1. Introduction

1.1 Background

Safety is one of the top considerations when deciding where to rent a house or purchase a property. It is important for a business owner to be aware of the safety concerns in a neighbourhood before making the decision to open a business in that neighbourhood.

Moving into an unsafe place could cost families or businesses a lot of money or even harm to staff or family members. The aim of the project is to analyze crimes committed in neighborhood in Toronto, Ontario. The project will categorize the types of crime that were committed in the different places and rank the places based on how dangerous they are. The project will analyze trends of these crimes from year 2014 till 2018.

This report will be valuable to people who are moving into the city. This will help serve as a caution to people who are looking to rent apartments within the city, safety is a subject to be considered when moving to a new location. It would be valuable to know how safe a place is before moving in or at the least, to be aware of the criminal activities that could happen in such location.

1.2 Problem

Safety is a subject to be considered when moving to a new location. It would be valuable to know how safe a place is before moving in or at the least, to be aware of the criminal activities that could happen in such location. The project will analyze crimes from year 2014 till 2018 in some neighbourhood in Toronto. The aim of the project is to rank how dangerous these neighbourhoods, thereby serving as caution to people who might want to move into these places in the future.

2. Data acquisition and cleaning

2.1 Data sources

This data was provided by the Toronto Police Service. The dataset includes all Major Crime Indicators (MCI) 2014 to 2018 occurrences by reported date and related offences. The Major Crime Indicators categories are Assault, Break and Enter, Auto Theft, Robbery and Theft Over (Excludes Sexual Assaults).

The information provided in the dataset are:

- Occurrence Date: This is the date the incident occurred.
- Reported Date: This is the date the incident was reported to the police.
- Year: The year when the incidence happened
- Premise Type: Examples include apartment, outside, house, commercial
- Offence: The type of offence that was committed
- Major Crime Indicators (MCI): The categories where the offences fall
- Neighborhood: This is where the incidence occurred
- Latitude & Longitude: There are approximate locations provided, for the sake of privacy for the people involved.

occurrencedate	reporteddate	premisetype	ucr_code	ucr_ext	offence	...	occurrencedayofyear	occurrencedayofweek	occurrencehour	MCI	Division	Hood_ID	Neighbourhood	Lat	Long
2014-06-20T10:55:00.000Z	2014-06-20T13:20:00.000Z	Apartment	2130	210	Theft Over	...	171.0	Friday	10	Theft Over	D52	76	Bay Street Corridor (76)	43.659229	-79.385193
2014-07-02T00:20:00.000Z	2014-07-02T02:58:00.000Z	Outside	1457	100	Pointing A Firearm	...	183.0	Wednesday	0	Assault	D32	36	Newtonbrook West (36)	43.777592	-79.425400
2014-07-02T00:20:00.000Z	2014-07-02T02:58:00.000Z	Outside	1610	100	Robbery With Weapon	...	183.0	Wednesday	0	Robbery	D32	36	Newtonbrook West (36)	43.777592	-79.425400
2014-07-02T01:30:00.000Z	2014-07-02T05:40:00.000Z	House	2120	200	B&E	...	183.0	Wednesday	1	Break and Enter	D42	132	Malvern (132)	43.801727	-79.210373
2014-07-02T20:52:00.000Z	2014-07-02T20:57:00.000Z	Commercial	1430	100	Assault	...	183.0	Wednesday	20	Assault	D42	130	Milliken (130)	43.835884	-79.254334
2014-07-18T00:01:00.000Z	2014-07-18T17:36:00.000Z	House	2120	200	B&E	...	199.0	Friday	0	Break and Enter	D41	120	Clairlea-Birchmount (120)	43.709972	-79.273819
2014-07-18T23:15:00.000Z	2014-07-18T23:15:00.000Z	House	1430	100	Assault	...	199.0	Friday	23	Assault	D13	31	Yorkdale-Glen Park (31)	43.709179	-79.466019
2014-07-19T01:30:00.000Z	2014-07-19T11:58:00.000Z	Outside	1610	100	Robbery With Weapon	...	200.0	Saturday	1	Robbery	D52	76	Bay Street Corridor (76)	43.655243	-79.386063
2014-07-19T15:00:00.000Z	2014-07-19T22:11:00.000Z	House	2120	220	B&E W'Intent	...	200.0	Saturday	15	Break and Enter	D42	132	Malvern (132)	43.791515	-79.237824

2.2 Data cleaning

There were over 160,000 crimes reported to the Toronto Police Service which were included in this dataset. There were a few columns that were not necessary for this analysis. I had to extract the columns that I thought were needed (reported year, premise type, offence, MCI, neighbourhood name, latitude and longitude).

The neighbourhood names had parentheses with numbers at the end of each name. I stripped the numbers and parenthesis off, as they were considered unneeded.

reportedyear	premisetype	offence	MCI	Neighbourhood	Lat	Long
2014	Apartment	Theft Over	Theft Over	Bay Street Corridor	43.659229	-79.385193
2014	Outside	Pointing A Firearm	Assault	Newtonbrook West	43.777592	-79.425400
2014	Outside	Robbery With Weapon	Robbery	Newtonbrook West	43.777592	-79.425400
2014	House	B&E	Break and Enter	Malvern	43.801727	-79.210373
2014	Commercial	Assault	Assault	Milliken	43.835884	-79.254334

I grouped the data by three fields: Neighbourhood, MCI, Year in order to get the cumulative of the crime types per year per neighbourhood. Then, I created two datasets out of this cleaned dataset:

1. A dataset that contained the total crimes in the different MCIs per neighbourhood per year.

Neighbourhood	Year	Assault	Auto Theft	Break and Enter	Robbery	Theft Over	Total
Agincourt North	2014	72.0	16.0	52.0	35.0	1.0	176.0
Agincourt North	2015	81.0	29.0	57.0	38.0	6.0	211.0
Agincourt North	2016	82.0	17.0	56.0	18.0	4.0	177.0
Agincourt North	2017	69.0	31.0	58.0	24.0	12.0	194.0
Agincourt North	2018	88.0	40.0	71.0	47.0	4.0	250.0
...	...	...	...	...	...	...	...
Yorkdale-Glen Park	2014	106.0	63.0	51.0	23.0	24.0	267.0
Yorkdale-Glen Park	2015	136.0	53.0	57.0	21.0	14.0	281.0
Yorkdale-Glen Park	2016	174.0	41.0	66.0	24.0	26.0	331.0
Yorkdale-Glen Park	2017	161.0	52.0	58.0	34.0	23.0	328.0
Yorkdale-Glen Park	2018	176.0	59.0	65.0	44.0	20.0	364.0

2. A dataset that has a sum of all the crimes committed throughout 2014 to 2018 per neighbourhood.

Neighbourhood	Assault	Auto Theft	Break and Enter	Robbery	Theft Over	Total
Agincourt North	392	133	294	162	27	1008
Agincourt South-Malvern West	580	159	381	148	63	1331
Alderwood	182	84	124	36	34	460
Annex	1523	115	782	314	174	2908
Banbury-Don Mills	398	84	341	70	45	938

The total number of neighbourhoods that were analyzed in this project were 141. The total number of MCIs were 5 namely: Assault, Break and Enter, Auto Theft, Robbery, Theft Over ($5000).

3. Exploratory Data Analysis

3.1 Data Visualization

3.1.1 Trend across years - Line graph

I created a line chart to view the trend of crimes in all the neighbourhoods from the year 2014 to 2018. The overall trend showed an increase in crime rate every year. I divided the dataset into 3 groups: Top 5, Middle 5 and Lowest 5 neighbourhoods with crime.

The Top 5 (Church-Yonge Corridor, Waterfront Communities - The Island, West Humber - Clairville, Moss Park, Bay Street Corridor) kept increasing every year and had steep increase from year 2016 till 2018.

The middle 5 (St.Andrew-Windfields, Greenwood-Coxwell, Englemount-Lawrence, Morningside, Mount Dennis) experienced a rise and fall in crime rates, with the year 2018 almost at par with 2014 but with highs and lows in between those years.

The bottom 5 (Broadview North, Markland Wood, Yonge-St.Clair, Lambton Baby Point, Eringate-Centennial West Deane) experienced highs and lows in crime rate but the rate across the years were lower than the first year (2014). The last year (2018) generally had lower rate compared to 2014.

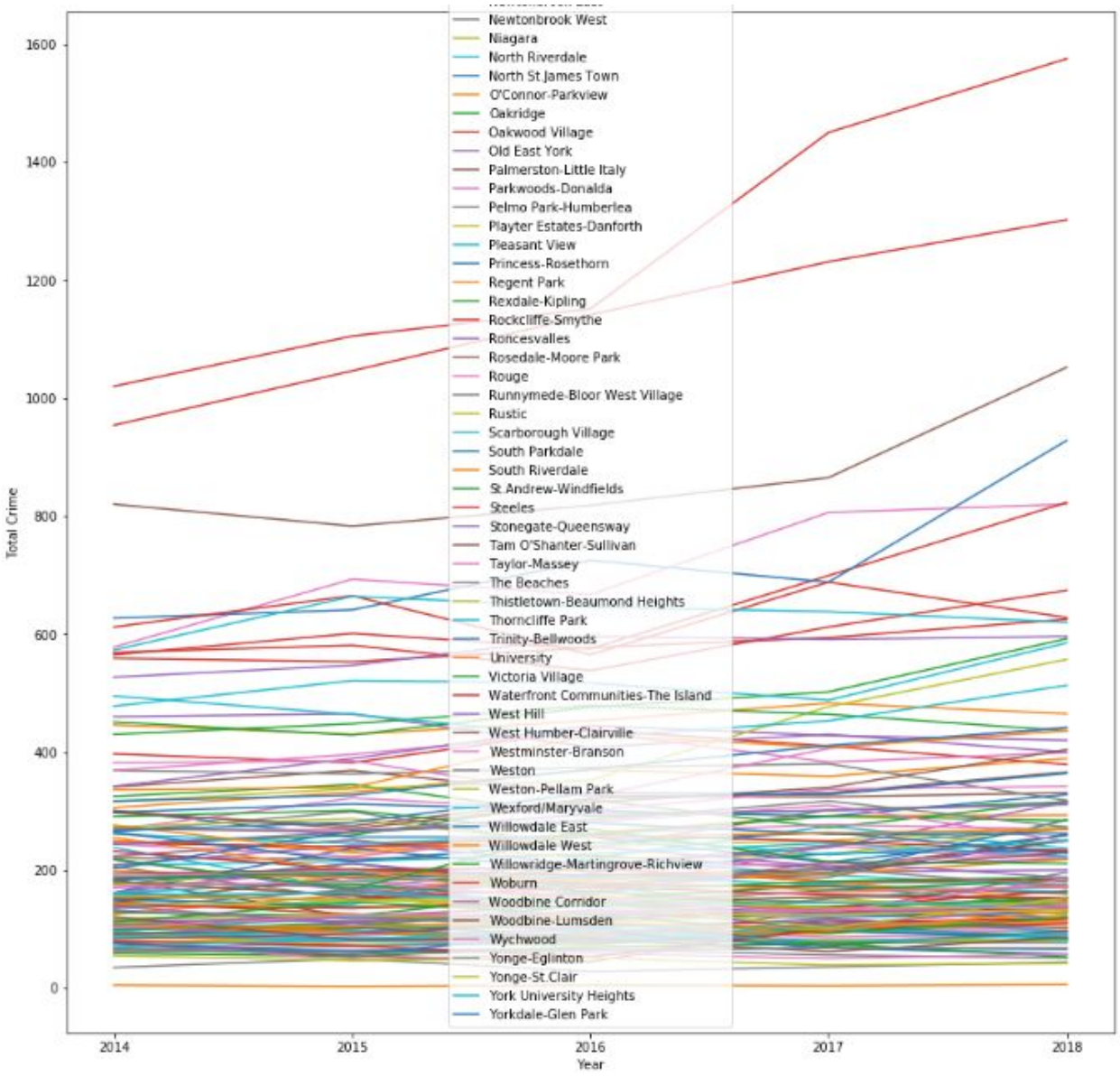


Chart above shows trends for all 141 neighbourhoods

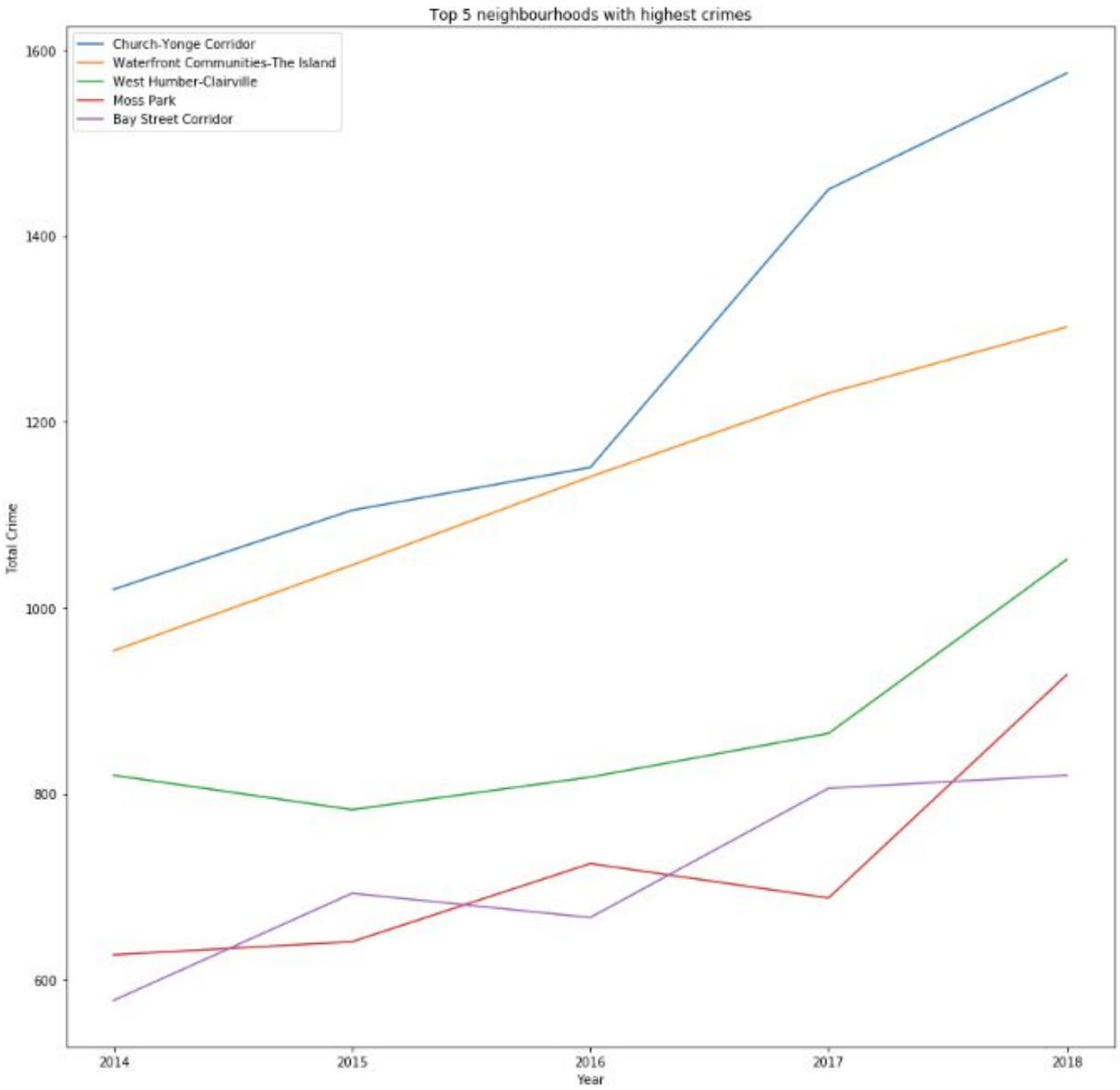


Chart above shows top 5 neighbourhoods with highest crimes

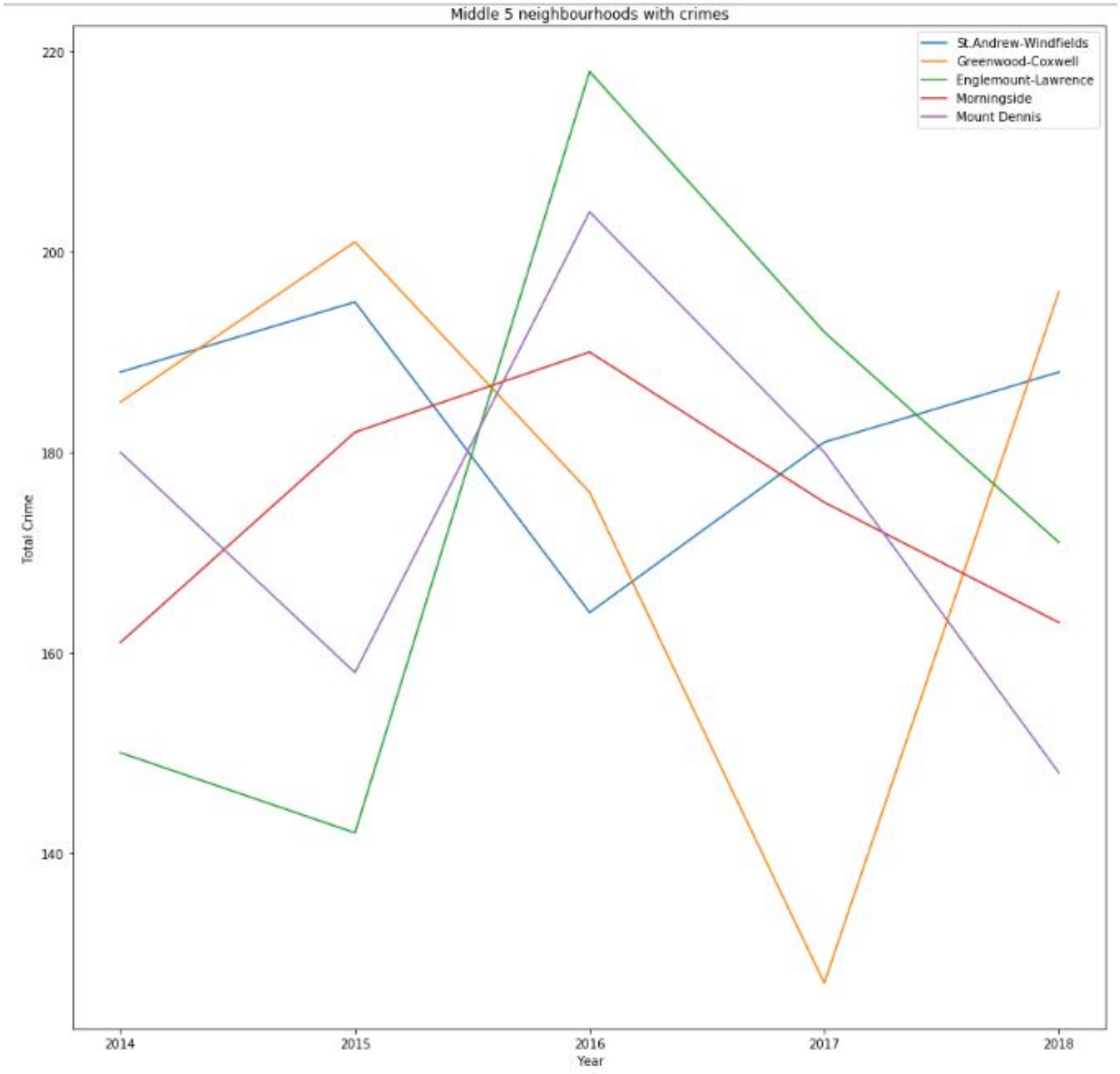


Chart above shows middle 5 neighbourhoods with highest crimes

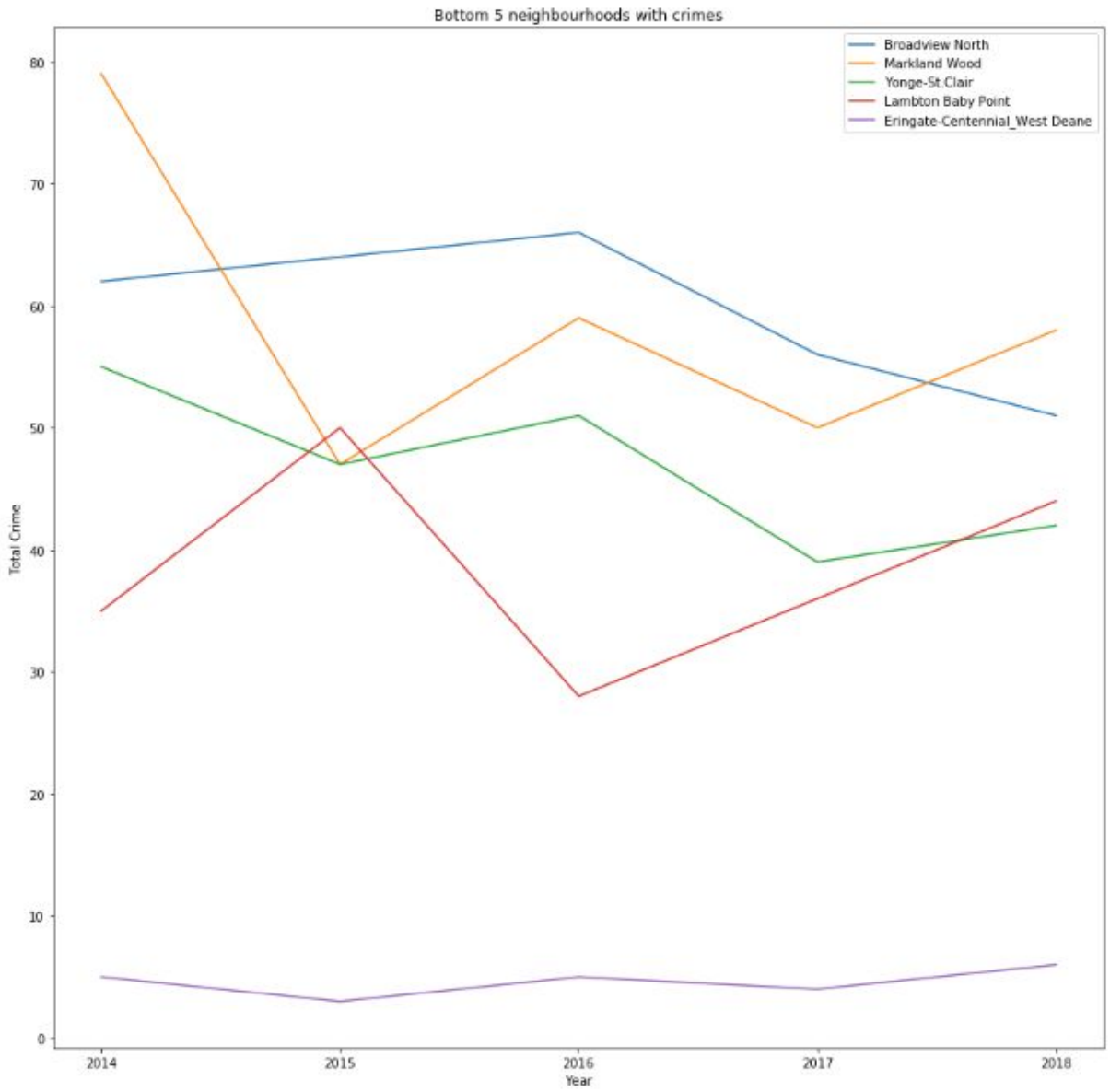
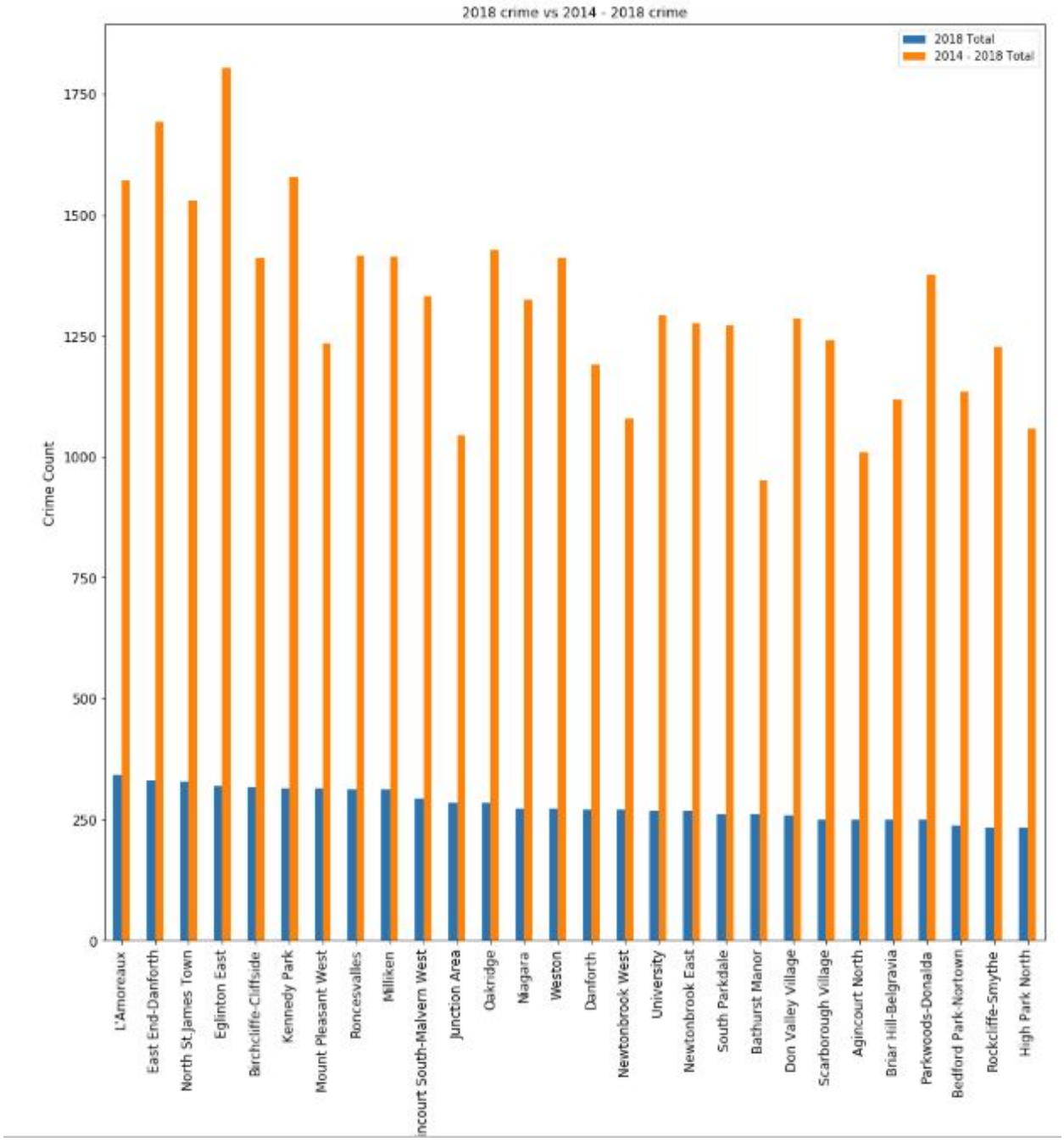


Chart above shows bottom 5 neighbourhoods with lowest crimes

3.1.2 2018 Crime / Total Crime - Bar graph

For every neighbourhood, I compared the 2018 crime against the total crimes from 2014 to 2018, I stored the ratio in the data as a column. The highest percentage was 27.44%, the lowest percentage was 15.42%, the average percentage was 21.19%.

I divided the data into 5 groups of 28 neighbourhoods in descending order of total crime rate. I created a bar graph showing the 2018 rate and sum of all crimes for all the neighbourhoods.



3.1.3 MCI analysis

I took an average of the MCI that were analyzed to see which of the crimes were committed more across the city: The crimes are listed below in decreasing order of occurrences:

MCI (Major crime indicator) across city	Average occurrence
Assault	644
Break and Enter	247
Auto Theft	128
Robbery	128
Theft Over	38

3.1.4 Neighbourhoods with highest crime rates

Comparing all 141 neighbourhoods that were analyzed from 2014 to 2018, the neighbourhoods with the highest crimes were: **Church-Yonge Corridor, Waterfront Communities - The Island, West Humber - Clairville, Moss Park, Kensington-Chinatown.**

Neighbourhood	Assault	Auto Theft	Break and Enter	Robbery	Theft Over	2014 - 2018 Total	2018 Total	2018/Total Crimes %	Lat	Long
Church-Yonge Corridor	4061	200	946	904	190	6301	1575	25.00	43.649132	-79.372192
Waterfront Communities-The Island	3790	245	1074	323	242	5674	1302	22.95	43.638840	-79.400650
West Humber-Clairville	1375	1684	658	376	245	4338	1052	24.25	43.732254	-79.618439
Moss Park	2134	119	632	630	94	3609	928	25.71	43.653381	-79.369148
Kensington-Chinatown	2013	130	627	367	126	3263	823	25.22	43.650673	-79.387512

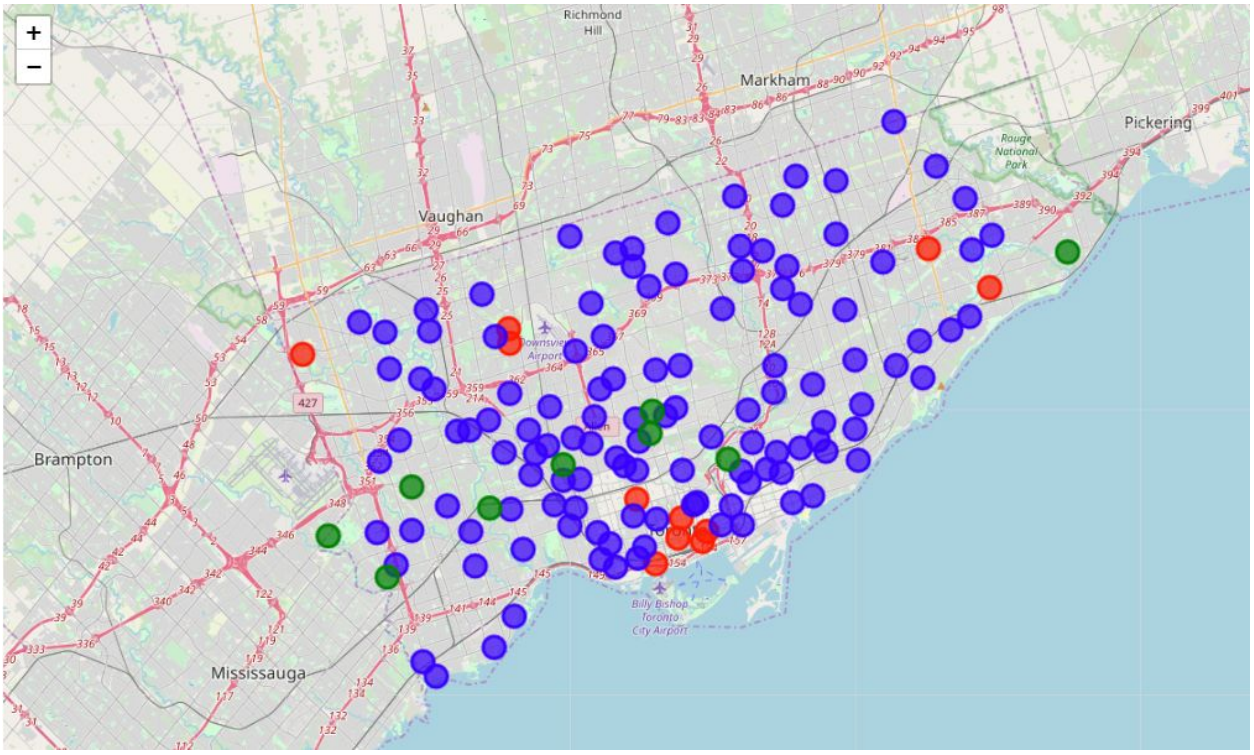
3.1.5 Neighbourhoods with lowest crime rates

Comparing all 141 neighbourhoods that were analyzed from 2014 to 2018, the neighbourhoods with the lowest crimes were: **Centennial Scarborough, Broadview North, Lambton Baby Point, Yonge-St.Clair, Eringate-Centennial_West Deane.**

Neighbourhood	Assault	Auto Theft	Break and Enter	Robbery	Theft Over	2014 - 2018 Total	2018 Total	2018/Total Crimes %	Lat	Long
Centennial Scarborough	185	27	67	25	7	311	53	17.04	43.777874	-79.146729
Broadview North	180	20	70	24	5	299	51	17.06	43.685982	-79.356293
Lambton Baby Point	98	34	46	10	5	193	44	22.80	43.663891	-79.503487
Yonge-St.Clair	113	17	81	8	15	234	42	17.95	43.696976	-79.404060
Eringate-Centennial_West Deane	4	4	9	3	3	23	6	26.09	43.651577	-79.603096

3.16 Neighbourhoods on the map of Toronto

The 141 neighbourhoods analyzed in this project are displayed on the map of Toronto, Ontario. The top 10 neighbourhoods with highest crimes are indicated with red circles, the 10 neighbourhoods with lowest crimes are indicated with green circles and other neighbourhoods are marked with blue circles.



4. Results

141 neighbourhoods were analyzed, the neighbourhoods with the highest crimes were: **Church-Yonge Corridor, Waterfront Communities - The Island, West Humber - Clairville, Moss Park, Kensington-Chinatown.** The neighbourhoods with the lowest crimes were: **Centennial Scarborough, Broadview North, Lambton Baby Point, Yonge-St.Clair, Eringate-Centennial_West Deane.**

5. Discussion

The aim of this project is to analyze the occurrences of crime in the neighbourhoods in Toronto, to find the places with the highest crimes and places with lowest crimes. The result of this project could serve as a guide for someone (personal or commercial) looking to move to one of these places.

When I compared the crime rate in 2018 to the total years that were examined (2014 - 2018), the average percentage was 21%, this means that the crime rate was balanced through the years because 5 years were analyzed.

However, the neighbourhoods with high crimes had increasing crime rate across the years. The neighbourhoods in the middle on the scale had rise and fall in crime rates through the years. The neighbourhoods at the bottom had a more constant increase across the years.

The top 3 crimes committed across the neighbourhoods in descending order were: **Assault, Break and Enter, Auto Theft**. These are crimes that the city might want to pay close attention to.

6. Conclusion

This project sheds more light into the crimes that are being committed in the different neighbourhoods across the city, which could possibly help a visitor or immigrant determine where to stay or rent. Safety is of utmost concern in determining where to live or establish a business. It is good to see how technology could help us make better or insightful decisions.

The future of this project is to examine the conditions of living in these neighbourhoods. Looking closely into job opportunities, proximity of police station, level of education etc. In depth study could help us determine the reasons behind the findings from this analysis.