Crime in NYC

City Challenge Week - Group 11

Before December 30, 2015 the New York Police Department (NYPD) collected and released felony crime statistics to the public, aggregated by police precinct numbers. Because the average citizen is unaware of the police precinct that corresponds to their neighborhood, this data had little utility. After releasing felony crime data on an incident level in December 2015, the NYPD created immense opportunity for citizens to analyze on a more granular level the prevalence of crime by neighborhood. Rather than aggregating data by precinct number, the new data sets provide exact geolocations of crimes and time information that can be clustered by specific neighborhoods.

The objective of this project is to perform spatio-temporal analysis and visualization on the NYPD major felony crime data, identify trends, and make recommendations for further study of the data sets used. The following analysis will focus on six of the seven major felony crimes recorded by the NYPD. Geolocation of the seventh felony, rape, was not released to protect the privacy of the victim.

The data released by the New York Police Department (NYPD) provides geolocation, time, and categorical data for the six major felonies: *Murder*, *Robbery, Felony Assault, Burglary, Grand Larceny, and Grand Larceny of a Motor Vehicle (GTA)*. In the first three quarters of 2015, there were 72,215 reported major felonies in New York City: Grand Larceny (29,337), Grand Larceny of a Motor Vehicle (5,357), Felony Assault (14,538), Robbery (12,072), Burglary (10,663), and Murder (247).
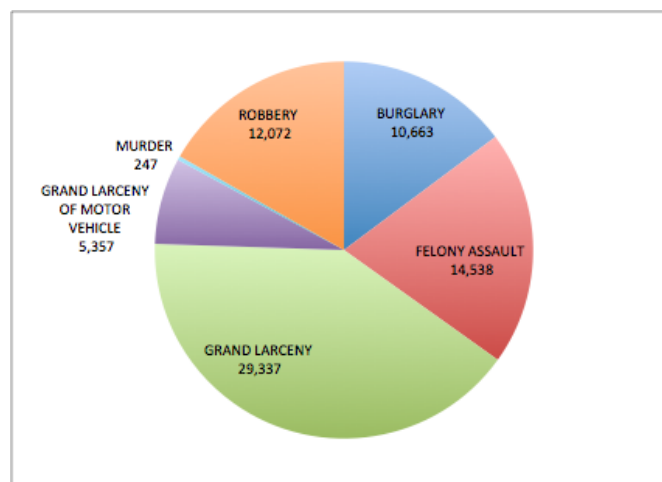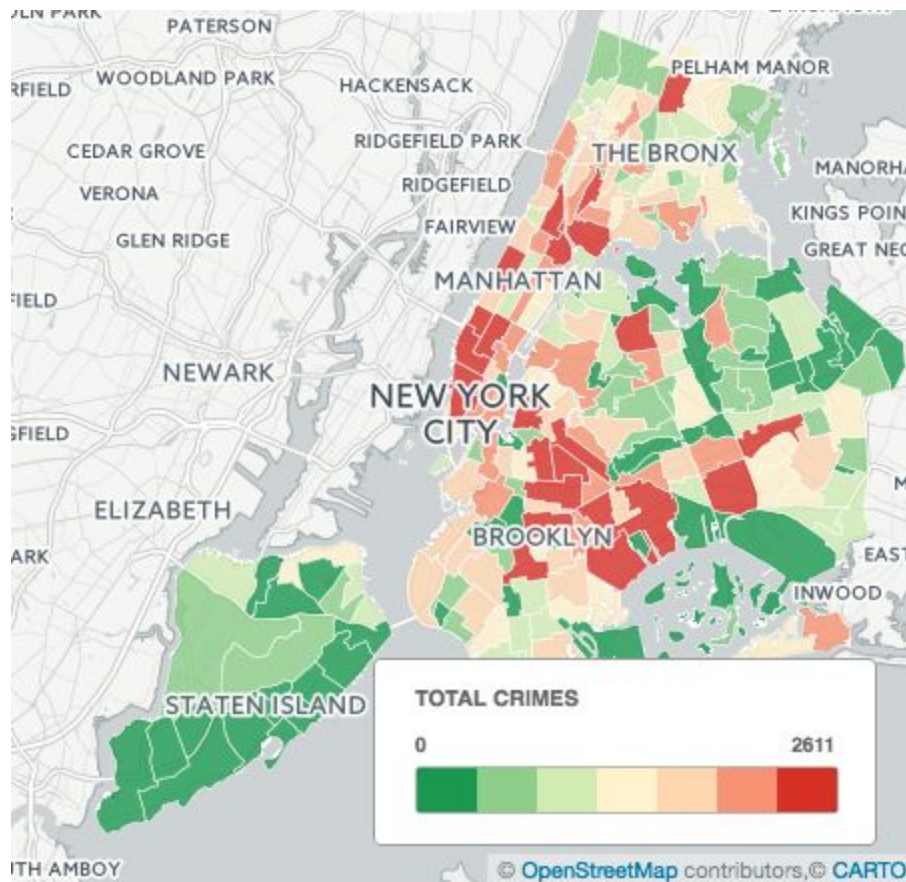

Figure 1. Pie chart showing the proportion of each major felony as it relates to the total number of 72,215 six major felony incidents.

Crime By Neighborhood

With the assistance of the Neighborhood Tabulation Areas (NTAs) contained in the U.S. Census data, felony crime geolocations, provided by the NYPD, can be mapped to specific neighborhoods for the first time.
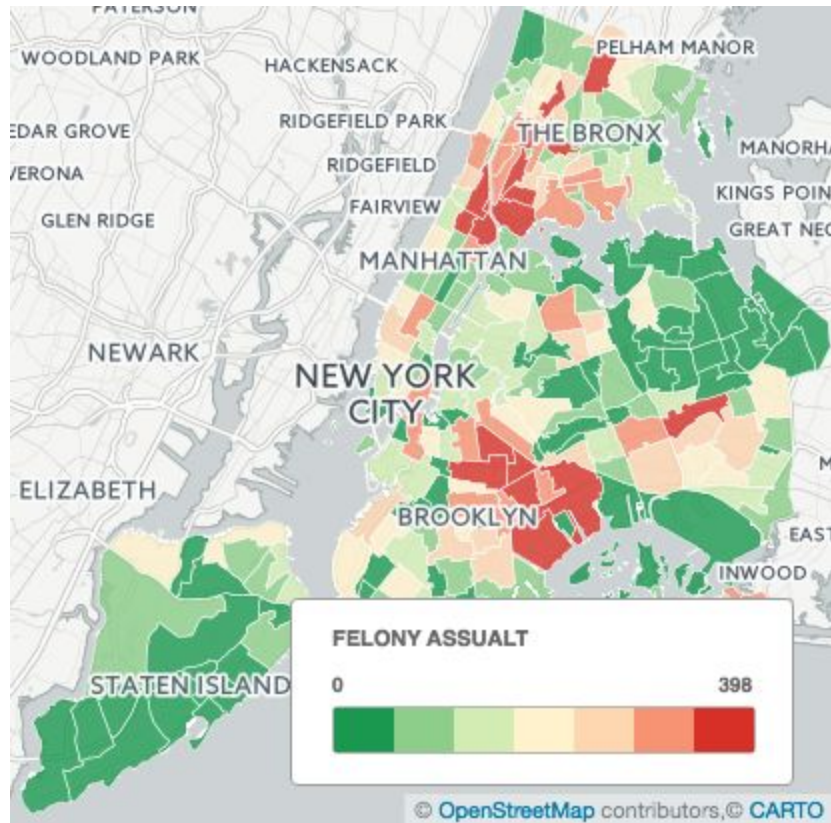
Map 1. Display of all neighborhoods and the prevalence of crime, by color.

Most crime is located in Manhattan and north of Brooklyn. More specifically, the neighborhood with the fewest reported number of felony incidents was 'Lindenwood-Howard Beach' with 29 incidents, while the 'Midtown-Midtown South' neighborhood reported the highest number of felony incidents with 2,611 incidents.

Neighborhood	# of Felony Incidents
Lindenwood-Howard Beach	29
Starrett City	34
Arden Heights	37
Crown Heights North	1,467
Hudson Yards-Chelsea-Flatiron-Union Square	1,484
Midtown-Midtown South	2,611

Figure 2. The neighborhood with the fewest reported incidents was 'Park-cemetery-etc-Staten Island' and the neighborhood with the most incidents was 'Hudson Yards-Chelsea-Flatiron-Union Square.'

It is also worth noting that the geographic distribution varies with crime type. The above map shows locations of all crime. However, if we plot only felony assault locations, we find that while northern Brooklyn is still a hot zone, Manhattan now appears safe.

Map 2. Display of all neighborhoods and the prevalence of felony assault crime, by color.

Weather and Seasonal Analysis

Utilizing historical data from Weather Underground, felony crime incidents were analyzed according to the average temperature of the day on which they occurred. In the Bronx, felony assault peaked when temperatures reached 70°F. In Brooklyn and Staten Island, grand larceny of a motor vehicle peaked when temperatures reached 80°F. In Manhattan, grand larceny of a motor vehicle peaked when temperatures reached 70°F.
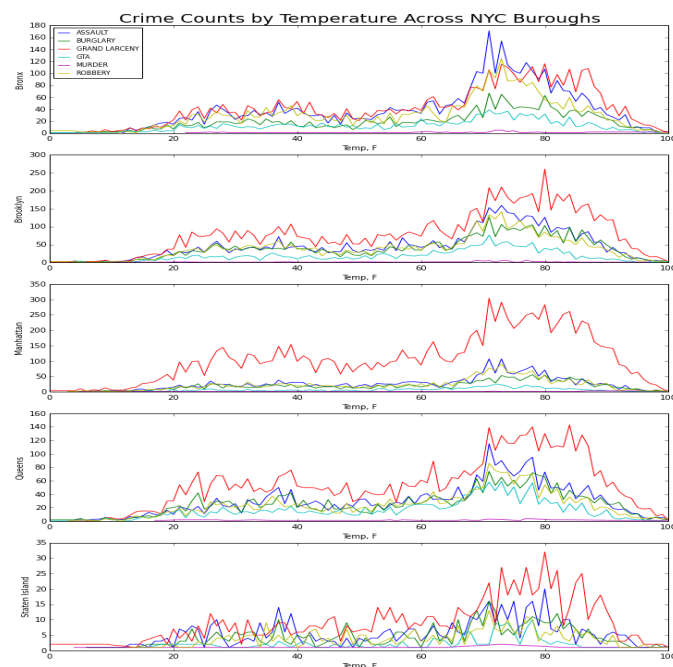

Figure 3. Felony crime incidents by temperature across NYC boroughs.

Across boroughs, felony crime incidents peaked between the months of May and August.
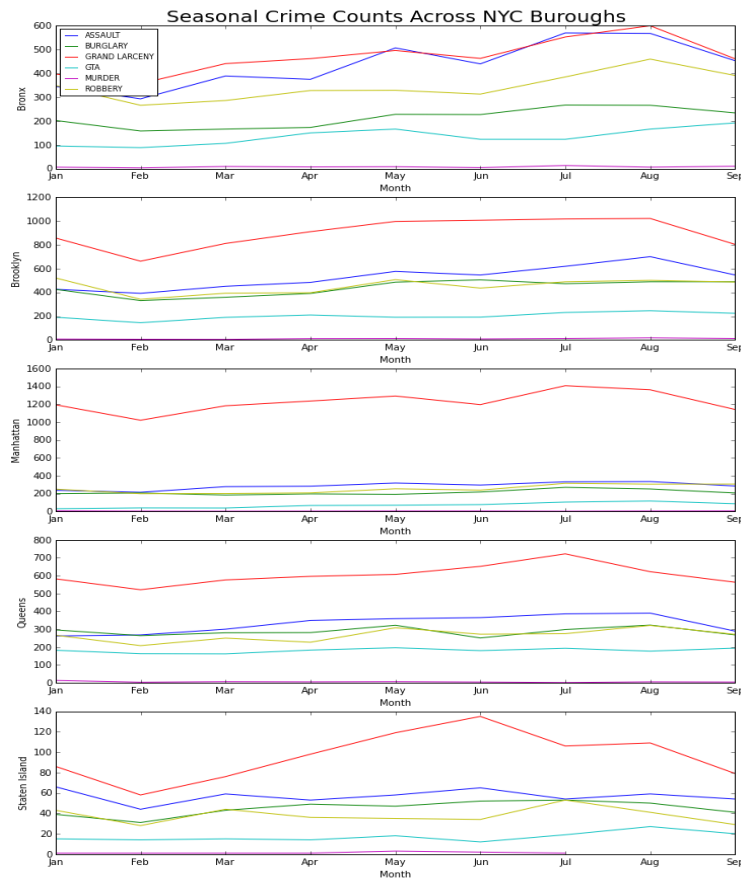

Figure 4. Felony crime incidents by month across NYC boroughs.

Time Series Crime Analysis

Across boroughs, grand larceny of a motor vehicle consistently peaked around 12PM and remained elevated throughout the afternoon. The Bronx had a significantly higher occurrence of felony assault incidents after 8PM through to 5AM.
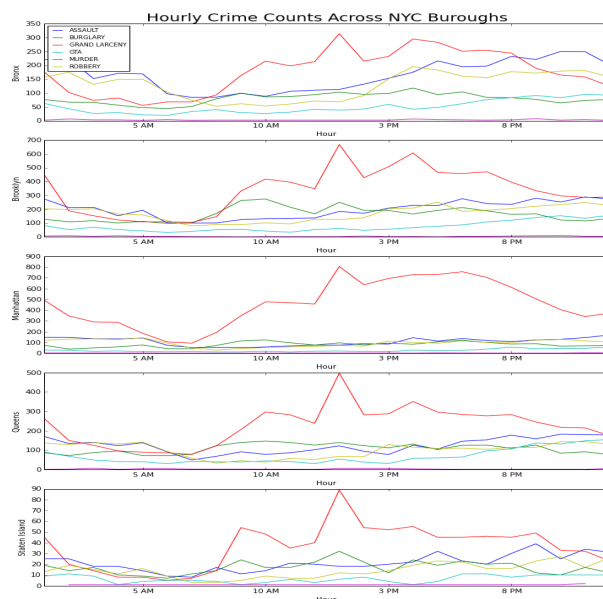

Figure 5. Felony crime incidents by hour across NYC boroughs.

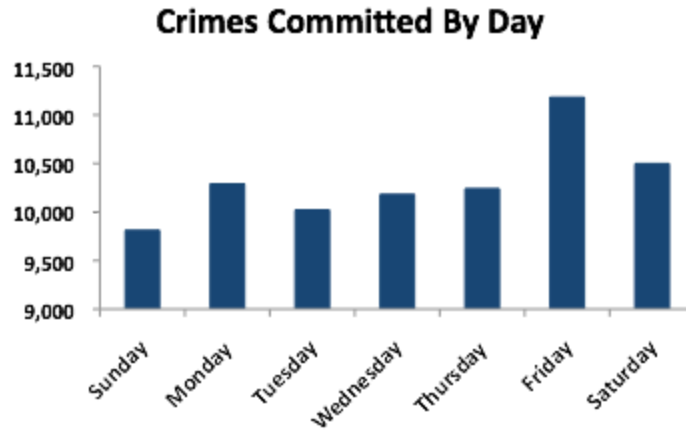Friday and Saturday recorded the most crime incidents by day of the week.

Crimes Committed By Day

Figure 6. Felony crime incidents by day of the week.

Crime Metric

$$C(x, y) = \sum_{j=1}^{6} \gamma_j \sum_{i=1}^{n} \sqrt{(x - x_{ji}^{(c)})^2 + (y - y_{ji}^{(c)})^2}$$

The occurrence of crimes in a particular area given the x- and y-coordinates of that area can be measured by first calculating the distance from that area to all crimes that have occurred in the past. Here, $x_{ji}^{(c)}$ and $y_{ji}^{(c)}$ represents the location of past crime j , where $i = 1, ..., n$ represents a particular crime and $j = 1, ..., 6$ represents the type of crime. This distance is then multiplied by a set of weights γ_j before summed to arrive at a metric value C, where the bigger the value of C, the lower the occurrence of crime in that area.

Conclusion

The release of incident level data by the New York Police Department significantly improved the utility of crime data to the average citizen. In contrast to previous crime stats, the 2015 release allowed for citizens and data analysts alike to engage with the NYPD felony data on a much more granular level. With geo locations and time data, major felony crimes in New York City can now be mapped to specific neighborhoods, blocks, and county districts, no longer just police precincts. Upon exploring the data, it is shown that Manhattan contained the neighborhood that recorded the highest count of any incident, most crimes were committed during the evening and early morning, over the weekend, and during the summer months.

To create a more holistic perspective of major felony crimes committed across New York City, data would need to be improved in the following ways: robust crime and weather data to represent the entire calendar year, representation of rape crimes, geo-spatial socio demographic data to understand neighborhood populations. In obtaining a more developed perspective of the data, there is potential to create an urban crime metric to assess risk of each neighborhood.