Explore Denver Neighborhoods for Rental Property Investment

I. Introduction

This project plans to explore and analyze the major neighborhoods in Denver county, Colorado. The goal is to identify the top choices of neighborhoods in Denver to either live in or invest in.

The city and county of Denver is the capital and the most populous municipality of Colorado. It has a population of over 700,000 (2018 est.), or approximately 4,520 per square mile. Ranked the 18th out of the 172 combined statistical areas and the 14th in population growth since 2010, Denver is among the biggest and the fastest growing areas in mid-west US. Denver has also been listed as the 3rd best place to live in US by the U.S News and World Report. Many reasons make Denver an attractive place for living, such as the fast growing economy, abundant outdoor activities, well-balanced life style, as well as the proximity to the scenic Rocky Mountain.

For the reasons mentioned above and many more, real estate industry has been going through quick and sustainable growth during the last several years. Denver property market has been attracting institutional and individual investors from nationwide. Per research by ATTOM Data Solutions, medium home price in Denver-Aurora-Lakewood MSA achieved 80% increase since the last recession (Dec. 2007), the highest among all MSA as of July 2019.

Analysis in this project were based on publicly available statistical data, including demographics, crime rates, property value index, and rental economics. This analysis intends to provide insights to the residents and the investors who are new to Denver, and to help them in their choice of location.

II. Data

The City and County of Denver contains a total of 78 neighborhoods. Data in this project comprises the following:

Demographic Data:

Data came from the American Community Survey 2011-2015 by Census Bureau. Data was collected from the Open Data Catalogue of the City and County of Denver in the form of csv files. Major metrics include medium household income, percent poverty, education level, and etc.

Crime Data:

Crime data were scraped from the Denver Post website, and was as of July 2019. Statistics contained detailed crime type information, and were grouped into the property crime and the violence crime categories in the analysis.

Rental Economics:

Data came from the American Community Survey 2011-2015 by Census Bureau. Data was collected from the Open Data Catalogue of the City and County of Denver in the form of csv files. Major metrics include medium home value, contract rent, vacancy, rental units percentage, and etc.

Home Value Index:

Median home price by month by neighborhood was collected through Quandl. The information was provided by the real estate database company Zillow. After cleaning up, data was available for 77 out of the 78 neighborhoods in Denver, for the period from April 1996 till July 2019.

Attractions and Points of Interest:
Information on major venues around the target neighborhoods were provided by FourSquare. The radius was defined as 1km within the target neighborhoods. Key metrics collected included the venue category, address, ratings, and the number of 'likes'.

III. Methodology

Step I: Analyze neighborhood demographics
The ACS data for Denver communities contains 184 metrics. These metrics were classified into two groups: demographic and real estate. 9 metrics were then chosen from the demographic group for further analysis.

For comparison purpose, data on education level were transformed from absolute counts to percentages.

Figure 1 is a summary of the 9 metrics of neighborhoods.

	TTL_POPULATION	MEDIAN_AGE	MED_HH_INCOME	PER_CAPITA_INCOME	PCT_POVERTY	PCT_LESS_THAN_HS_DIPLOMA	PCT_HSGRAD_OR_EQUIV	PCT_SOMECOLLEGE_OR_AA	PCT_BACHELORS_OR_HIGHER
count	78.000000	78.000000	78.000000	78.000000	78.000000	78.000000	78.000000	78.000000	78.000000
mean	8328.897436	34.958846	59767.287564	27172.535641	17.878077	14.419550	17.145852	22.823217	45.611381
std	5909.150409	5.671120	25415.886865	17156.381371	12.344167	13.984654	9.061600	6.356085	23.035131
min	825.000000	17.600000	9849.000000	0.000000	2.800000	0.000000	4.066781	8.946918	4.681648
25%	4602.500000	31.500000	42593.625000	15543.175000	8.937500	3.336673	8.592255	18.281512	25.272311
50%	7196.500000	34.465000	54718.000000	25205.400000	15.375000	8.980771	15.901114	22.471906	49.554859
75%	9722.250000	38.700000	69478.417500	37001.385000	24.417500	23.684982	25.793530	27.599444	66.710577
max	34957.000000	49.000000	134167.000000	73861.550000	86.500000	51.498127	36.753355	44.327177	86.130137

Data were first run through OPTICS model for clustering analysis. Minimum samples of clustering were set at 2, 3 and 4. However, OPTICS model did not return good clustering results. With minimum samples at 4, neighborhoods were clustered to five (5) groups, while 43 neighborhoods were left as outliers. Results were even worse with minimum samples at 2 and 3.

In the 2nd round, analysis was focused on three key metrics: Medium Household Income, Percent Poverty, and Percent Less than High School Diploma. Thresholds were set as 'above medium' (2nd quantile) for all metrics.

Twenty-eight (28) out of the 78 neighborhoods met all three thresholds. These neighborhoods are:

- Wellshire, Rosedale, Cheesman Park, Hilltop, Montclair, Hale, South Park Hill, Virginia Village, Auraria, Platte Park, Southmoor Park, Hampden South, Cory – Merrill, Belcaro, Washington Park, Washing Park West, Cherry Creek, Country Club, Congress Park, City Park, Civic Center, Stapleton, Lowry Field, West Highland, Berkeley, Regis, Marston, and Indian Creek.

Step 2: Analyze neighborhood rental economics
Eight (8) metrics were initially chosen from all the real estate metrics.

Vacancy percentage was calculated using the absolute counts of Vacant Units and Total Housing Units. Percentage Rental was calculated using the absolute counts of Owner Occupied Units and Renter Occupied Units. Vacant Units, Occupied Units, Owner Occupied Units and Renter Occupied Units were then dropped.

Rent Value Ratio was calculated as Medium Contract Rent divided by Medium Home Value for each neighborhood.

Below is a summary of these metrics.

	MED_YR_STRUCTURE_BUILT	MEDIAN_HOME_VALUE	MED_CONTRACT_RENT	RENT_VALUE_RATIO	TTL_HOUSING_UNITS	VACANCY	PCT_RENTAL
count	78.000000	78.000000	78.000000	78.000000	78.000000	78.000000	78.000000
mean	1747.628077	303488.034103	962.938077	inf	3535.833333	7.090469	50.107623
std	603.815697	151329.497509	269.609444	NaN	2224.292249	4.865881	18.904421
min	0.000000	0.000000	218.000000	1.833017	59.000000	0.971323	12.418773
25%	1950.250000	191450.000000	805.002500	3.106928	1875.750000	4.081456	35.153559
50%	1958.500000	279658.335000	880.875000	3.848924	3161.000000	6.432474	51.652059
75%	1973.875000	363004.167500	1078.875000	5.105415	4159.750000	9.066444	63.850755
max	2006.500000	824500.000000	1720.000000	inf	10717.000000	36.392786	100.000000

Metrics were then further filtered to Rent Value Ratio and Vacancy. Thresholds were set to be 'above medium' (2nd quantile) for both Rent Value Ratio and the Vacancy. Twenty-one (21) neighborhoods were short listed based on these criteria:

- Chaffee Park, Athmar Park, Northeast Park Hill, University Hills, Harvey Park, Mar Lee, Westwood, College View – South Platte, Overland, Ruby Hill, Bear Valley, Harvey Park South, Hampden South, Cory – Merrill, Stapleton, Montebello, Regis, Skyland, Barnum, Gateway – Green Valley Ranch, Indian Creek.

Five (5) neighborhoods out of the 78 made it on both lists: Hampden South, Cory – Merrill, Stapleton, Regis, and Indian Creek.

Key metrics of these five (5) neighborhoods are summarized as below:

NBHD	RENT_VALUE_RATIO	VACANCY	MED_HH_INCOME	PCT_POVERTY	PCT_LESS_THAN_HS_DIPLOMA
Hampden South	4.129653	6.421894	67354.67	5.10	3.780702
Cory - Merrill	4.536792	2.587601	94583.00	7.40	2.458034
Stapleton	4.232819	4.135664	117256.00	4.05	8.368132
Regis	4.298282	2.207235	56691.00	13.50	7.661437
Indian Creek	6.221172	4.489164	56940.00	7.40	4.026380

Step 3: Analyze crime data.

Property crimes and violence crimes by neighborhood were each aggregated. Since the size of the neighborhoods varies substantially, it would be misleading to use the absolute counts to measure the safety of these neighborhoods. In order to avoid that, crime counts were normalized. Crimes per 1K People ratio was used instead of the absolute counts. The denominator, Total Population, was collected in Step 1 of this analysis, and was ready for use.

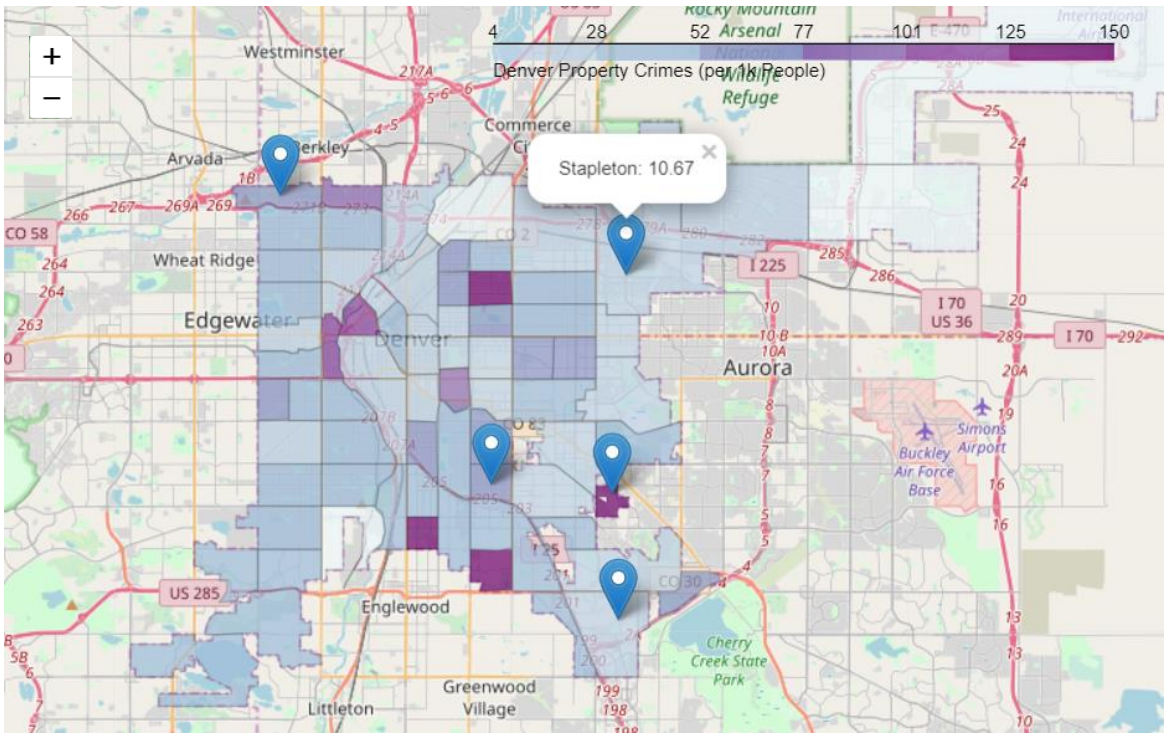
Data of the selected neighborhoods are summarized as below:

	Neighborhood	Lat	Long	Property Crimes per 1k People	Violence Crimes per 1k People
0	Hampden South	39.6434	-104.8940	25.542526	19.544413
1	Cory - Merrill	39.6893	-104.9501	72.298944	31.681560
2	Stapleton	39.7603	-104.8908	10.666062	7.488937
3	Regis	39.7874	-105.0439	53.105737	61.403509
4	Indian Creek	39.6858	-104.8965	148.348519	106.492027

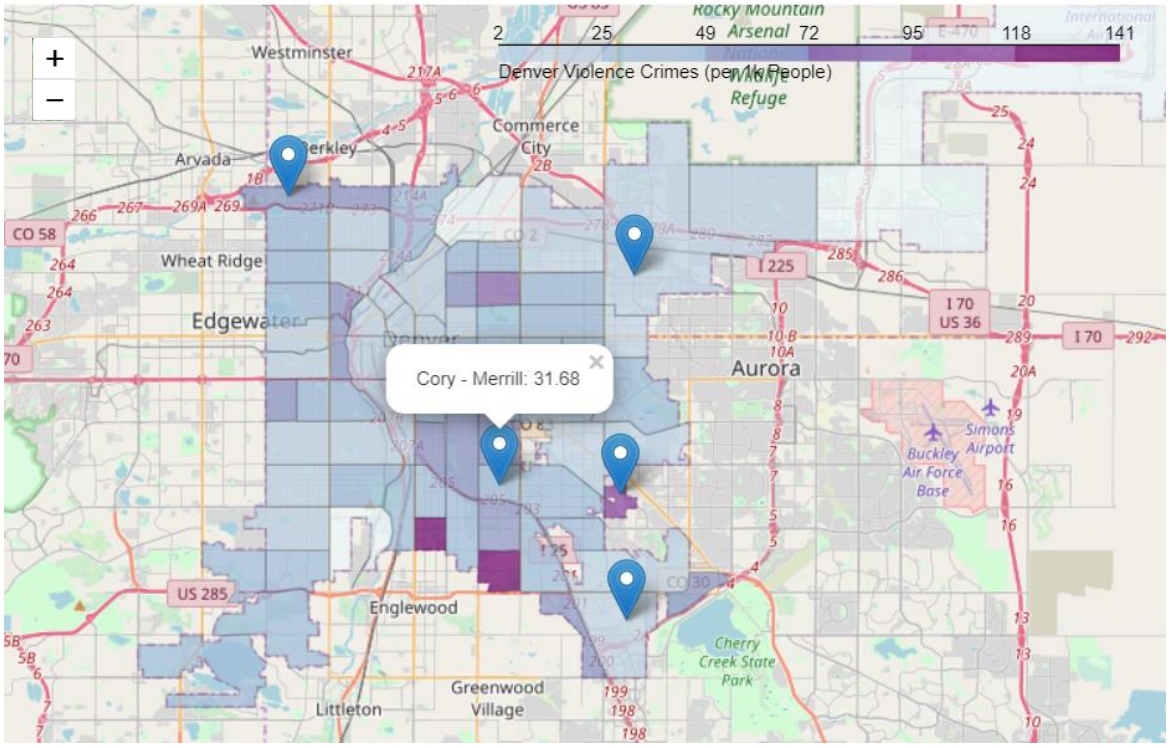
Among the five neighborhoods, four show crime counts lower than the medium. Indian Creek though show relatively high crime counts.

Choropleth maps were generated to show the crime occurrence across different neighborhoods in Denver county. The different shades of color helps to compare the safeness of a neighborhood relative to the others. The five neighborhood candidates were labeled on the map with name and the crime count per 1K people.

Below is the choropleth map of the property crimes among Denver neighborhoods:



Below is the choropleth map of the violence crimes among Denver neighborhoods:



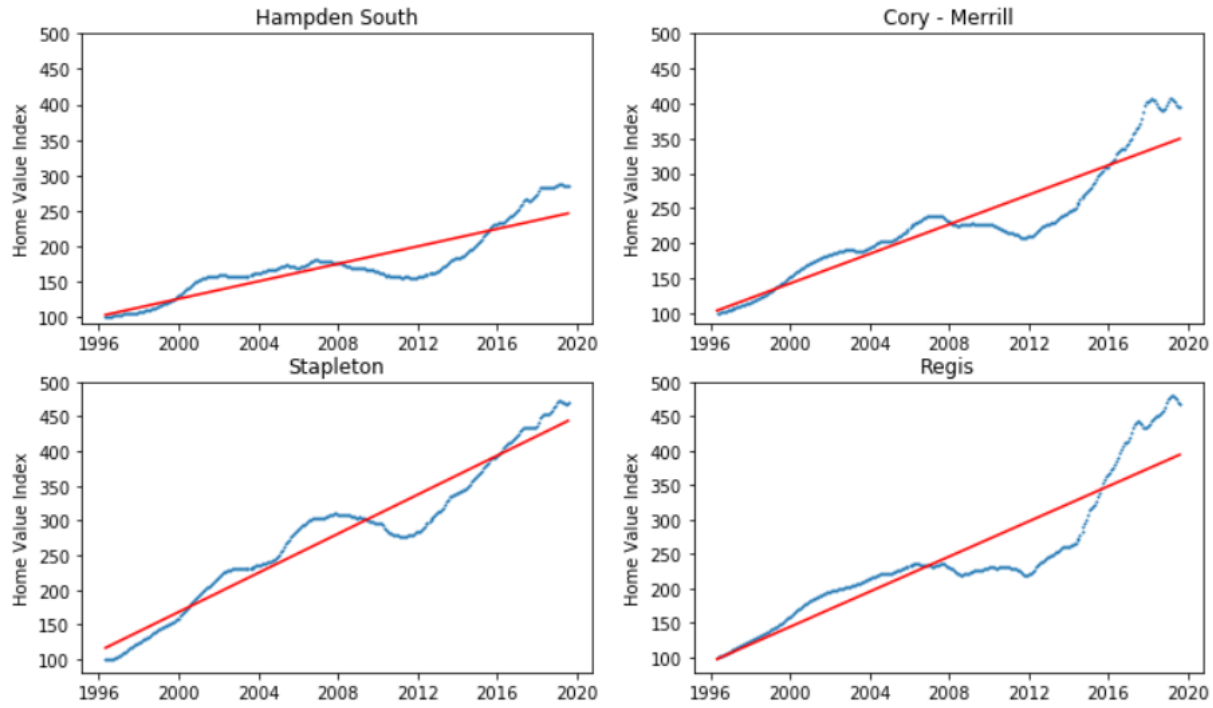
Step 4: Analyze home value growth

Home value growth rates were estimated using the linear regression model, based on medium home price from April 1996 to July 2019. Data was first standardized. April 1996 home value was set as the baseline, with index value 100. Historical neighborhood data was available per Quandl for 77 of the 78 Denver communities. Auraria data was missing. Since our neighborhood choices have been narrowed down to four (4) and Auraria was not one of them, this issue did not cause big concern.

Regression on home value index and years generated the following results:

	Coefficient	Intercept
Stapleton	1.174002	116.441815
Hampden South	0.513026	103.234205
Regis	1.065035	96.975227
Merrill	0.881004	103.546473

I then plotted the results using Matplotlib for easier visualization.



It is easy to see from the plots that home value of the four neighborhoods shares a similar pattern, which is probably highly correlated with the overall Colorado real estate market. Of the four neighborhoods, Stapleton has the steepest slope among the four neighborhoods, meaning the highest growth. Stapleton ranked as the 16th fastest growing neighborhoods among the 77. Regis (rank: 19th) and Cory – Merrill (rank: 33rd) also show healthy growth over time. In recent years especially, the momentum seems to have carried through and the price growth has been accelerating. Hampden South, with a relatively gentle slope, show the lowest growth (rank: 63rd), slower than average among the Denver communities.

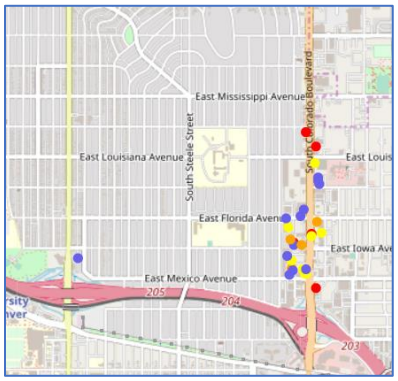
Step 5: Analyze points of interest around the target neighborhoods

For each of the three remaining neighborhoods, Cory – Merrill, Stapleton, and Regis, I further gathered information on major venues within 1km radius of the neighborhood. Key metrics used were ratings and number of 'likes'.

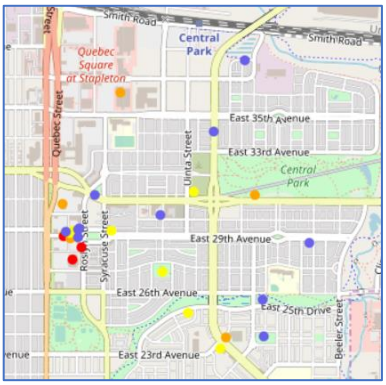
Below are the venue maps of each neighborhood. The colored dots represented these venues. Red dots are venues with over 50 'likes', orange 30 to 49, and yellow 10 to 29. The remaining are in purple.

It is obvious on the map that Regis has less yellow and orange dots, meaning fewer popular places as compared with the other two neighborhoods. It is also easy to see on the map that most venues in Cory – Merrill are clustered around the Colorado Blvd. For Stapleton and Regis, venues scatter across.

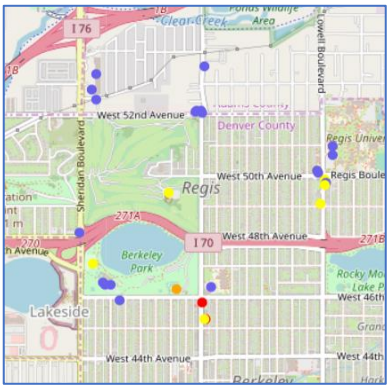
Cory – Merrill:



Stapleton:



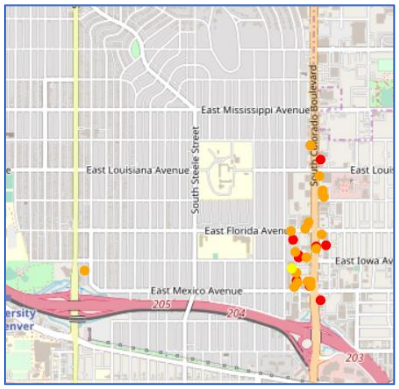
Regis:



Below are some similar maps, but venue colors represent different ratings. Red dots are for ratings 8 and above, orange for 7 and above, and yellow for 6 and above. The remaining are in purple.

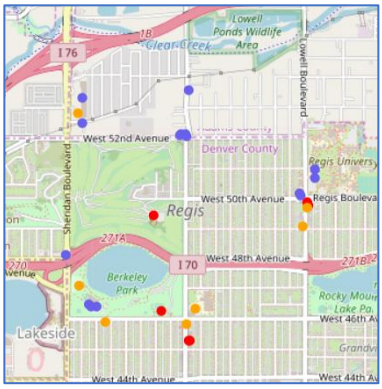
Most of the venues in Cory – Merrill are rated comparatively high at 7 or above, while in Stapleton and Regis, venues with all levels of ratings are mixed and scattered.

Cory – Merrill:



Stapleton:

Regis:



IV. Results

As analyzed above, Stapleton, Cory – Merrill, and Regis stood out as good candidates for rental property investment. They demonstrated below features when compared with other neighborhoods in Denver area.

- Demographics indicated that these neighborhoods are above average in terms of household financial strength and the education level, which implies lower risk of default from tenants. These features are also desirable for primary residence.
- These neighborhoods show above medium Rent to Value Ratio, and relatively low Vacancy as compared with the other neighborhoods. Both measurements indicated good profitability of a rental property. Among the three selected neighborhoods, Cory – Merrill achieved the highest Rent to Value Ratio.
- Property and violence crimes per 1K people were below average for all three neighborhoods. Stapleton boasts the lowest crime counts among the three.

- Stapleton shows the highest growth during the period of April 1996 to July 2019. Regis and Cory - Merrill traced closely. Property value in Hampden South grew slower than average based on track records.
- All three neighborhoods have easy access to restaurants and other points of interest. In average, venues in Cory – Merrill are rated higher than those in the other two neighborhoods.

V. Discussion

In this analysis, four features are selected as the major criteria to filter down areas for property investment. The four features are (a) robust financial strength of the residents; (b) desirable profit-making capacity as rental units; (c) safe areas with low crime counts; (d) value growth potential; (e) access to points of interest.

However, many other factors may also heavily impact the choice of location to invest in, such as the transportation, volume of new supplies, infrastructure and public facilities, etc. This study can serve as an initial analysis of neighborhoods for an interested investor or a new resident who wants to get some quick color of Denver area. Further analysis on specific locations and properties will be needed in order to make an intelligent decision.

VI. Conclusion

In this study, I targeted on analyzing the Denver neighborhoods to narrow down candidates that may worth investing in. It could also provide insights to people planning to move to the Denver area as new residents. Points of consideration include average financial strength, rental property economics, safety and security concern, growth momentum, and access to popular venues. The study used various analytical tools such as regression, clustering, and plotting for visualization. Three neighborhoods, Stapleton, Cory – Merrill and Regis, stood out as good candidates for potential investments.

I hope the approach used in this study brought thoughts and idea to the investors on how to quickly explore an area using the tools of publicly available data, upon entrance to a brand new market.