Adverse Health and Economic Impacts of US Storms

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1: Synopsis

The following analysis investigates which types of severe weather events are most harmful on:

1. Health (injuries and fatalities)
2. Property and crops (economic consequences)

2: Data Processing

2.1: Data Loading

Download the raw data file and extract the data into a dataframe.Then convert to a data.table

```
library("data.table")
library("ggplot2")
fileUrl <- "https://d396qusza40orc.cloudfront.net/repdata%2Fdata%2FStormData.csv.bz2"
download.file(fileUrl, destfile = paste0("D:/r-projects/datasciencecoursera", '/repdata%2Fdata%2FStormDa
dat <- read.csv("D:/r-projects/datasciencecoursera/repdata%2Fdata%2FStormData.csv.bz2")
# Converting data.frame to data.table
data <- as.data.table(dat)
```

2.2: Examining Column Names

```
colnames(data)
```

```
##  [1] "STATE__"    "BGN_DATE"   "BGN_TIME"   "TIME_ZONE"  "COUNTY"
##  [6] "COUNTYNAME" "STATE"      "EVTYPE"     "BGN_RANGE"  "BGN_AZI"
## [11] "BGN_LOCATI" "END_DATE"   "END_TIME"   "COUNTY_END" "COUNTYENDN"
## [16] "END_RANGE"  "END_AZI"    "END_LOCATI" "LENGTH"     "WIDTH"
## [21] "F"          "MAG"        "FATALITIES" "INJURIES"   "PROPDMG"
## [26] "PROPDMGEXP" "CROPDMG"    "CROPDMGEXP" "WFO"        "STATEOFFIC"
## [31] "ZONENAMES"  "LATITUDE"   "LONGITUDE"  "LATITUDE_E" "LONGITUDE_"
## [36] "REMARKS"    "REFNUM"
```

2.3: Data Subsetting

Subset the dataset on the parameters of interest. Basically, we remove the columns we don't need for clarity.

```
# Finding columns to remove
cols2Remove <- colnames(data[, !c("EVTYPE"
  , "FATALITIES"
  , "INJURIES"
  , "PROPDMG"
  , "PROPDMGEXP"
  , "CROPDMG"
  , "CROPDMGEXP")])
# Removing columns
data[, c(cols2Remove) := NULL]
# Only use data where fatalities or injuries occurred.
data <- data[(EVTYPE != "?" &
              (INJURIES > 0 | FATALITIES > 0 | PROPDMG > 0 | CROPDMG > 0)), c("EVTYPE"
                                                                              , "FATALITIES"
                                                                              , "INJURIES"
                                                                              , "PROPDMG"
                                                                              , "PROPDMGEXP"
                                                                              , "CROPDMG"
                                                                              , "CROPDMGEXP") ]
```

2.4: Converting Exponent Columns into Actual Exponents instead of (-,+, H, K, etc)

Making the PROPDMGEXP and CROPDMGEXP columns cleaner so they can be used to calculate property and crop cost.

```
# Change all damage exponents to uppercase.
cols <- c("PROPDMGEXP", "CROPDMGEXP")
data[,  (cols) := c(lapply(.SD, toupper)), .SDcols = cols]
# Map property damage alphanumeric exponents to numeric values.
propDmgKey <-  c("\"\"" = 10^0,
                 "-" = 10^0,
                 "+" = 10^0,
                 "0" = 10^0,
                 "1" = 10^1,
                 "2" = 10^2,
                 "3" = 10^3,
                 "4" = 10^4,
                 "5" = 10^5,
                 "6" = 10^6,
                 "7" = 10^7,
                 "8" = 10^8,
                 "9" = 10^9,
                 "H" = 10^2,
                 "K" = 10^3,
                 "M" = 10^6,
                 "B" = 10^9)
# Map crop damage alphanumeric exponents to numeric values
cropDmgKey <-  c("\"\"" = 10^0,
                 "?" = 10^0,
                 "0" = 10^0,
                 "K" = 10^3,
                 "M" = 10^6,
                 "B" = 10^9)
```

```
data[, PROPDMGEXP := propDmgKey[as.character(data[,PROPDMGEXP])]]
data[is.na(PROPDMGEXP), PROPDMGEXP := 10^0 ]
data[, CROPDMGEXP := cropDmgKey[as.character(data[,CROPDMGEXP])] ]
data[is.na(CROPDMGEXP), CROPDMGEXP := 10^0 ]
```

2.5: Making Economic Cost Columns

```
data <- data[, .(EVTYPE, FATALITIES, INJURIES, PROPDMG, PROPDMGEXP, propCost = PROPDMG * PROPDMGEXP, CR
```

2.6: Calcuating Total Property and Crop Cost

```
totalCostDT <- data[, .(propCost = sum(propCost), cropCost = sum(cropCost), Total_Cost = sum(propCost) +
totalCostDT <- totalCostDT[order(-Total_Cost), ]
totalCostDT <- totalCostDT[1:10, ]
head(totalCostDT, 5)
```

```
##               EVTYPE     propCost   cropCost   Total_Cost
## 1:             FLOOD 144657709807 5661968450 150319678257
## 2: HURRICANE/TYPHOON  69305840000 2607872800  71913712800
## 3:           TORNADO  56947380677  414953270  57362333947
## 4:       STORM SURGE  43323536000       5000  43323541000
## 5:              HAIL  15735267513 3025954473  18761221986
```

2.7: Calcuating Total Fatalities and Injuries

```
totalInjuriesDT <- data[, .(FATALITIES = sum(FATALITIES), INJURIES = sum(INJURIES), totals = sum(FATALI
totalInjuriesDT <- totalInjuriesDT[order(-FATALITIES), ]
totalInjuriesDT <- totalInjuriesDT[1:10, ]
head(totalInjuriesDT, 5)
```

```
##            EVTYPE FATALITIES INJURIES totals
## 1:        TORNADO       5633    91346  96979
## 2: EXCESSIVE HEAT       1903     6525   8428
## 3:    FLASH FLOOD        978     1777   2755
## 4:           HEAT        937     2100   3037
## 5:      LIGHTNING        816     5230   6046
```

3: Results

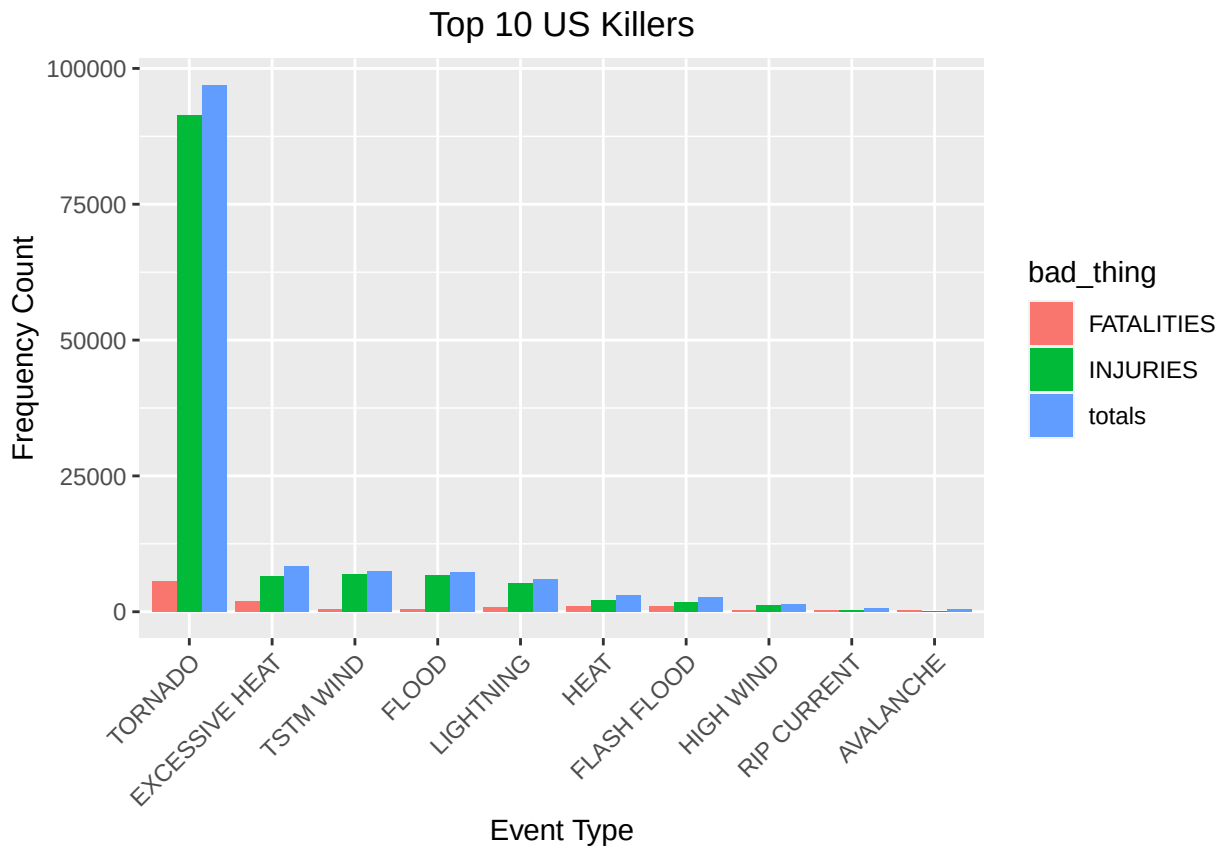
3.1: Events that are Most Harmful to Population Health

Melting data.table so that it is easier to put in bar graph format

```
bad_stuff <- melt(totalInjuriesDT, id.vars="EVTYPE", variable.name = "bad_thing")
head(bad_stuff, 5)
```

```
##            EVTYPE  bad_thing value
## 1:        TORNADO FATALITIES  5633
## 2: EXCESSIVE HEAT FATALITIES  1903
## 3:    FLASH FLOOD FATALITIES   978
## 4:           HEAT FATALITIES   937
## 5:      LIGHTNING FATALITIES   816
```

```
# Create chart
healthChart <- ggplot(bad_stuff, aes(x=reorder(EVTYPE, -value), y=value))
# Plot data as bar chart
healthChart = healthChart + geom_bar(stat="identity", aes(fill=bad_thing), position="dodge")
# Format y-axis scale and set y-axis label
healthChart = healthChart + ylab("Frequency Count")
# Set x-axis label
healthChart = healthChart + xlab("Event Type")
# Rotate x-axis tick labels
healthChart = healthChart + theme(axis.text.x = element_text(angle=45, hjust=1))
# Set chart title and center it
healthChart = healthChart + ggtitle("Top 10 US Killers") + theme(plot.title = element_text(hjust = 0.5))
healthChart
```



3.2: Events that have the Greatest Economic Consequences

Melting data.table so that it is easier to put in bar graph format

```
econ_consequences <- melt(totalCostDT, id.vars="EVTYPE", variable.name = "Damage_Type")
head(econ_consequences, 5)
```

```
##                EVTYPE Damage_Type        value
## 1:              FLOOD    propCost 144657709807
## 2: HURRICANE/TYPHOON    propCost  69305840000
## 3:            TORNADO    propCost  56947380677
## 4:        STORM SURGE    propCost  43323536000
## 5:               HAIL    propCost  15735267513
```

```
# Create chart
econChart <- ggplot(econ_consequences, aes(x=reorder(EVTYPE, -value), y=value))
# Plot data as bar chart
econChart = econChart + geom_bar(stat="identity", aes(fill=Damage_Type), position="dodge")
# Format y-axis scale and set y-axis label
econChart = econChart + ylab("Cost (dollars)")
# Set x-axis label
econChart = econChart + xlab("Event Type")
# Rotate x-axis tick labels
econChart = econChart + theme(axis.text.x = element_text(angle=45, hjust=1))
# Set chart title and center it
econChart = econChart + ggtitle("Top 10 US Storm Events causing Economic Consequences") + theme(plot.ti
econChart
```