MILESTONE 1

Week 2

Abstract

This is the first milestone in this one I will get a sense of my data and introduce it for future uses

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Introduction

For this Milestone, I will use the data from Kaggle (Singh, 2014). The Robbery_2014_to_2019.csv dataset, and use the APA system for the bibliography. Also, the R code that I used to process the data is available on my GitHub account, which address is mentioned in the bibliography part. I also put my code in the appendix part.

The objective is to get a sense of the data. Secondly, to find subsets of data, get descriptive statistics for each subset, and create visualizations for subset data.

Content and context of the dataset

This database contains 21543 rows of data about reported robberies in Toronto. Toronto is regarded as one of North America's safest cities. According to a study of more than 1,000 Canadians, the Economist Intelligence Unit's 2019 Safe Cities Index classified Toronto as the 6th safest city in the world. (Patton, 2019)

With This dataset about Robbery, we can find out how the crime rate is going in Toronto, and we can also make subsets of locations so we can analyze them in detail.

This dataset has 27 columns, but most of them are about the time of the robbery and when it is reported (14 columns) and also four columns are identifiers, and 7 columns are about the location of the theft so this dataset needs a lot of cleaning before it can be used and it will be more effective if it is divided by subsets.

The content of the dataset is the following list

- Index: Record Unique Identifier
- eventuniqueid: Event Unique Identifier
- occurrencedate: Date of occurrence
- reporteddate: Date occurrence was reported
- premisetype: Premise where the occurrence took place
- ucrcode: URC Code ucrext: URC Code Extension
- offence : Offence related to the occurrence
- reportedyear : Year occurrence was reported
- reportedmonth : Month occurrence was reported
- reportedday : Day occurrence was reported
- reporteddayofyear : Day of week occurrence was reported

- reporteddayofweek : Day of year Occurrence was reported
- reportedhour : Hour occurrence was reported
- occurrenceyear : Occurrence year
- occurrencemonth : Occurrence month
- occurrenceday : Occurrence day
- occurrencedayofyear : Occurrence day of year
- occurrencedayofweek : Occurrence day of week
- occurrencehour : Occurrence hour
- MCI : Major Crime Indicator related to the offence
- Division : Division where event occurred
- Hood_ID : Neighbourhood Name
- Neighbourhood : Neighbourhood Identificator
- Long : Longitude of point extracted after offsetting X and & Coordinates to nearest intersection node
- Lat : Latitude of point extracted after offsetting X and & Coordinates to nearest intersection node

Methodology

This milestone is divided into many parts, each dealing with one of the aspects of the project.

Part 1: Data cleaning

For this dataset, the data cleaning part is a challenge since there are many duplicated columns my goal here is to make three sub-tables one based on the type of the robbery, one based on the timing of the robbery and based on the location of the robberies

```
 # first of all I delete duplicate rows

rob <- data[!duplicated(data), ]

#Now I clean offence columns by deleting the "Robbery -" part

rob <- data %>%

  mutate_at("offence", str_replace, "Robbery - ", "")

#Now i delete the useless columns

nolist <- c("Index_","event_unique_id","occurrencedate","reporteddate",

            "ucr_code","ucr_ext","reportedyear","reportedmonth","reportedday",

            "reporteddayofyear","reporteddayofweek","reportedhour",

            "MCI","ObjectId")

rob <- rob[,!(names(rob) %in% nolist)]

#Now I combine time columns to make them one

rob$datatime <-paste(rob$occurrenceday," ",rob$occurrencemonth," ",

                     rob$occurrenceyear," ",rob$occurrencehour)



rob$datatime <- parse_date_time(rob$datatime, orders = "dmy_h")

#Now I can delete the rest of columns

notimelist <- c("occurrenceyear" ,"occurrencemonth","occurrenceday",

                "occurrencedayofyear","occurrencedayofweek","occurrencehour")

rob <- rob[,!(names(rob) %in% notimelist)]

rob1<- rob
```

```
#Now I set premise, Hood_Id,Neighbourhood  and Division  as factor

rob$premisetype<-as.factor(rob$premisetype)

rob$Division<-as.factor(rob$Division)

rob$Hood_ID<-as.factor(rob$Hood_ID)

rob$Neighbourhood<-as.factor(rob$Neighbourhood)

# Now I group by neighbourhood

Mode <- function(x) {

  ux <- unique(x)

  ux[which.max(tabulate(match(x, ux)))]

}

arrange(desc(number_player))

Hood<- rob %>%

  group_by(Neighbourhood,Hood_ID) %>%

  summarize(NumberOfRobbery = n(),MostOffence = Mode(offence),Division = Mode(Division),Datemean
= median(datatime,na.rm = T),

            Long = mean(Long),Lat = mean(Lat))

# Now I group by offence

Offence<- rob %>%

  group_by(offence) %>%

  summarize(NumberOfRobbery = n(),MostHood = Mode(Neighbourhood),MostHood_ID =
Mode(Hood_ID),Division = Mode(Division),Datemean = median(datatime,na.rm = T),

            Long = mean(Long),Lat = mean(Lat))

# Now I group by date

Date<- rob %>%

  group_by(year(datatime),month(datatime)) %>%

  summarize(NumberOfRobbery = n(),MostOffence = Mode(offence),MostHood =
Mode(Neighbourhood),MostHood_ID = Mode(Hood_ID),Division = Mode(Division),

            Long = mean(Long),Lat = mean(Lat))
```

Now that we cleaned the data and created the tables we can continue to the next step.

Part 2: Data analysis

Now we run some descriptive analytics on data. the First thing that I want to see is whether are the numbers increasing each year or not? and what is the crime change rate each month

```
 #New we calculate crime rate

ggplot(Date, aes(x= ym , y =NumberOfRobbery)) + geom_point()+geom_smooth()+

  labs(title ="Number Of Robbery in time", x="", y = "Number of Robbery")

lead(Date$`month(datatime)`)



Date <- Date %>%

  mutate(crime_change = (NumberOfRobbery/lead(NumberOfRobbery) - 1) * 100)

# now I delete outliers

boxplot(Date$crime_change)$out

Date$crime_change <- rm.outlier(Date$crime_change, fill = TRUE, median = FALSE, opposite =
FALSE)

ggplot(Date, aes(x= ym , y =crime_change)) + geom_point()+geom_smooth()+

  labs(title ="crime change", x="",y="changes")
```

according to my calculations ang graph 1 there was no significant changes.

Now I use Hood table to see weather there is connection between crimes in neighborhood and divisions or not .

```
 # now testing connection between crimes and locations

p<-ggplot(data=Hood, aes(x=Division, y=NumberOfRobbery,fill=MostOffence)) +

  geom_bar(stat="identity")

p
```

after creating bar plot 1 I found out most crimes were mugging

Part 3: Discussion and conclusion

All in all, this database showed me that the crime rate isn't changing a lot in Toronto and the most common type of robbery is mugging. Right now after analyzing this database I feel safer in Toronto now that I know the crime rate is so low.

Part4: graphs , Tables and charts

```
 > head (Hood)
# A tibble: 6 × 8
# Groups:   Neighbourhood [6]
  Neighbourhood    Hood_ID NumberOfRobbery MostOffence Division Datemean             Long
  <fct>            <fct>             <int> <fct>       <fct>    <dttm>               <dbl>
1 Agincourt North… 129                 181 Mugging     D42      2017-08-07 21:00:00 -79.3
2 Agincourt South… 128                 164 Mugging     D42      2017-05-26 00:00:00 -79.3
3 Alderwood (20)   20                   41 Mugging     D22      2016-12-09 18:00:00 -79.5
4 Annex (95)       95                  245 Mugging     D53      2017-05-18 11:00:00 -79.4
5 Banbury-Don Mil… 42                   90 Mugging     D33      2016-04-27 12:30:00 -79.3
6 Bathurst Manor … 34                   56 Robbery Wi… D32      2017-05-06 12:00:00 -79.5
# … with 1 more variable: Lat <dbl>
```

Table 1 : Hood table

```
 > head (Offence)
# A tibble: 6 × 8
  offence   NumberOfRobbery MostHood MostHood_ID Division Datemean             Long   Lat
  <chr>               <int> <fct>    <fct>       <fct>    <dttm>               <dbl> <dbl>
1 Armoured…              33 Bedford… 39          D32      2016-04-22 04:00:00 -79.4  43.7
2 Atm                    76 Church-… 75          D51      2017-05-20 02:00:00 -79.4  43.7
3 Business             2434 Church-… 75          D51      2017-05-14 03:00:00 -79.4  43.7
4 Delivery…             215 York Un… 27          D31      2017-11-26 02:00:00 -79.4  43.7
5 Financia…             644 Bay Str… 76          D22      2017-01-24 10:00:00 -79.4  43.7
6 Home Inv…             830 Waterfr… 77          D43      2016-11-02 02:00:00 -79.4  43.7
```

Table 2 : Offences

```
 > head (Date)

# A tibble: 6 × 11

# Groups:   year(datatime) [2]

  `year(datatime)` `month(datatime)` NumberOfRobbery MostOffence     MostHood MostHood_ID

             <dbl>             <dbl>           <int> <chr>           <fct>    <fct>

1              2012                 2               1 Mugging         Keelesd… 110

2              2013                 1               2 Mugging         Moss Pa… 73

3              2013                 2               1 Mugging         West Hi… 136

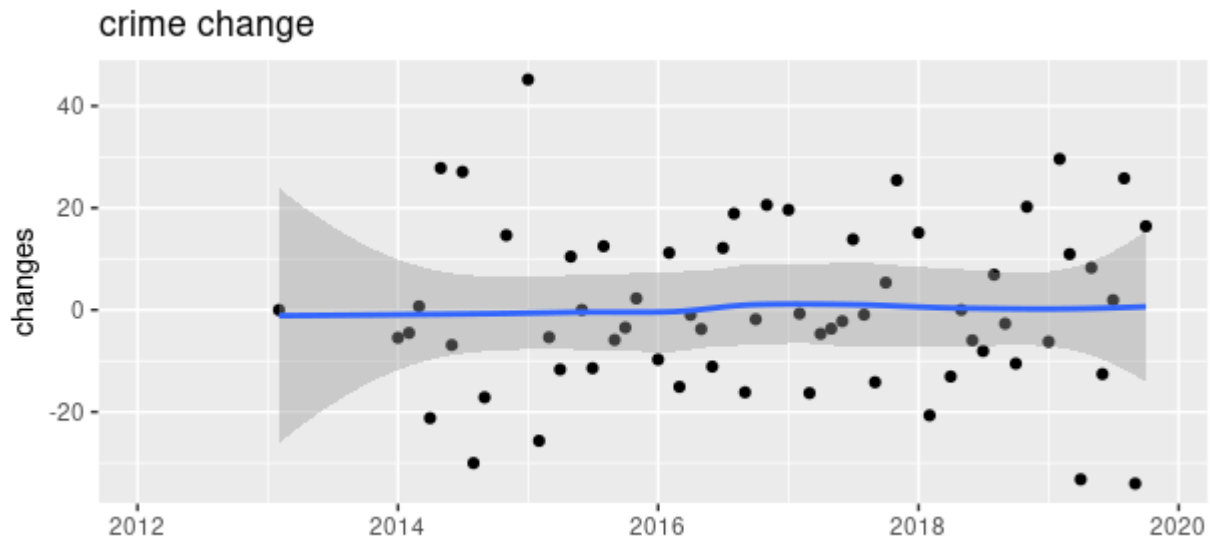
4              2013                 6               1 Other           Church-… 75

5              2013                 8               2 Other           Moss Pa… 73

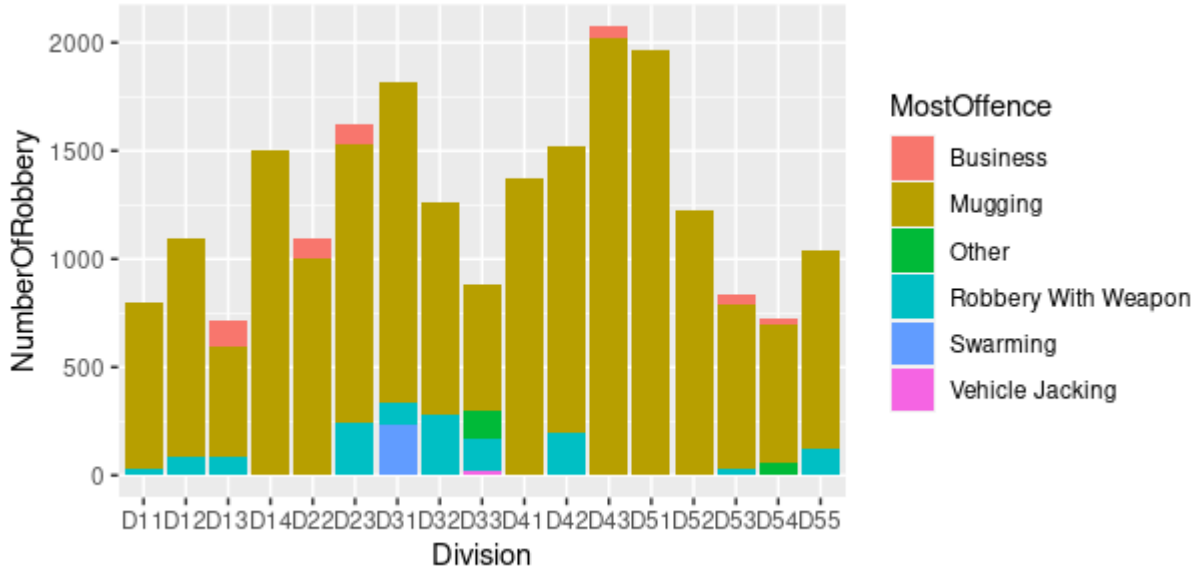
6              2013                 9              18 Robbery With W… Waterfr… 77

# … with 5 more variables: Division <fct>, Long <dbl>, Lat <dbl>, ym <dttm>,
```

Table 3 : Offence



Graph 1 Crime Changes



Graph 2 Crime vs Division

Bibliography

Patton, J. (2019). Toronto ranked among safest cities in the world by Economist Intelligence Unit. [online] Global News. Available at: https://globalnews.ca/news/5829962/toronto-safest-cities-index-2019/ [Accessed 9 Mar. 2022].

Singh, A. (2014). Toronto Robbery 2014-2019. [online] Kaggle.com. Available at: https://www.kaggle.com/cosmicakshh/toronto-robbery-20142019 [Accessed 9 Mar. 2022].

momova97 (2022). momova97/ALY6010_Movahedi: This is the place that I will keep my projects R code. [online] GitHub. Available at: https://github.com/momova97/ALY6010_Movahedi [Accessed 8 Mar. 2022].

Appendix

```
 print("Mohammad Hossein Movahedi")

print("Milestone 1")

#importing and instaling libraries

install.packages('FSA')

install.packages('FSAdata')

install.packages('magrittr')

install.packages('dplyr')

install.packages('tidyr')

install.packages('plyr')

install.packages('tidyverse')

install.packages('outliers')

install.packages('ggplot2')

install.packages('lubridate')



library(ggplot2)

library(outliers)

library(FSA)

library(FSAdata)

library(magrittr)

library(dplyr)

library(tidyr)

library(plyr)

library(tidyverse)

library(scales)

library(lubridate)

#importing dataset

data <- read.csv("Robbery_2014_to_2019.csv")
```

```
# first of all I delete duplicate rows

rob <- data[!duplicated(data), ]

#Now I clean offence columns by deleting the "Robbery -" part

rob <- data %>%

  mutate_at("offence", str_replace, "Robbery - ", "")

#Now i delete the useless columns

nolist <- c("Index_","event_unique_id","occurrencedate","reporteddate",

            "ucr_code","ucr_ext","reportedyear","reportedmonth","reportedday",

            "reporteddayofyear","reporteddayofweek","reportedhour",

            "MCI","ObjectId")

rob <- rob[,!(names(rob) %in% nolist)]

#Now I combine time columns to make them one

rob$datatime <-paste(rob$occurrenceday," ",rob$occurrencemonth," ",

                     rob$occurrenceyear," ",rob$occurrencehour)


rob$datatime <- parse_date_time(rob$datatime, orders = "dmy_h")

#Now I can delete the rest of columns

notimelist <- c("occurrenceyear" ,"occurrencemonth","occurrenceday",

                "occurrencedayofyear","occurrencedayofweek","occurrencehour")

rob <- rob[,!(names(rob) %in% notimelist)]

rob1<- rob

#Now I set premise, Hood_Id,Neighbourhood  and Division  as factor

rob$premisetype<-as.factor(rob$premisetype)

rob$Division<-as.factor(rob$Division)

rob$Hood_ID<-as.factor(rob$Hood_ID)

rob$Neighbourhood<-as.factor(rob$Neighbourhood)

# Now I group by neighbourhood

Mode <- function(x) {

  ux <- unique(x)
```

```
  ux[which.max(tabulate(match(x, ux)))]

}



Hood<- rob %>%

  group_by(Neighbourhood,Hood_ID) %>%

  summarize(NumberOfRobbery = n(),MostOffence = Mode(offence),Division =
Mode(Division),Datemean = median(datatime,na.rm = T),

            Long = mean(Long),Lat = mean(Lat))

head (Hood)

# Now I group by offence

Offence<- rob %>%

  group_by(offence) %>%

  summarize(NumberOfRobbery = n(),MostHood = Mode(Neighbourhood),MostHood_ID =
Mode(Hood_ID),Division = Mode(Division),Datemean = median(datatime,na.rm = T),

            Long = mean(Long),Lat = mean(Lat))

head (Offence)

# Now I group by date

Date<- rob %>%

  group_by(year(datatime),month(datatime)) %>%

  summarize(NumberOfRobbery = n(),MostOffence = Mode(offence),MostHood =
Mode(Neighbourhood),MostHood_ID = Mode(Hood_ID),Division = Mode(Division),

            Long = mean(Long),Lat = mean(Lat))

Date <- Date[-c(1,82),]

Date$ym <- paste(Date$`year(datatime)`,"-",Date$`month(datatime)`)

Date$ym <- parse_date_time(Date$ym,order = "ym")

head (Date)

#New we calculate crime rate

ggplot(Date, aes(x= ym , y =NumberOfRobbery)) + geom_point()+geom_smooth()+

  labs(title ="Number Of Robbery in time", x="", y = "Number of Robbery")

lead(Date$`month(datatime)`)
```

```
Date <- Date %>%

  mutate(crime_change = (NumberOfRobbery/lead(NumberOfRobbery) - 1) * 100)

# now I delete outliers

boxplot(Date$crime_change)$out

Date$crime_change <- rm.outlier(Date$crime_change, fill = TRUE, median = FALSE, opposite =
FALSE)

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# now testing connection between crimes and locations

p<-ggplot(data=Hood, aes(x=Division, y=NumberOfRobbery,fill=MostOffence)) +

  geom_bar(stat="identity")

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