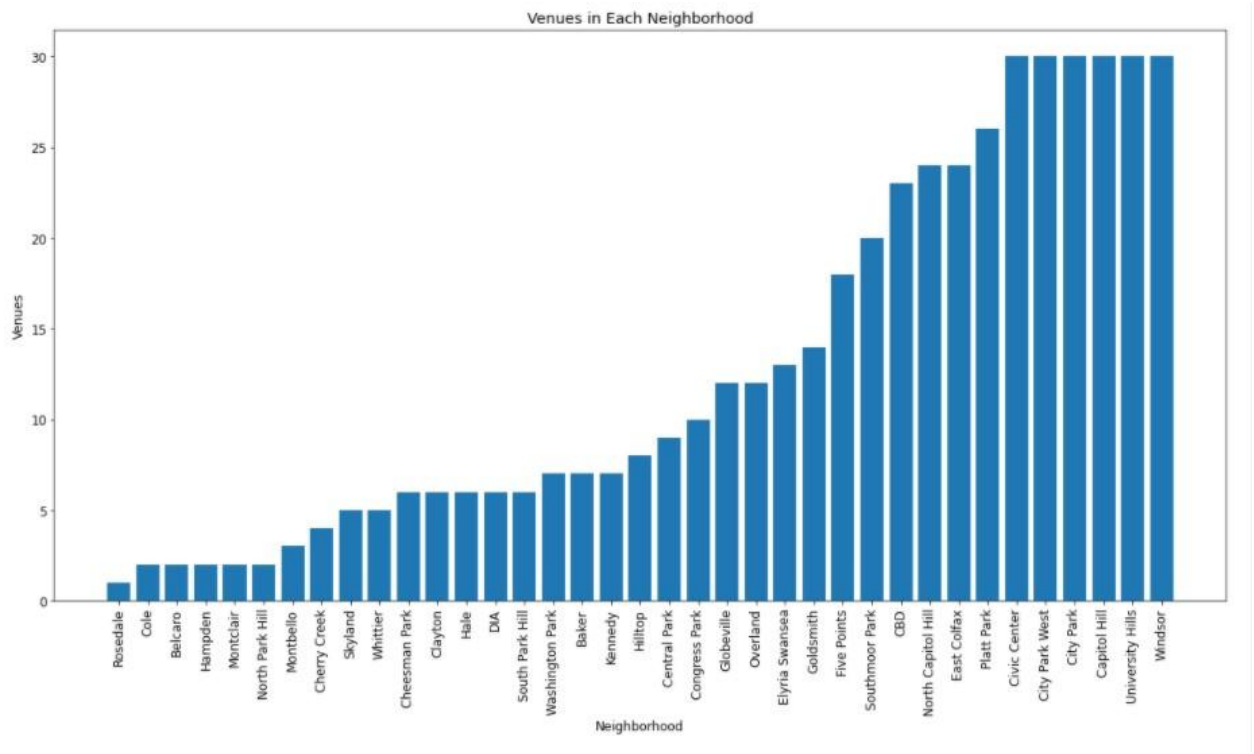
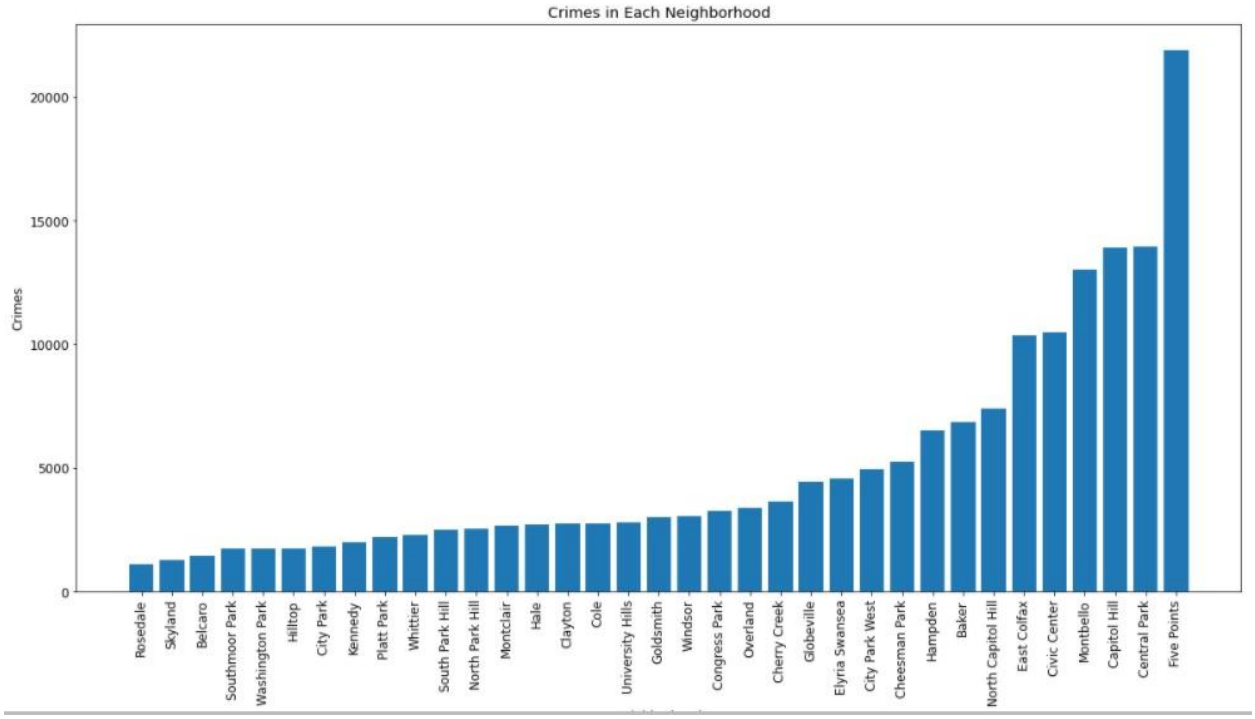
Capitol Hill	45
City Park	45
Union Station	89
Windsor	100





tliers, I decided to first max our values at 75 percentile and finally we omitted a few for this reason.

Third , throughout the analysis it becomes clear that more precise analysis would create the actual user value. As the analysis continued the project grew to a level that was not

appropriate for an example, Therefore relevant information WAS omitted to reduce complexity. But should not have a substantial change on the question: Is this neighborhood safe?

2.3 Feature selection

After cleaning our , we examined the value of each feature to our case and it was clear that some things did not appear relevant to our question. For example, in our arrest data, we could have grouped crime by coordinates or neighborhood. In a more extensive analysis it would be valuable to associate police encounters to the venue then to a neighborhood. In our case we were able to group immediately to number of police encounters within a neighborhood.

Therefore, it was not important where individual venues were locoated within in a neighborhood. So we select neighborhoods with at least 60 venues. We also made sure that there was a threshold for distinct types of venues.
