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**Denver Crime**

**Introduction**

Tracking crime is vital to help keep citizens safe. Whether one lives in the city, or is just visiting, it is useful to know where crime takes place in order to keep one’s family and oneself safe. Some areas experience more crime than others within a city. It is important to know which areas are less safe and to take extra precautions when in that region. It is also crucial for law enforcement to understand the geospatial patterns of crime to know where to allocate resources, and where areas of need exist. Also, if violent crimes are more likely to occur in a certain area, police need to know that in order to keep themselves safe. This report maps the patterns of a select number of crimes in the city of Denver, Colorado. This report is not exhaustive of all crimes in the city, but highlights a few key crimes that both law enforcement and the average citizen would be concerned about. Finally, a small pattern emerges from the data, that region should be studied more by law enforcement.

**Data**

The city of Denver manages an open data catalog[[1]](#footnote-1) of many different topics, one of which is crime. The crime database available to the public contains all of the crime incidents of the last five years that have occurred in Denver, and contains nearly 400,000 entries. Unfortuantely, the dates of the incidents are not included. However, the database is updated monthly, and old entries are removed. This means that the data shows the most recent crimes from the past five years. This is useful for public safety, as it communicates which parts of the city have experienced the most crime recently, within the last five years. The database also suppresses geographic information about all sex related crimes. Becasue of this fact, this report will focus on nonsexual violent crime predominantly, including murders, robberies, and purse theft. This report also includes pickpocketing to help with public safety as well as heroin possession and sale, to glean some insight into drug related crimes in Denver. The data set also included a second index file that defined the offense codes for Denver, which greatly helped with sorting. Apart from the date being excluded, this open database is quite robust and had everything else necessary to complete this project, outside of the boundaries of the city of Denver itself. To obtain the Denver shapefile, the bondaries of the census tracts of Denver were acquired from Koordinates.com.[[2]](#footnote-2) This was a shapefile containing all the census tracts of the city of Denver.

**Methodology**

First, all of the necessary libraries were imported. These included pandas/geopandas, numpy, matplotlib, shapely, and bokeh. Once these were imported, the two main files were read. These were the Denver crime file and the Denver census tract boundary file. The census file had the boundaries of the tracts in a usable state, without discernable errors, so no cleaning was necessary. The crime file had several points that were far outside Denver’s city limits and needed to be removed. A for loop read each line of the crime database and an if statement found the rows that had latitude or longitude outside Denver and removed those rows. Once the loops had finished, there were a seven lines that still were outside of Denver, those were removed as well by gpd.drop([row-number]).

With the data cleaned, now it needed to be sorted. In the crime database, each incident had its corresponding offense code as its own column entry. This made sorting quite easy, as the rows containing the correct crime could be extracted and then mapped. For example, in Denver, murders are codes 902 through 912. A for loop read line by line, and an if statement extracted all lines that had codes 902 through 912. This produced a data frame of only murders. The geographic points of the all the murders were then overlaid, over the census tract data, forming a map. This process was repeated for each crime that was selected. Further, this same method can be repeated for any set of offense codes that one would like to study. One could look up an offense code in the index file and extract the incidents of that crime to make a map. This index document is also included with the other necessary documents. The maps were saved as .png files and are inserted into this document in the following section.

Finally, the last step was to produce an interactive bokeh map so that census tracts could be easily identified by mousing over them. As it is an .html file, the interactive map could not be inserted into Microsoft Word properly but is included alongside the files. It was used in creating this report in order to properly and easily identify the census tracts.

**Results**

A map of denver murder

Description automatically generated The first map produced was a map of all the murders that have taken place within the city of Denver in the last five years. The murder incidents were extracted by the offense code as described above. Codes 902 through 912 were selected and are defined as follows: 902:Homicide by family member, 903:Homicide by stranger with gun, 904:Homicide by stranger with weapon, 907:Homicide of Police Officer with gun, 908: Homicide of Police Officer with a weapon, 910:Homicide by negligence, 911:Homicide by gun, 912:Homicide by other means. There were significantly fewer murders in the southeastern quadrant of the city than everywhere else. The cluster in the central tracts of the city will begin a pattern of many crimes occurring around there in census tracts 16, 17.01, 17.02, 17.03, 24.02, 24.03, 26.01, and 26.02.

A map of denver with numbers

Description automatically generatedA map of denver purse theft

Description automatically generated The next map produced was a map of all the robberies in Denver. This map comprises offense codes 1201 through 1212. This map is only robberies, not burglaries. Robberies are typically considered violent, burglaries, nonviolent. From this map it was made clear that there were many more robberies in Denver over the last five years than murders. There were enough robberies that a discernable pattern cannot be easily seen, as robberies took place throughout the city.

A much more readable map was produced as an offshoot from the previous robberies map. One type of robbery, offense code 1210 is Forcible Purse Snatching. This does not happen as frequently as other forms of robbery and it is very useful to know if there is a geospatial pattern for this crime. People need to know if certain streets/neighborhoods are unsafe to walk through due to purse robbers. The biggest cluster of purse thefts was found in the same tracts that had a large cluster of murders. Once again census tracts 16, 17.01, 17.02, 17.03, 24.02, 24.03, 26.01, and 26.02 form a cluster of points. Performing a table sort showed that some of these tracts are some of the most populated in the city, or A blue map with red dots

Description automatically generatedadjacent to them, so it is not surprising that a lot of the crime occurs here.

Another crime that is related to theft is pickpocketing. In Denver this is offense code 2301. Pickpocketing, (or pocketpicking as the database calls it) is classified as larceny, as opposed to robbery or burglary. Larceny is also considered nonviolent, like burglary. Whereas burglary focuses on the unlawful entry of a property, larceny focuses on how the thief takes from a person, without means of force. Again, the biggest cluster by far is in the populated tracts in the center of the city. When a tract is less densely populated, incidents of pickpocketing seem to diminish greatly.

A map of denver with red dots

Description automatically generatedMoving on from theft related crimes to drug related crimes, the last two maps are maps of heroin possession incidents, and heroin sale incidents. Heroin possession is offense code 3512, and selling Heroin is offense code 3510. The largest cluster of possession incidents can be seen once again in the densely populated city center, but a few other clusters emerge as well. The western half of the city has significantly more incidents of possession of Heroin than the eastern half. However, there are still incidents in the east especially the southeast which had fewer incidents of crime relative to A map of denver with red dots

Description automatically generatedother areas. There still is less in the east, but there is a notable cluster in tracts 51.02, 51.04, and 155.

The final map is a map showing the incidents of selling Heroin. This map has less points than the previous, but it does follow the patterns seen in the possession map. The largest cluster is in the city center, with many points in the west, as well as a few in the southeast.

**Conclusion**

The overall conclusion from these maps is that more densely populated areas can frequently experience more crime than other areas of a city. Purse theft and pickpocketing maps in particular can help people identify areas where more caution needs to be taken. The biggest limitation was that there were no dates tied to these crime incidents. Without dates, tracking trends and when crimes occur throughout a city is impossible. With the current database, the next steps would be to track the different drug related crimes by the type of drug to see if any noteworthy patterns develop. There may be different patterns depending on the drug. A big thank you to the city of Denver for making this project possible, and open data is a great public service for a city, hopefully more cities will adopt this if they have not already.

**References**

Denver Census Tract Shapefile - *Koordinates*, koordinates.com/layer/101892-denver-colorado-census-tracts-2010/. Accessed 4 Aug. 2024.

Denver Crime Data - “Open Data Catalog.” *Open Data Catalog*, opendata-geospatialdenver.hub.arcgis.com/. Accessed 4 Aug. 2024 via Kaggle at https://www.kaggle.com/datasets/paultimothymooney/denver-crime-data

1. “Open Data Catalog.” <https://opendata-geospatialdenver.hub.arcgis.com/> [↑](#footnote-ref-1)
2. *Koordinates*, koordinates.com/layer/101892-denver-colorado-census-tracts-2010/. Accessed 4 Aug. 2024. [↑](#footnote-ref-2)