

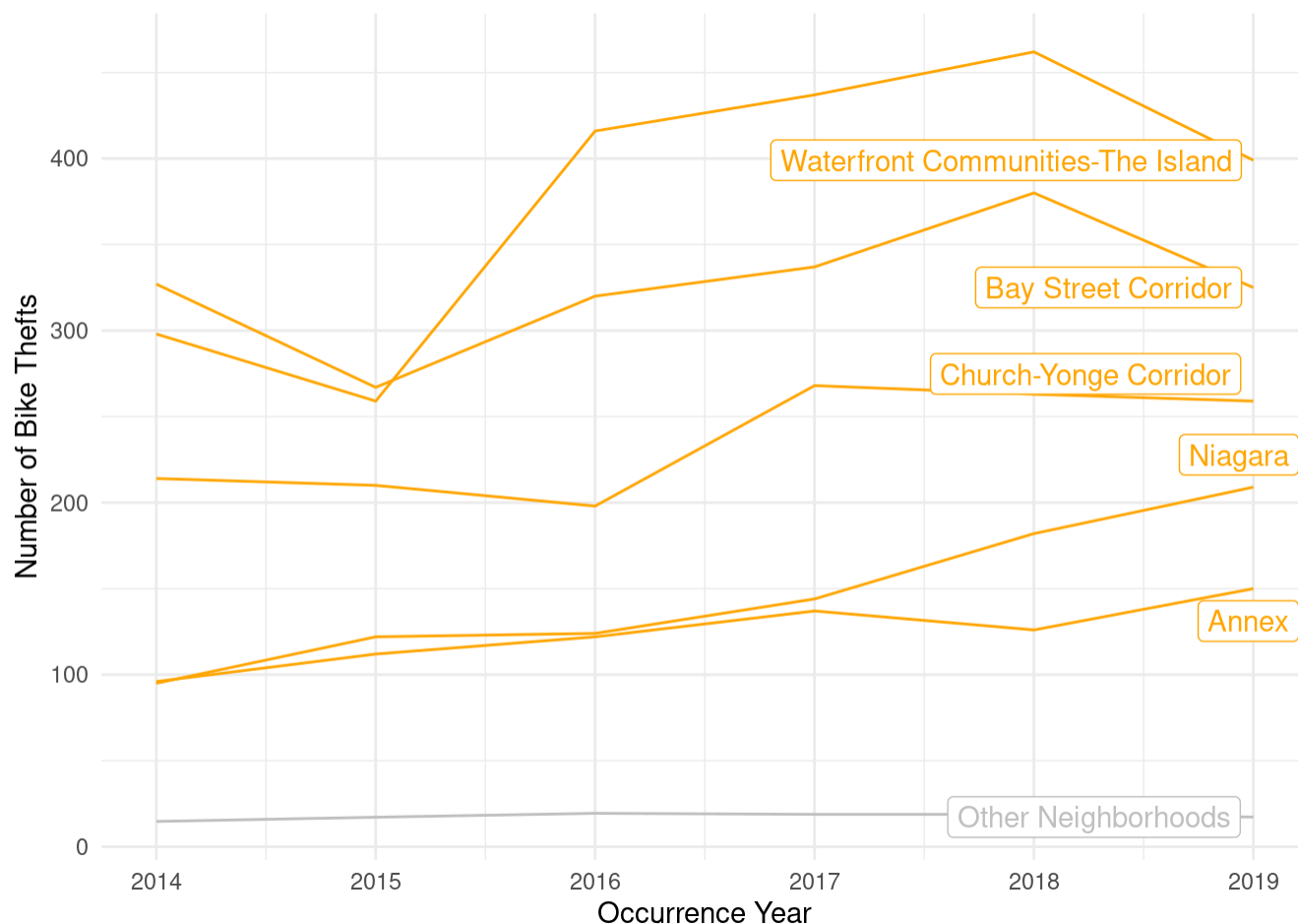
Bike Features of Most Frequently Occurred Bike Thefts

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Introduction

These years, Toronto bicycle theft has aroused a lot of attention in recent years due to its negative influence on the sustainable transportation mode. The present research brings attention to this issue by analyzing the multifaceted problem of bicycle theft in Toronto, Ontario, Canada. A survey data set with over 20,000 records was released by the Toronto Police Service Public Safety Data Portal for this purpose. This report tries to understand bicycle theft through answering the questions “who are theft-risky neighborhoods”, “when do theft most frequently happen”, “how does the chance of being stolen differ in premise types, and” which are the features of thieves’ target bicycles”. Insights drew from this study can help the government, policy makers better understand the bicycle theft development in Toronto and give the residents, general public suggestions on reducing their bicycles’ risks of being stolen.

Top 5 Toronto Neighborhoods Who Have Greatest Amount of Bike Thefts



One interesting insight we want to see at first is that if certain neighbourhoods have significantly more occurrences throughout the four years, and thus we could make other analysis based on that. We first generated distribution of bike thefts amount by year by each neighbourhood, and there are five neighborhoods stood out.

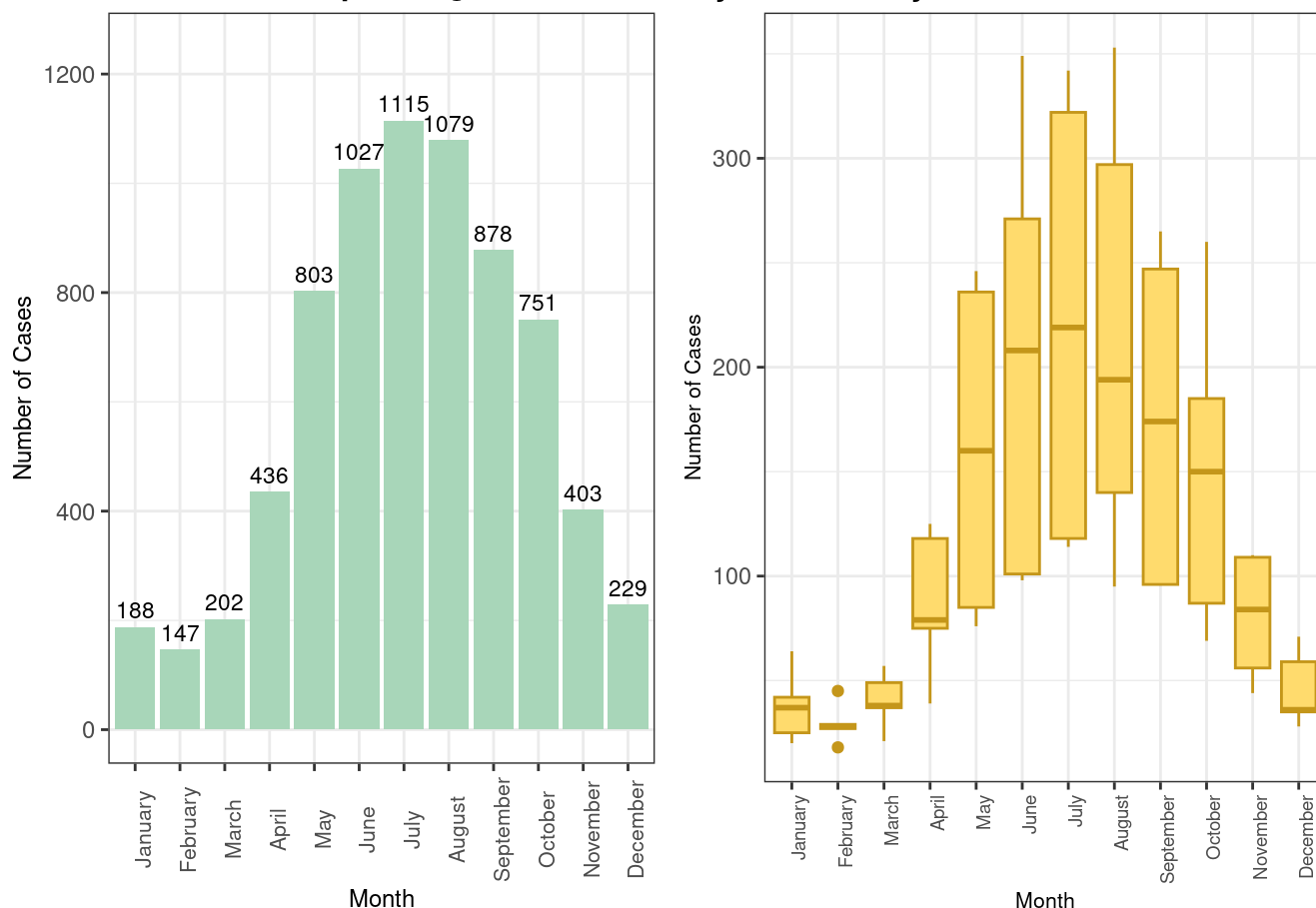
Then visualization 1 was created, which highlights the five communities and compares to mean of occurrence of bike thefts in other neighbourhoods as well. Here we didn't plot all the other neighborhoods one by one since we want to make the graph maintain high discriminability and separability. From the visualization, we could observe the five neighborhoods have constantly large amount of bike thefts from 2014-2019. And based on some simple calculations, we could see that the top 5 neighborhoods contributed 29.5%, 31%, 34%, 35.8%, 36.5% of overall occurrences in each year from 2015 to 2019, which emphasizes again the following analysis have more meaningful and helpful conclusions and suggestions for cyclists living in these five regions.

Due to lack of bike thefts data from 2020-2022, the top five neighborhoods may change over time, and the analysis somewhat lacks timeliness. It can be improved by collecting most recent data or predicting data based on existing ones.

After pinning down to these significantly bike thefts occurred regions, we want to figure out if bike thefts occurred more in certain months.

Month-by-month Trend across Top 5 Neighborhoods

Top 5 Neighbourhoods Bicycle Thefts by Month



In the previous section, we identified the top 5 neighborhoods with the highest bike theft rates. In this section, we want to reveal the months and seasons with the highest theft rates based on the top 5 neighborhoods with

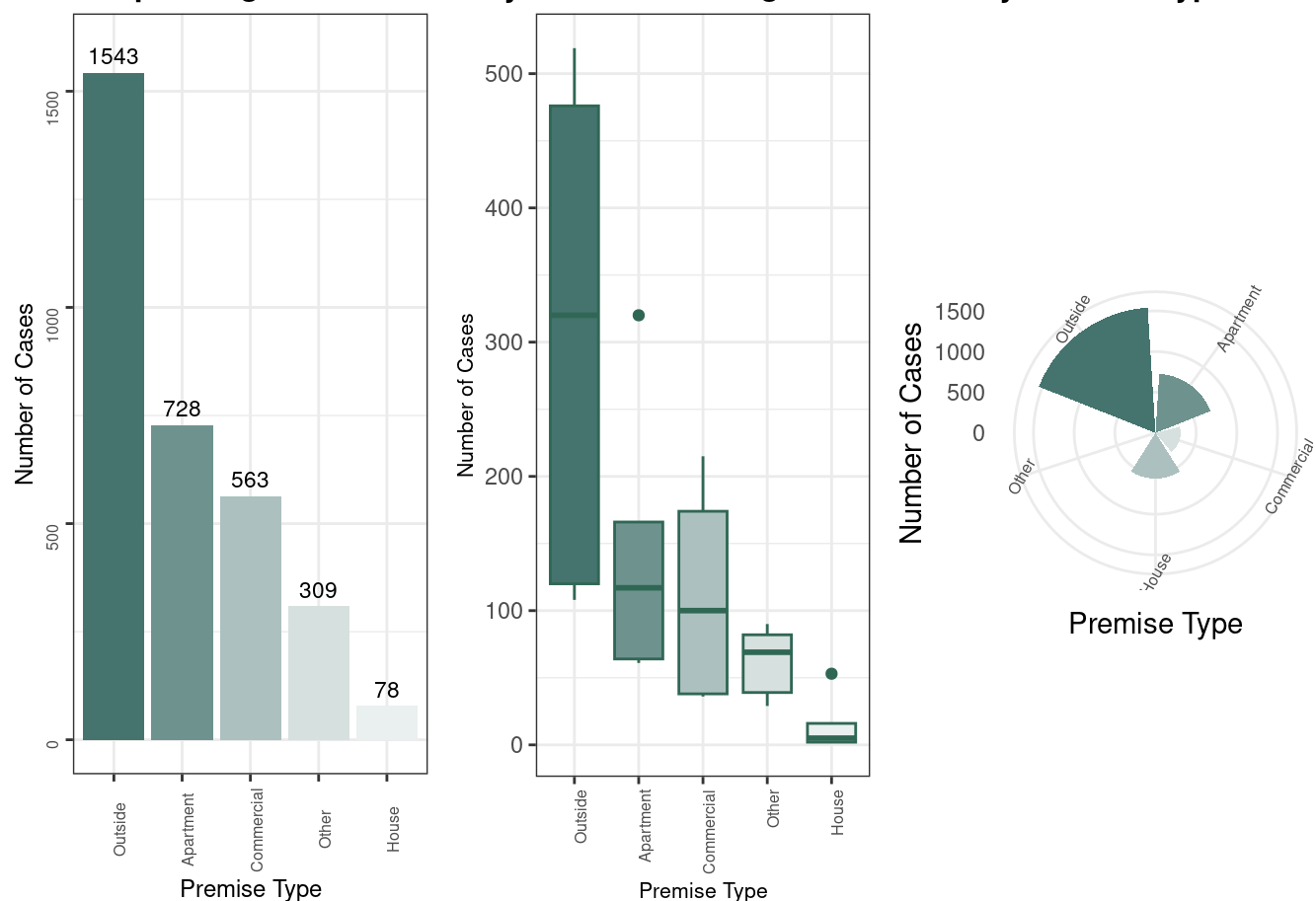
the highest bike theft crime ratio, so that the government can strengthen police enforcement intervention during our detected periods and issue more warnings to citizens on property safety during their travel, achieving our goal of an obvious overall dropdown on bike theft after such efficient intervention.

Then visualization 2 was created, which shows the distribution of monthly theft in the top 5 neighborhoods over a year. By looking at the month-by-month trend, the summer season's bike theft cases stand out. The number of cases begins to rise in the spring and peaks in the summer with over 1000 monthly cases, then it falls steadily from the fall through the winter seasons. The insights are clear now: summer is the season with the most bike theft cases and its variance is also much larger than other seasons. This shows that summer is a warning and uncertain season where the bike thefts happen the most often. In particular, we take cases that occurred in June, July, and August, these three months for investigation.

Our target is narrowed down to bike thefts in Top 5 Neighborhoods during summer season. Next step, considered various premise types (outside, apartment, house, commercial, and so on), it is unrealistic to draw general conclusions that differ in premise types. Therefore, we want to find a specific premise type that is most frequently being stolen for our study. Outside bikes, by common sense, are guessed easier being stolen than other types. To verify our hypothesis, visualization 3 was generated to figure out the most serious premise type that we should consider.

Most Frequently-stolen Premise Type Bicycle

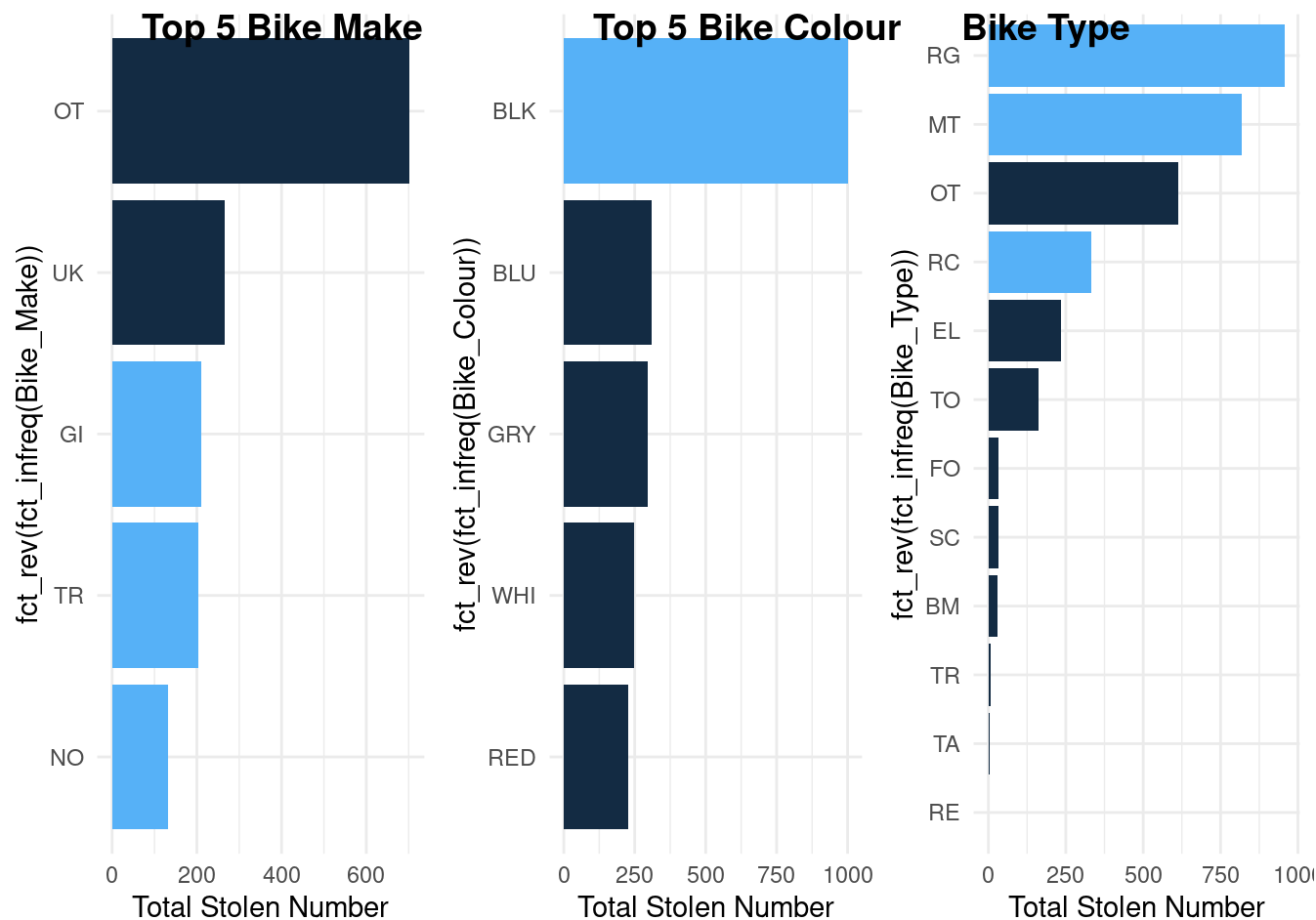
Top 5 Neighbourhoods Bicycle Thefts During the Summer by Premise Type



We drew a barchart, a boxplot, and a bicycle-wheel shaped pie chart and found that outside bicycles account for over 40%, nearly half, of the total cases across premise types. Bicycles used for house purpose have low risks to be stolen. This is consistent with our common sense. On the one hand, people usually take care of

their private or self-owned vehicles more carefully and are more lax with public properties. On the other hand, house bikes are usually parked in the garage or somewhere safe, unlike outside bikes that are mostly exposed on the street. As a result, in the following step, we shed light on the exterior features of stolen outside bicycles to provide more information to bicycle owners.

Bike Features of Bike Thefts Occurred Outside During Summer In Five Neighborhoods



Finally, we aim to analyzed if bikes, that had been stolen outside during June, July, and August in Waterfront Communities-The Island, Bay Street Corridor, Church-Yonge Corridor, Niagara, and Annex, have certain features. Within bike features that can be distinguished somewhat from observing the appearance, which we assume is also what drives thieves to steal, we first hypothesized that bike thieves tend to steal more expensive ones, more bright-colored like red or white, more famous ones, or more advanced-functional ones. However, there was no obvious pattern shown in relation with original prices of the bikes maybe because thieves can't tell a bike's price from its appearance.

Subsequently, the visualization was made and shown above. It can be seen from the first subfigure that the well-known brands, Giant, Trek, and Norco are top three frequently stolen brands. Black bikes were stolen dramatically more than other colored ones. Regular, mountain, and racer bikes tend to be targeted more by the thieves.

Since there are great amount of “Other” and “Unknown” values exist, it's hard to conclude any meaningful things from them. Potential future classification within “Other” would help to build a more accurate and insightful analysis.

Take-away Messages

If you are living in Waterfront Communities-The Island, Bay Street Corridor, Church-Yonge Corridor, Niagra, or Annex, please pay more attention to your bikes and buy a firmer locker when you put them outside especially during summer time; at the same time, if you own a black regular, mountain, or racer bike from Giant, Trek or Norco, please be more aware of bike thieves and give more protection on your bike.

References:

Van Lierop, D., Grimsrud, M., & El-Geneidy, A. (2015). Breaking into bicycle theft: Insights from Montreal, Canada. *International Journal of Sustainable Transportation*, 9(7), 490-501.