Analysis of Major Crimes in Toronto And Suggestions on How to Protect Ourselves

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Safety is one of the most important factors that people consider when deciding where to live and go. This report uses data from Open Data Toronto to analyze the occurrences of various types of crimes in different regions of Toronto, as well as the trend over the past ten years. The result shows that Downtown Toronto and evenings have a relatively high occurrences of crimes, which could be used as a suggestion on both individuals and government dicision-making.

Introduction

On Dec 25th, 2023, the Christmas Day, a news has raised huge concerns among people — a man was seriously injured after stabbing in downtown Toronto. This was not the first such incident on that block in December; unfortunately, such distressing news has become more and more prevalent nowadays. As the pandemic comes to an end, there is a noticeable increase in people returning to the office and going out more frequently than in previous years. Naturally, public safety has become particularly crucial, prompting a crucial question: How can we proactively prevent such incidents from affecting ourselves and our loved ones?

Providing information like location and crime types, major crimes statistics is an important tool for resource allocation and law enforcement strategy. It also provides the public a clear picture of the safety, which helps individuals make informed decisions, influence choices such as where to buy a house.

For this paper, I will use open-access data from the OpenDataToronto (Gelfand 2022) to analyze major crime patterns over the years and how ordinary citizens could do to reduce the likelihood of getting hurt. In addition, I will discuss how funding could be allocated for higher efficiency and potential bias in crime data. In this paper, I discuss the data in Section 2, including data source and software (Section 2.1), data collection (Section 2.2), data analysis and visualizations (Section 2.3). In Section 3, I conclude that….

Data

Data Source and Software

The data utilized throughout this paper, in csv format, is obtained from Toronto Police Services on the City of Toronto Open Data Website (Gelfand 2022), with the title "MAJOR CRIME INDICATORS".

This dataset will be processed and analyzed in the open source R (R Core Team 2022) using packages Dplyr (Wickham et al. 2022), Tidyverse (Wickham et al. 2019), Here (Müller 2020), Leaflet (Cheng et al. 2023), and Janitor (Firke 2021). Visualizations including tables and figures will be created using ggplot2 (Wickham 2016) and Knitr(**Knitr?**).

Data Collection

The dataset contains all Major Crime Indicators occurrences by report data. The categories of major crimes are Assault, Break and Enter, Auto Theft, Robbery and Theft Over. The latest refresh was on Jan 11, 2024.

There are two factors that may influence the reliability of the data. First, this dataset includes all occurrences reported to the Toronto Police Station, except those have been considered as unfounded. Second, this data is provided at the offence and victim level, so one occurrence number may have a few rows of data with different major crime indicators types used to categorize the occurrence.

Data Analysis and Visualizations

The Major Crimes in Toronto dataset contains 27 columns and 372899 rows, including the repeated occurrences with different crime categories. All the samples of major crimes were reported from 2014 to 2023. Among 27 columns, the variables I will use are x_id, report_year, occ_year, occ_month, occ_dow (Day of the Week Offence Occurred), occ_hour, mci_category, division. I will create two more variables, division_area, which classifies 18 police divisions (including a NSA) into 6 regions of Toronto (including Other for NSA), and weekend_weekday, which indicates whether the occurrence happen on a weekday or a weekend.

Table 1: The Number of Major Crimes and the Month with the Most Crimes (2014-2023)

Year	Total Number of Crimes	Month with the Most Crimes
2014	32477	October
2015	32938	August
2016	33654	July

Year	Total Number of Crimes	Month with the Most Crimes
2017	35547	July
2018	37545	October
2019	40098	July
2020	35196	July
2021	34777	October
2022	41299	October
2023	47833	August

Table 1 provides a brief summary of the total number of crimes from 2014 to 2023. Over this period, the overall number of crimes shows a consistent increase, except for the years 2020 and 2021, which have a decline probably due to the impact of the pandemic. However, in 2022 and 2023, there is a significant increase by more than 6000. In each year, the month with the highest number of crimes tends to be either July, August, or October, concentrating primarily in the summer-fall period.

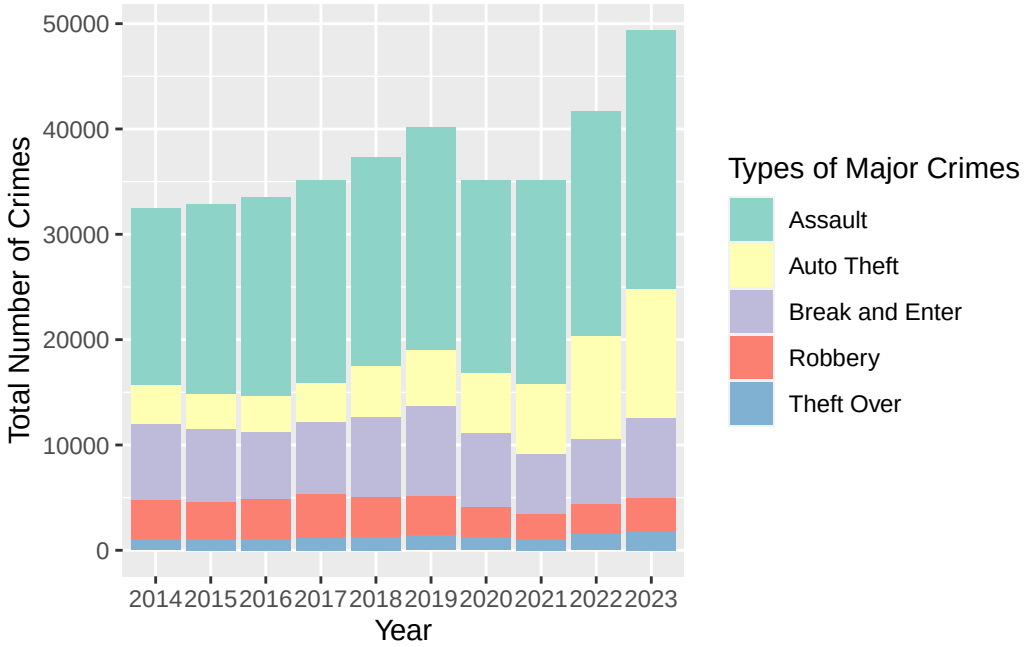

Figure 1: The Number of Crimes Reported, Classified by Crime Types (2014-2023)

Figure 1 visualizes the annual distribution of major crime types with five categories: Assault, Break and Enter, Auto Theft, Robbery, and Theft Over. Across all years, 'Assault' records the highest count, followed by 'Break and Enter' and 'Auto Theft'. 'Robbery' and 'Theft Over' show comparatively lower numbers. Notably, there has been a slight decrease in "Break and Enter" since the pandemic, and an obvious increase in 'Auto Theft' during 2022 and 2023,

leading 'Auto Theft' surpassing the number of 'Break and Enter'.

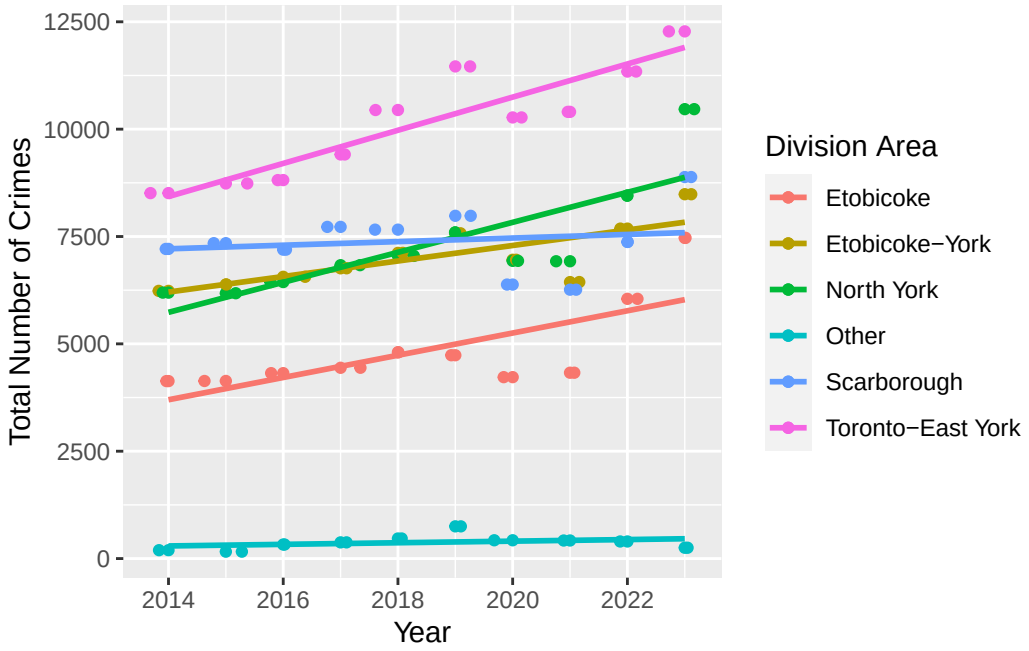

Figure 2: Total Number of Crimes in Different Police Division Areas

There are 18 police divisions, which are D11, D12, D13, D14, D22, D23, D31, D32, D33, D41, D42, D43, D51, D52, D53, D54, D55, and NSA. Putting them into 6 regions based on geographical location, Etobicoke-York, Etobicoke, North York, Scarborough, Toronto-East York, and other for NSA. Based on Figure 2, Toronto-East York reports the highest amount of crimes, and Etobicoke-York has the lowest. North York, Scarborough, and Etobicoke-York have similar numbers, but the rate of increase in North York is higher than that observed in the other two.

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Figure 3 indicates the preferred time for committing crimes. The graph reveals a higher likelihood of criminal behaviors during the evening, with occurrences steadily increasing as the night progresses towards midnight and afterwards, the occurrences decrease until six in the morning. Interestingly, there is a surprising local peak at noon, while 11:00 and 13:00 do not show a high probability.

Conclusion

In summary,

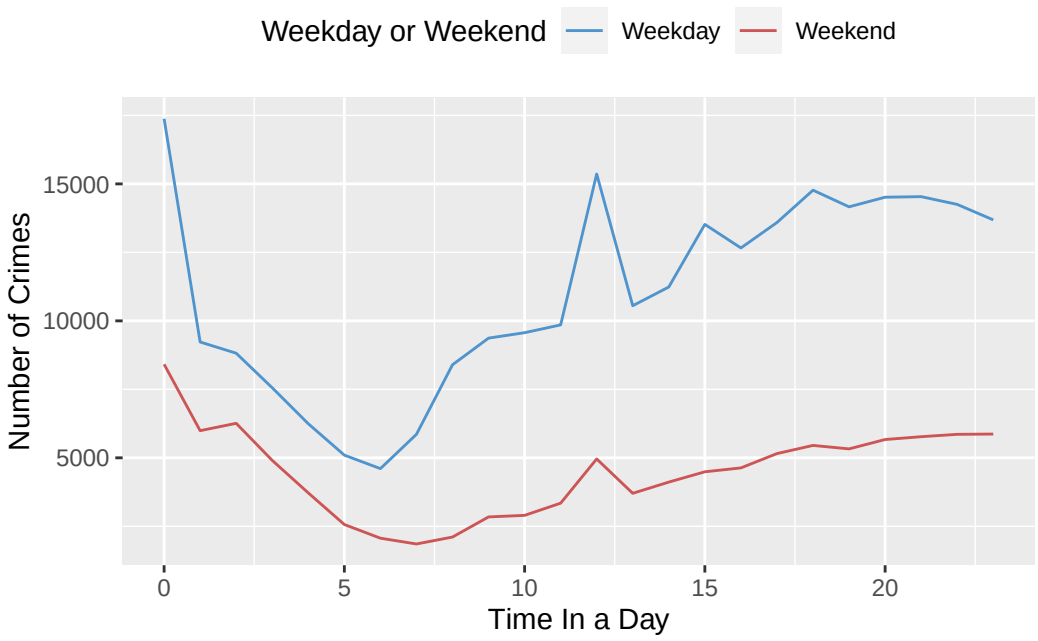

Figure 3: Number of Crimes in a Day

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