ACADGILD

# SESSION 12: Generalized Linear Models

## Assignment 1

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## 1. PROBLEM STATEMENT

1. Use the given link below:
https://archive.ics.uci.edu/ml/machine-learning-databases/communities/

Perform the below operations:

a) Find out top 5 attributes having highest correlation (select only Numeric features).
b) Find out top 3 reasons for having more crime in a city.
c) Which all attributes have high correlation with crime rate?

## 2. SOLUTION

### a) Find out top 5 attributes having highest correlation (select only Numeric features).

**The R-script for the given problem is as follows:**

```
library(readr)
Crimes <- read_csv("F:/ACADGILD - Online Course/1. DATA SETS/communities.csv ")
View(Crimes)

names(Crimes) <- c("Case", "Number", "Date", "Block", "IUCR", "Primary Type",
"Description",
                   "Location Desc", "Arrest", "Domestic", "Beat", "District", "Ward",
"Community Area",
                   "FBI Code", "X Coordinate", "Y Coordinate", "Year", "Updated On",
                   "Latitude", "Longitude", "Location")
head(Crimes)
str(Crimes)

#a. Find out top 5 attributes having highest correlation (select only Numeric features).

Crimes <- na.omit(Crimes)
names(Crimes)
c <- cor(Crimes[c(11,12,13,14,18,20,21)])
c
library(reshape2)
m <- melt(c)
```

```
library(dplyr)
m
top <- m%>%select(Var1, Var2, value)%>%filter(value != 1)
top[order(top$value, decreasing = T)[1:10],]
```

## The output of the R-Script (from Console window) is given as follows:

```
> library(readr)
> Crimes <- read_csv("F:/ACADGILD - Online Course/1.
DATA SETS/communities.csv")
Parsed with column specification:
cols(
  .default = col_character(),
  ID = col_double(),
  Arrest = col_logical(), Domestic
  = col_logical(), Beat =
  col_double(), District =
  col_double(), Ward =
  col_double(), `Community Area` =
  col_double(), `X Coordinate` =
  col_double(), `Y Coordinate` =
  col_double(), Year =
  col_double(),
  Latitude = col_double(),
  Longitude = col_double()
)
See spec(...) for full column specifications.
|=================================================================
==================================| 100%  216 MB
> View(Crimes)
> names(Crimes) <- c("Case", "Number", "Date", "Block",
"IUCR", "Primary Type", "Description",
+                    "Location Desc", "Arrest", "Domestic", "Beat",
"District", "Ward", "Community Area",
+                    "FBI Code", "X Coordinate", "Y Coordinate",
"Year", "Updated On",
+                    "Latitude", "Longitude", "Location")
> head(Crimes)
# A tibble: 6 x 22
    Case Number Date  Block IUCR  `Primary Type` Description `Location
Desc` Arrest Domestic  Beat District  Ward
   <dbl> <chr> <chr> <chr> <chr> <chr>          <chr>       <chr>
<lgl>  <lgl>    <dbl>    <dbl> <dbl>
1  1.05e7 HZ250~ 5/3/~ 013X~ 486   BATTERY        DOMESTIC B~ APARTMENT
TRUE   TRUE      1022        10    24
2  1.05e7 HZ250~ 5/3/~ 061X~ 486   BATTERY        DOMESTIC B~ RESIDENCE
FALSE  TRUE       313         3    20
3  1.05e7 HZ250~ 5/3/~ 053X~ 470   PUBLIC PEACE ~ RECKLESS C~ STREET
FALSE  FALSE     1524        15    37
4  1.05e7 HZ250~ 5/3/~ 049X~ 460   BATTERY        SIMPLE      SIDEWALK
FALSE  FALSE     1532        15    28
5  1.05e7 HZ250~ 5/3/~ 003X~ 820   THEFT          $500 AND U~ RESIDENCE
FALSE  TRUE      1523        15    28
6  1.05e7 HZ250~ 5/3/~ 082X~ 041A  BATTERY        AGGRAVATED~ STREET
FALSE  FALSE      631         6     8
# ... with 9 more variables: `Community Area` <dbl>, `FBI Code` <chr>,
`X Coordinate` <dbl>, `Y Coordinate` <dbl>,
```

```
#   Year <dbl>, `Updated On` <chr>, Latitude <dbl>, Longitude <dbl>,
Location <chr>
> str(Crimes)
Classes ‘spec_tbl_df’, ‘tbl_df’, ‘tbl’ and 'data.frame':       1048575
obs. of  22 variables:
 $ Case           : num  10508693 10508695 10508697 10508698 10508699
...
 $ Number         : chr  "HZ250496" "HZ250409" "HZ250503" "HZ250424" ...
 $ Date           : chr  "5/3/2016 23:40" "5/3/2016 21:40" "5/3/2016
23:31" "5/3/2016 22:10" ...
 $ Block          : chr  "013XX S SAWYER AVE" "061XX S DREXEL AVE"
"053XX W CHICAGO AVE" "049XX W FULTON ST" ...
 $ IUCR           : chr  "486" "486" "470" "460" ...
 $ Primary Type   : chr  "BATTERY" "BATTERY" "PUBLIC PEACE VIOLATION"
"BATTERY" ...
 $ Description    : chr  "DOMESTIC BATTERY SIMPLE" "DOMESTIC BATTERY
SIMPLE" "RECKLESS CONDUCT" "SIMPLE" ...
 $ Location Desc : chr  "APARTMENT" "RESIDENCE" "STREET" "SIDEWALK" ...
 $ Arrest         : logi  TRUE FALSE FALSE FALSE FALSE FALSE ...
 $ Domestic       : logi  TRUE TRUE FALSE FALSE TRUE FALSE ...
 $ Beat           : num  1022 313 1524 1532 1523 ...
 $ District       : num  10 3 15 15 15 6 1 2 24 7 ...
 $ Ward           : num  24 20 37 28 28 8 3 3 40 17 ...
 $ Community Area: num  29 42 25 25 25 44 35 38 1 67 ...
 $ FBI Code       : chr  "08B" "08B" "24" "08B" ...
 $ X Coordinate   : num  1154907 1183066 1140789 1143223 1139890 ...
 $ Y Coordinate   : num  1893681 1864330 1904819 1901475 1901675 ...
 $ Year           : num  2016 2016 2016 2016 2016 ...
 $ Updated On     : chr  "5/10/2016 15:56" "5/10/2016 15:56" "5/10/2016
15:56" "5/10/2016 15:56" ...
 $ Latitude       : num  41.9 41.8 41.9 41.9 41.9 ...
 $ Longitude      : num  -87.7 -87.6 -87.8 -87.7 -87.8 ...
 $ Location       : chr  "(41.864073157, -87.706818608)" "(41.782921527,
-87.60436317)" "(41.894908283, -87.758371958)" "(41.885686845, -
87.749515983)" ...
 - attr(*, "spec")=
  .. cols(
  ..   ID = col_double(),
  ..   `Case Number` = col_character(),
  ..   Date = col_character(),
  ..   Block = col_character(),
  ..   IUCR = col_character(),
  ..   `Primary Type` = col_character(),
  ..   Description = col_character(),
  ..   `Location Description` = col_character(),
  ..   Arrest = col_logical(),
  ..   Domestic = col_logical(),
  ..   Beat = col_double(),
  ..   District = col_double(),
  ..   Ward = col_double(),
  ..   `Community Area` = col_double(),
  ..   `FBI Code` = col_character(),
  ..   `X Coordinate` = col_double(),
  ..   `Y Coordinate` = col_double(),
  ..   Year = col_double(),
  ..   `Updated On` = col_character(),
  ..   Latitude = col_double(),
  ..   Longitude = col_double(),
  ..   Location = col_character()
  .. )
```

```
> Crimes <- na.omit(Crimes)
> names(Crimes)
 [1] "Case"            "Number"          "Date"            "Block"
"IUCR"            "Primary Type"
 [7] "Description"     "Location Desc"   "Arrest"          "Domestic"
"Beat"            "District"
[13] "Ward"            "Community Area" "FBI Code"        "X Coordinate"
"Y Coordinate"    "Year"
[19] "Updated On"      "Latitude"        "Longitude"       "Location"
> c <- cor(Crimes[c(11,12,13,14,18,20,21)])
> c
                      Beat      District         Ward Community Area
Year      Latitude     Longitude
Beat            1.00000000   0.996402087  0.687144016   -0.49621344 -
0.012652765   0.575284245 -0.479976546
District        0.99640209   1.000000000  0.691655842   -0.49621461 -
0.008529942   0.576344843 -0.483244475
Ward            0.68714402   0.691655842  1.000000000   -0.54302431 -
0.004215319   0.592008238 -0.397964013
Community Area -0.49621344 -0.496214608 -0.543024307      1.00000000
0.001632430  -0.691892413   0.221028077
Year            -0.01265277 -0.008529942 -0.004215319     0.00163243
1.000000000  -0.002721412 -0.004346718
Latitude        0.57528424   0.576344843  0.592008238   -0.69189241 -
0.002721412   1.000000000 -0.209999084
Longitude       -0.47997655 -0.483244475 -0.397964013    0.22102808 -
0.004346718  -0.209999084   1.000000000
> library(reshape2)
> m <- melt(c)
> library(dplyr)

Attaching package: ‘dplyr’

The following objects are masked from ‘package:stats’:

    filter, lag

The following objects are masked from ‘package:base’:

    intersect, setdiff, setequal, union

> m
              Var1          Var2        value
1             Beat          Beat  1.000000000
2         District          Beat  0.996402087
3             Ward          Beat  0.687144016
4   Community Area          Beat -0.496213439
5             Year          Beat -0.012652765
6         Latitude          Beat  0.575284245
7        Longitude          Beat -0.479976546
8             Beat      District  0.996402087
9         District      District  1.000000000
10            Ward      District  0.691655842
 11 Community Area      District -0.496214608
12            Year      District -0.008529942
13        Latitude      District  0.576344843
14       Longitude      District -0.483244475
15            Beat          Ward  0.687144016
16        District          Ward  0.691655842
17            Ward          Ward  1.000000000
```

```
 18 Community Area          Ward -0.543024307
 19           Year          Ward -0.004215319
 20       Latitude          Ward  0.592008238
 21      Longitude          Ward -0.397964013
22           Beat Community Area -0.496213439
23       District Community Area -0.496214608
24           Ward Community Area -0.543024307
25 Community Area Community Area  1.000000000
26           Year Community Area  0.001632430
27       Latitude Community Area -0.691892413
28      Longitude Community Area  0.221028077
 29           Beat          Year -0.012652765
 30       District          Year -0.008529942
 31           Ward          Year -0.004215319
 32 Community Area           Year 0.001632430
 33           Year           Year 1.000000000
 34       Latitude          Year -0.002721412
 35      Longitude          Year -0.004346718
 36           Beat      Latitude 0.575284245
 37       District      Latitude 0.576344843
 38           Ward      Latitude 0.592008238
 39 Community Area      Latitude -0.691892413
 40           Year      Latitude -0.002721412
 41       Latitude       Latitude 1.000000000
 42      Longitude      Latitude -0.209999084
 43           Beat     Longitude -0.479976546
 44       District     Longitude -0.483244475
 45           Ward     Longitude -0.397964013
 46 Community Area      Longitude 0.221028077
 47           Year     Longitude -0.004346718
 48       Latitude     Longitude -0.209999084
 49      Longitude      Longitude 1.000000000
> top <- m%>%select(Var1, Var2, value)%>%filter(value != 1)
> top[order(top$value, decreasing = T)[1:10],]
       Var1     Var2     value
1  District     Beat 0.9964021
7      Beat District 0.9964021
8      Ward District 0.6916558
14  District    Ward 0.6916558
2       Ward    Beat 0.6871440
13      Beat    Ward 0.6871440
17  Latitude    Ward 0.5920082
33     Ward Latitude 0.5920082
11 Latitude District 0.5763448
32 District Latitude 0.5763448
```

## Conclusion/Interpretation:

District~Beat, Ward~District, Ward~Beat, Latitude ~Ward, Latitude~District are top5 attributes with highest correlations

## b) Find out top 3 reasons for having more crime in a city.

### The R-script for the given problem is as follows:

```
x <- as.data.frame(table(Crimes$Description))
x[order(x$Freq, decreasing = T)[1:3],]
```

### The output of the R-Script (from Console window) is given as follows:

```
> x <- as.data.frame(table(Crimes$Description))
> x[order(x$Freq, decreasing = T)[1:3],]
                         Var1   Freq
 279                   SIMPLE 107887
1             $500 AND UNDER  97476
118 DOMESTIC BATTERY SIMPLE   93001
```

### Conclusion/Interpretation:

**Simple**, **$500 and under** and Domestic **Battery Simple** are the top 3 reasons for having more crime

## c) Which all attributes have high correlation with crime rate?

### The R-script for the given problem is as follows:

```
crime <- Crimes
head(crime)
table(is.na(crime))

crime$Date <- as.POSIXlt(crime$Date, format= "%m/%d/%Y %H:%M:%S")
crime$`Updated On` <- as.POSIXlt(crime$`Updated On`, format= "%m/%d/%Y
%H:%M:%S")

install.packages("chron")
library(chron)

crime$Time <- time(format(crime$Date,"%H:%M:%S"))
crime$Date <- as.POSIXct(crime$Date)
crime$`Updated On` <- as.POSIXct(crime$`Updated On`)

# There could be certain time intervals of the day where criminal activity is
more prevalent

time.tag <- chron::chron(time=c("00:00:00", "06:00:00", "12:00:00",
"18:00:00","23:59:00"))
time.tag
crime$time.tag <- cut(crime$Time, breaks= time.tag,
```

```
labels= c("00-06","06-12", "12-18", "18-00"), include.lowest =TRUE)
table(crime$time.tag)

# date variable to contain just the date part
crime$date <- as.POSIXlt(strptime(crime$Date, format = "%Y-%m-%d"))
crime$date <- as.POSIXct(crime$date)

# days and months could be predicatble variable
crime$day <- as.factor(weekdays(crime$Date, abbreviate = TRUE))
crime$month <- as.factor(months(crime$Date, abbreviate = TRUE))
str(crime$day)
str(crime$month)

# converting Arrest yes / no to binary varibale
crime$Arrest <- ifelse(as.character(crime$Arrest) == "true",1,0)

# The data contain about 31 crime types, not all of which are mutually exclusive. We can combine
# two or more similar categories into one to reduce this number and make the analysis a bit easier.7
crime$crime <- as.character(crime$`Primary Type`)
crime$crime <- ifelse(crime$crime %in% c("CRIM SEXUAL
ASSAULT","PROSTITUTION", "SEX OFFENSE","HUMAN TRAFFICKING"),
'SEX', crime$crime)
crime$crime <- ifelse(crime$crime %in% c("MOTOR VEHICLE THEFT"), "MVT",
crime$crime)
crime$crime <- ifelse(crime$crime %in% c("GAMBLING",
"INTERFEREWITH PUBLIC OFFICER", "INTERFERENCE WITH PUBLIC
OFFICER", "INTIMIDATION",
                                         "LIQUOR LAW VIOLATION", "OBSCENITY", "NON-
CRIMINAL", "PUBLIC PEACE VIOLATION",
                                         "PUBLIC INDECENCY", "STALKING", "NON-CRIMINAL
(SUBJECT SPECIFIED)","NON - CRIMINAL"),
                  "NONVIO", crime$crime)
crime$crime <- ifelse(crime$crime == "CRIMINAL
DAMAGE", "DAMAGE",crime$crime)
crime$crime <- ifelse(crime$crime == "CRIMINAL
TRESPASS","TRESPASS", crime$crime)
crime$crime <- ifelse(crime$crime %in% c("NARCOTICS", "OTHER
NARCOTIC VIOLATION", "OTHER NARCOTIC VIOLATION"), "DRUG",
crime$crime) crime$crime <- ifelse(crime$crime == "DECEPTIVE
PRACTICE","FRAUD", crime$crime)
crime$crime <- ifelse(crime$crime %in% c("OTHER
OFFENSE", "OTHEROFFENSE"), "OTHER", crime$crime)
```

```
crime$crime <- ifelse(crime$crime %in% c("KIDNAPPING", "WEAPONS
VIOLATION", "CONCEALED CARRY LICENSE VIOLATION","OFFENSE
INVOLVING CHILDREN"), "VIO", crime$crime) table(crime$crime)


# A potential important indicator of criminal activity in a particular area could be
the history of criminal activities in the past.

temp <- aggregate(crime$crime, by=list(crime$crime, crime$time.tag), FUN=length)
names(temp) <- c("crime", "time.tag", "count")
library(dplyr)
temp <- ddply(crime, .(crime, day), summarise, count = length(date))

#install.packages("doBy")
library(doBy)
crime.agg <- ddply(crime, .(crime, Arrest, Beat, date, `X Coordinate`, `Y
Coordinate`, time.tag, day, month),
                summarise, count=length(date), .progress='text')

beats <- sort(unique(crime.agg$Beat))
dates <- sort(as.character(unique(crime.agg$date)))
temp <- expand.grid(beats, dates)
names(temp) <- c("Beat", "date")

model.data <- aggregate(crime.agg[, c('count', 'Arrest')], by=
                    list(crime.agg$Beat, as.character(crime.agg$date)), FUN=sum)
names(model.data) <- c("Beat", "date", "count", "Arrest")
model.data <- merge(temp, model.data, by= c('Beat', 'date'), all.x= TRUE)
#View(model.data)
model.data$count[is.na(model.data$count)] <- 0
model.data$Arrest[is.na(model.data$Arrest)] <- 0
model.data$day <- weekdays(as.Date(model.data$date), abbreviate= TRUE)
model.data$month    <-    months(as.Date(model.data$date),    abbreviate=
TRUE) pastDays <- function(x) {c(0, rep(1, x))}
 model.data$past.crime.1 <- ave(model.data$count, model.data$Beat,
                        FUN=function(x) filter(x, pastDays(1), sides= 1))
 model.data$past.crime.7 <- ave(model.data$count, model.data$Beat,
                        FUN=function(x) filter(x, pastDays(7), sides= 1))
model.data$past.crime.30 <- ave(model.data$count, model.data$Beat,
                         FUN=function(x) filter(x, pastDays(30), sides= 1))

meanNA <- function(x){mean(x, na.rm= TRUE)}
model.data$past.crime.1 <- ifelse(is.na(model.data$past.crime.1),
                           meanNA(model.data$past.crime.1), model.data$past.crime.1)
model.data$past.crime.7 <- ifelse(is.na(model.data$past.crime.7),
```

```
                        meanNA(model.data$past.crime.7), model.data$past.crime.7)
model.data$past.crime.30 <- ifelse(is.na(model.data$past.crime.30),
                         meanNA(model.data$past.crime.30), model.data$past.crime.30)
# past variables for arrests
model.data$past.arrest.30 <- ave(model.data$Arrest, model.data$Beat,
                       FUN= function(x) filter(x, pastDays(30), sides= 1))
model.data$past.arrest.30 <- ifelse(is.na(model.data$past.arrest.30),
                          meanNA(model.data$past.arrest.30), model.data$past.arrest.30)
# arrests per crime
model.data$policing <- ifelse(model.data$past.crime.30 == 0, 0,
                     model.data$past.arrest.30/model.data$past.crime.30)

# trend
model.data$crime.trend <- ifelse(model.data$past.crime.30 == 0, 0,
                       model.data$past.crime.7/model.data$past.crime.30)

# season could be another reason
model.data$season <- as.factor(ifelse(model.data$month %in% c("Mar", "Apr",
"May"), "spring",
                               ifelse(model.data$month %in% c("Jun", "Jul", "Aug"),
"summer",
                                      ifelse(model.data$month %in% c("Sep", "Oct","Nov"),
"fall", "winter"))))

model.cor <- cor(model.data[, c("count", "past.crime.1", "past.crime.7",
                        "past.crime.30","policing", "crime.trend")])
model.cor
library(psych)
psych::cor.plot(model.cor)
```

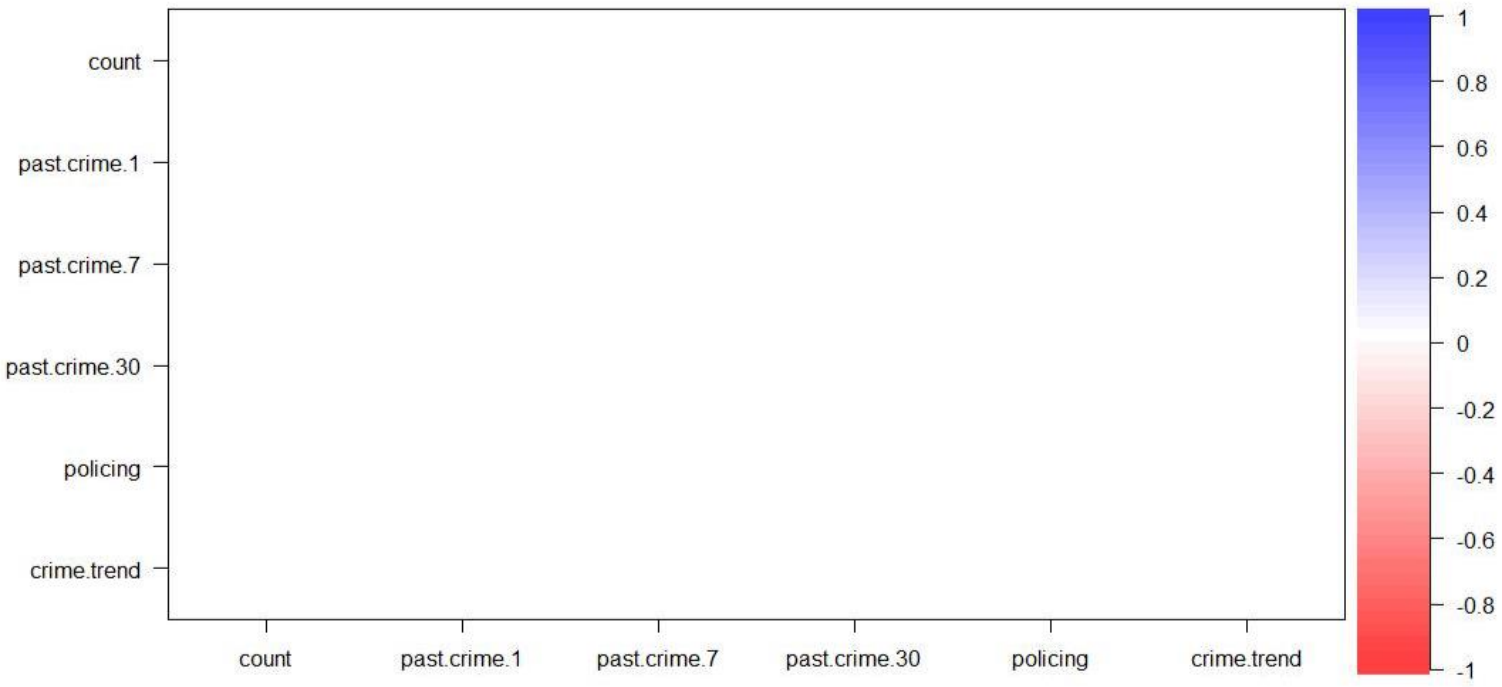
## The output of the R-Script (from Console window) is given as follows:

```
> crime <- Crimes
> head(crime)
# A tibble: 6 x 22
     Case Number Date   Block IUCR  `Primary Type` Description `Location
Desc` Arrest Domestic  Beat District  Ward
    <db1> <chr>  <chr>  <chr> <chr> <chr>          <chr>       <chr>
<lgl>  <lgl>    <db1>    <db1> <db1>
1 1.05e7  HZ250~ 5/3/~ 013X~ 486   BATTERY        DOMESTIC B~ APARTMENT
TRUE   TRUE      1022        10   24
2 1.05e7  HZ250~ 5/3/~ 061X~ 486   BATTERY        DOMESTIC B~ RESIDENCE
FALSE  TRUE       313         3   20
3 1.05e7  HZ250~ 5/3/~ 053X~ 470   PUBLIC PEACE ~ RECKLESS C~ STREET
FALSE  FALSE     1524        15   37
4 1.05e7  HZ250~ 5/3/~ 049X~ 460   BATTERY        SIMPLE      SIDEWALK
FALSE  FALSE     1532        15   28
```

```
5 1.05e7 HZ250~ 5/3/~ 003X~ 820   THEFT          $500 AND U~ RESIDENCE
FALSE  TRUE      1523       15     28
6 1.05e7 HZ250~ 5/3/~ 082X~ 041A  BATTERY        AGGRAVATED~ STREET
FALSE  FALSE      631        6     8
# ... with 9 more variables: `Community Area` <dbl>, `FBI Code` <chr>,
`X Coordinate` <dbl>, `Y Coordinate` <dbl>,
#   Year <dbl>, `Updated On` <chr>, Latitude <dbl>, Longitude <dbl>,
Location <chr>
> table(is.na(crime))

   FALSE
22863082

> crime$Date <- as.POSIXlt(crime$Date, format= "%m/%d/%Y %H:%M:%S")
> crime$`Updated On` <- as.POSIXlt(crime$`Updated On`,
format= "%m/%d/%Y %H:%M:%S")
> library(chron)
> crime$Time <- time(format(crime$Date,"%H:%M:%S"))
> crime$Date <- as.POSIXct(crime$Date)
> crime$`Updated On` <- as.POSIXct(crime$`Updated On`)
> # There could be certain time intervals of the day where
criminal activity is more prevalent
>
> time.tag <- chron::chron(time=c("00:00:00", "06:00:00", "12:00:00",
"18:00:00","23:59:00"))
> time.tag
[1] 00:00:00 06:00:00 12:00:00 18:00:00 23:59:00
> crime$time.tag <- cut(crime$Time, breaks= time.tag,
+                       labels= c("00-06","06-12", "12-18", "18-00"),
include.lowest =TRUE)
> table(crime$time.tag)

00-06 06-12 12-18 18-00
    0     0     0     0

> # date variable to contain just the date part
> crime$date <- as.POSIXlt(strptime(crime$Date, format = "%Y-%m-%d"))
> crime$date <- as.POSIXct(crime$date)
> # days and months could be predicatble variable
> crime$day <- as.factor(weekdays(crime$Date, abbreviate = TRUE))
> crime$month <- as.factor(months(crime$Date, abbreviate = TRUE))
> str(crime$day)
 Factor w/ 0 levels: NA NA NA NA NA NA NA NA NA NA ...
> str(crime$month)
 Factor w/ 0 levels: NA NA NA NA NA NA NA NA NA NA ...
> # converting Arrest yes / no to binary varibale
> crime$Arrest <- ifelse(as.character(crime$Arrest) == "true",1,0)
> # The data contain about 31 crime types, not all of which are mutually
exclusive. We can combine
> # two or more similar categories into one to reduce this number and make
the analysis a bit easier.7
> crime$crime <- as.character(crime$`Primary Type`)
> crime$crime <- ifelse(crime$crime %in% c("CRIM SEXUAL
ASSAULT","PROSTITUTION", "SEX OFFENSE","HUMAN TRAFFICKING"),
'SEX', crime$crime)
> crime$crime <- ifelse(crime$crime %in% c("MOTOR VEHICLE THEFT"), "MVT",
crime$crime)
> crime$crime <- ifelse(crime$crime %in% c("GAMBLING", "INTERFEREWITH PUBLIC
OFFICER", "INTERFERENCE WITH PUBLIC OFFICER", "INTIMIDATION",
```

```
+                                              "LIQUOR LAW VIOLATION",
"OBSCENITY", "NON-CRIMINAL", "PUBLIC PEACE VIOLATION",
+                                              "PUBLIC INDECENCY", "STALKING",
"NON-CRIMINAL (SUBJECT SPECIFIED)","NON - CRIMINAL"),
+                        "NONVIO", crime$crime)
> crime$crime <- ifelse(crime$crime == "CRIMINAL
DAMAGE", "DAMAGE",crime$crime)
> crime$crime <- ifelse(crime$crime == "CRIMINAL TRESPASS","TRESPASS",
crime$crime)
> crime$crime <- ifelse(crime$crime %in% c("NARCOTICS", "OTHER NARCOTIC
VIOLATION", "OTHER NARCOTIC VIOLATION"), "DRUG", crime$crime)
> crime$crime <- ifelse(crime$crime == "DECEPTIVE PRACTICE","FRAUD",
crime$crime)
> crime$crime <- ifelse(crime$crime %in% c("OTHER OFFENSE", "OTHEROFFENSE"),
"OTHER", crime$crime)
> crime$crime <- ifelse(crime$crime %in% c("KIDNAPPING", "WEAPONS VIOLATION",
"CONCEALED CARRY LICENSE VIOLATION","OFFENSE INVOLVING CHILDREN"), "VIO",
crime$crime)
> table(crime$crime)

    ARSON   ASSAULT   BATTERY BURGLARY    DAMAGE       DRUG    FRAUD HOMICIDE
MVT    NONVIO      OTHER   ROBBERY      SEX
     1448     63675    187643     61045   108508    109738    46558        76
43785     19536     61262    39491     13796
    THEFT TRESPASS       VIO
   234716     27458     20496


> temp <- aggregate(crime$crime, by=list(crime$crime, crime$time.tag), FUN=length)
> names(temp) <- c("crime", "time.tag", "count")
> library(dplyr)
> temp <- ddply(crime, .(crime, day), summarise, count = length(date))
> install.packages("doBy")

> library(doBy)
> length(Case ~ crime + month)
[1] 3
> length(crime)
[1] 28
> install.packages("doBy")

> temp <- aggregate(crime$crime, by=list(crime$crime, crime$time.tag), FUN=length)
> names(temp) <- c("crime", "time.tag", "count")
> library(dplyr)
> temp <- ddply(crime, .(crime, day), summarise, count = length(date))
> library(doBy)
> # temp <- summaryBy(Case ~ crime + month, data = crime, FUN= length)
> # names(temp)[3] <- "count"
>
> crime.agg <- ddply(crime, .(crime, Arrest, Beat, date, `X Coordinate`, `Y
Coordinate`, time.tag, day, month),
+                    summarise, count=length(date), .progress='text')

|=================================================================================
==================================| 100%
> beats <- sort(unique(crime.agg$Beat))
> dates <- sort(as.character(unique(crime.agg$date)))
> temp <- expand.grid(beats, dates)
> names(temp) <- c("Beat", "date")
> model.data <- aggregate(crime.agg[, c('count', 'Arrest')], by=

+ list(crime.agg$Beat, as.character(crime.agg$date)), FUN=sum)

> names(model.data) <- c("Beat", "date", "count", "Arrest")
> model.data <- merge(temp, model.data, by= c('Beat', 'date'), all.x= TRUE)
```

```
> View(model.data)
> model.data$count[is.na(model.data$count)] <- 0
> model.data$Arrest[is.na(model.data$Arrest)] <- 0
> model.data$day <- weekdays(as.Date(model.data$date), abbreviate= TRUE)
> model.data$month <- months(as.Date(model.data$date), abbreviate= TRUE)
> pastDays <- function(x) {c(0, rep(1, x))}
> model.data$past.crime.1 <- ave(model.data$count, model.data$Beat,
+                                FUN=function(x) filter(x, pastDays(1), sides= 1))
> model.data$past.crime.7 <- ave(model.data$count, model.data$Beat,
+                                FUN=function(x) filter(x, pastDays(7), sides= 1))
> model.data$past.crime.30 <- ave(model.data$count, model.data$Beat,
+                                 FUN=function(x) filter(x, pastDays(30), sides=
1))
> meanNA <- function(x){mean(x, na.rm= TRUE)}
> model.data$past.crime.1 <- ifelse(is.na(model.data$past.crime.1),
+ meanNA(model.data$past.crime.1), model.data$past.crime.1)

> model.data$past.crime.7 <- ifelse(is.na(model.data$past.crime.7),
+ meanNA(model.data$past.crime.7), model.data$past.crime.7)

> model.data$past.crime.30 <- ifelse(is.na(model.data$past.crime.30),
+ meanNA(model.data$past.crime.30), model.data$past.crime.30)

> # past variables for arrests
> model.data$past.arrest.30 <- ave(model.data$Arrest, model.data$Beat,

+ FUN= function(x) filter(x, pastDays(30), sides= 1))

> model.data$past.arrest.30 <- ifelse(is.na(model.data$past.arrest.30),
+ meanNA(model.data$past.arrest.30), model.data$past.arrest.30)

> # arrests per crime
> model.data$policing <- ifelse(model.data$past.crime.30 == 0, 0,
+                               model.data$past.arrest.30/model.data$past.crime.30)
> # trend
> model.data$crime.trend <- ifelse(model.data$past.crime.30 == 0, 0,
+
model.data$past.crime.7/model.data$past.crime.30)
```




## Conclusion/Interpretation:

All the variables considered in the model have significant relation with the crime.