Exploratory Data Analysis

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Set-up

Most of columns are categorical variables.

```
drops = c("title", "link", "excerpt", "Company", "money_raised", "linkedin_link",
          "Company_at_Linkedin", "Specialties", "Website", "Location",
          "zip_code","State",
          "Description", "Also.viewed", "Industry")
data = data[, !(names(data) %in% drops) ]

# check columns 1:13. Columns 13: have same format.
str(data[, 1:13 ])
```

```
## 'data.frame':    232 obs. of  13 variables:
##  $ published_at                  : Factor w/ 209 levels "1/11/2010","1/14/2016",..: 189 176 160 158 1
##  $ funding_round                 : Factor w/ 6 levels "","Series B",..: 4 4 4 4 4 4 4 4 4 4 ...
##  $ money_raised_float            : num  45 39 40 48 90 20.2 29 32 36 20 ...
##  $ CompanyName                   : Factor w/ 232 levels "2U","3D Robotics",..: 25 29 185 126 39 127 1
##  $ CompanySize                   : Factor w/ 8 levels "10-Jan","10,001+",..: 4 7 7 7 4 4 7 7 7 7 ...
##  $ Founded                       : num  2013 2013 2015 2011 2013 ...
##  $ City                          : Factor w/ 68 levels "","Arlington",..: 1 1 36 1 55 1 52 36 52 23
##  $ address_check                 : Factor w/ 2 levels "False","True": 1 1 2 1 2 1 2 2 2 2 ...
##  $ Country                       : Factor w/ 23 levels "Belgium","Brazil",..: 8 22 23 22 23 7 23 23 1
##  $ latitude                      : num  NA NA 40.7 NA 37.4 ...
##  $ longitude                     : num  NA NA -74 NA -122 ...
##  $ Industry_consolidated         : Factor w/ 16 levels "Computer & Network Security & Hardware",..: 1
##  $ spc_Logistics.and.Supply.Chain: int  0 0 0 1 0 0 0 0 0 0 ...
```

```
# show columns with na
na = lapply(data, function(x) sum(ifelse(is.na(x) | x == "" | x == "not found", TRUE, FALSE)))
na[na > 0]
```

```
## $funding_round
## [1] 12
##
## $City
## [1] 46
```

```
##
## $latitude
## [1] 46
##
## $longitude
## [1] 46
```

Univariate Analysis

- Funding round

As intended, most companies are in Series B and Series C. Need to merge “series C” and “Series C”.

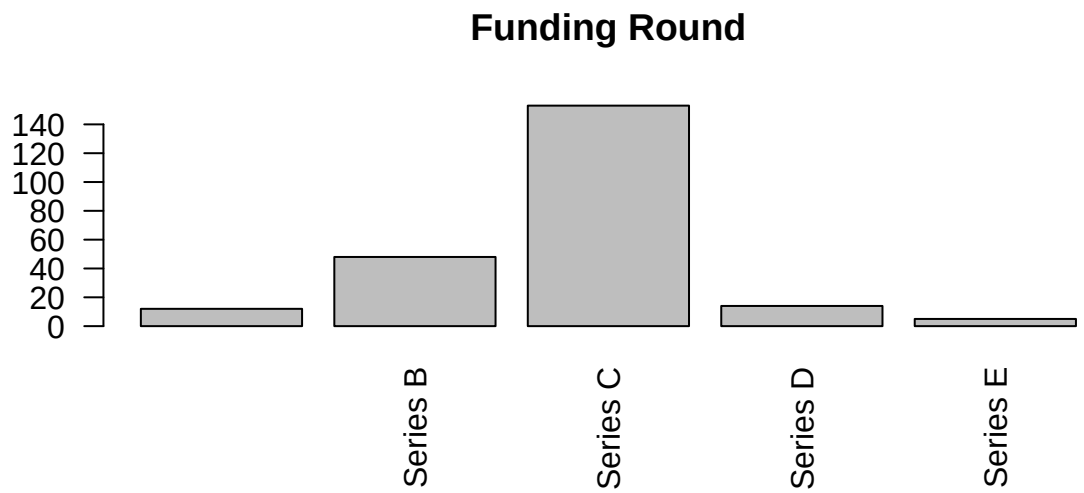
```
# counts = table(data$funding_round)
# counts

data$funding_round[data$funding_round == "series C"] = "Series C"

# remove the level does not occur ("series C")
data$funding_round = factor(data$funding_round)

counts = table(data$funding_round)
counts
```

```
##
##          Series B Series C Series D Series E
##       12       48      153       14        5
```

```
prop.table(table(data$funding_round))
```

```
##
##              Series B   Series C   Series D   Series E
## 0.05172414 0.20689655 0.65948276 0.06034483 0.02155172
```

```
barplot(counts, main = "Funding Round", las = 2)
```



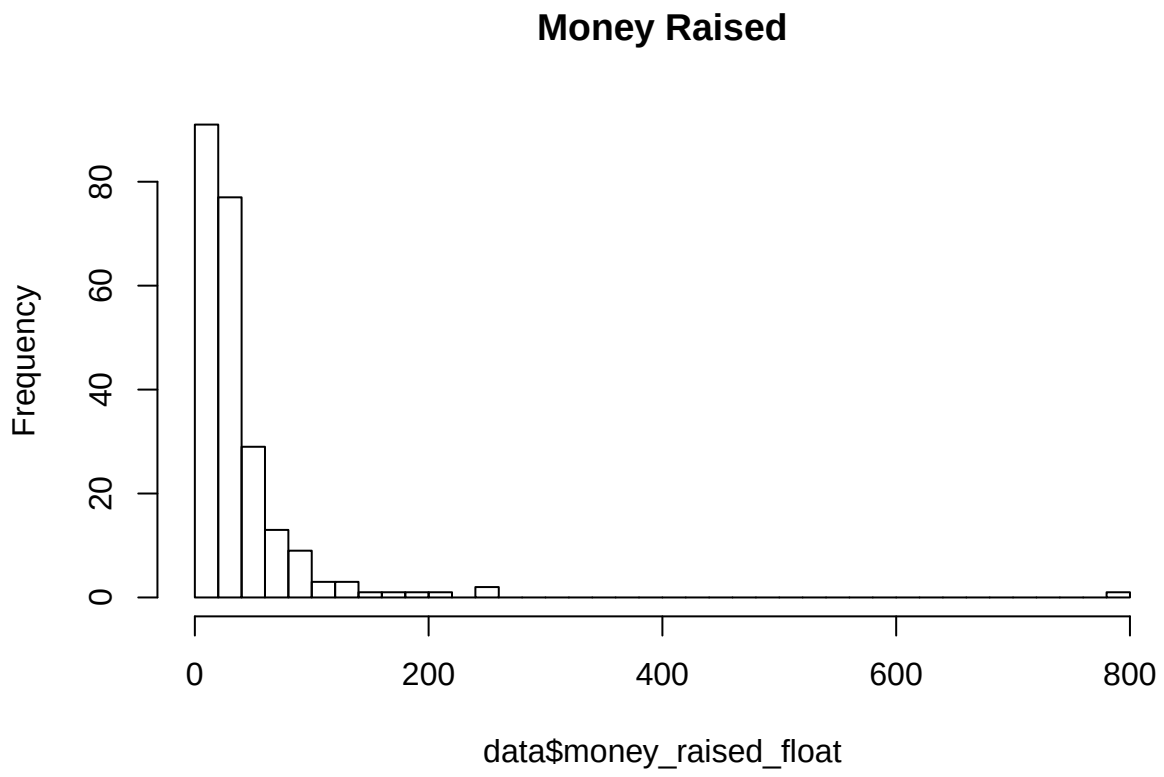
- Money raised

Most of companies raised money under $100M. We observe some outliers: Magic Leap, Pivotal, GitHub, and Opendoor.com.

```
summary(data$money_raised_float)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   10.00   15.00   25.00   41.17   45.00  793.50
```

```
hist(data$money_raised_float, breaks = 40, main = "Money Raised")
```




```
# check the outliers
data[data$money_raised_float > 200, c("CompanyName", "funding_round", "CompanySize","money_raised_float
```

```
##      CompanyName funding_round CompanySize money_raised_float
## 28    Magic Leap      Series C   1001-5000              793.5
## 157      Pivotal      Series C   1001-5000              253.0
## 173       GitHub      Series B    501-1000              250.0
## 230 Opendoor.com      Series D     201-500              210.0
```

- Number of Employees

```
# counts = table(data$CompanySize)
# counts

# str(data$CompanySize)

# clean up - factors
data$CompanySize = revalue(data$CompanySize, c("Nov-50"="11-50", "10-Jan"="1-10"))
```

```
# clean up - the level orders
data$CompanySize = factor(data$CompanySize, levels = c("1-10", "11-50","51-200","201-500", "501-1000",
                                                       "1001-5000","5001-10,000","10,001+"))

counts = table(data$CompanySize)
counts
```

```
##
##        1-10       11-50      51-200     201-500    501-1000   1001-5000
##           1          27         101          64          14          21
## 5001-10,000     10,001+
##           2           2
```

```
barplot(counts, main = "Company size", las=2)
```

- When Companies Are Founded

There are some companies founded before 2000. I suspect Hillshire Brands, founded in 1939, is a startup.

```
counts = table(data$Founded)
counts
```

```
##
## 1939 1976 1986 1989 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
##    1    1    1    1    2    2    3    2    5    4   12   18   20   16   16
## 2010 2011 2012 2013 2014 2015 2016 2017
##   21   33   31   22   14    5    1    1
```

```
data[data$Founded < 2000, c("Founded", "CompanyName", "funding_round",
                                    "CompanySize","money_raised_float")]
```

```
##     Founded                                          CompanyName
## 120    1999                                            Snagajob
## 142    1999 Trion Group, a Marsh & McLennan Agency, LLC Company
## 143    1986                                            Like.com
## 146    1976                                          Ticketmaster
## 152    1989                        La Jolla Pharmaceutical Company
## 214    1939                                      Hillshire Brands
```

```
##     funding_round CompanySize money_raised_float
## 120      Series C     201-500                 27
## 142      Series C     201-500                 70
## 143      Series C       11-50                 32
## 146      Series C 5001-10,000                 25
## 152      Series C      51-200                 12
## 214      Series B 5001-10,000                 24
```

- Country Companies Are Based In

Since I collected startups from TechCrunch, the US based news outlet, it turns out 77% startup in the dataset are based in the US. This might also be because the US produces the largest number of startups.

```
counts = table(data$Country)
counts
```

```
##
##        Belgium         Brazil         Canada          China        Denmark
##              1              1              4              1              1
##         France        Germany          India           iran         Israel
##              1              8              4              1              1
##          Italy          Japan          Korea    New Zealand         Norway
##              1              1              1              1              1
##         Poland         Russia      Singapore         Sweden       Thailand
##              1              1              4              1              1
##         Turkey United Kingdom  United States
##              1             17            178
```

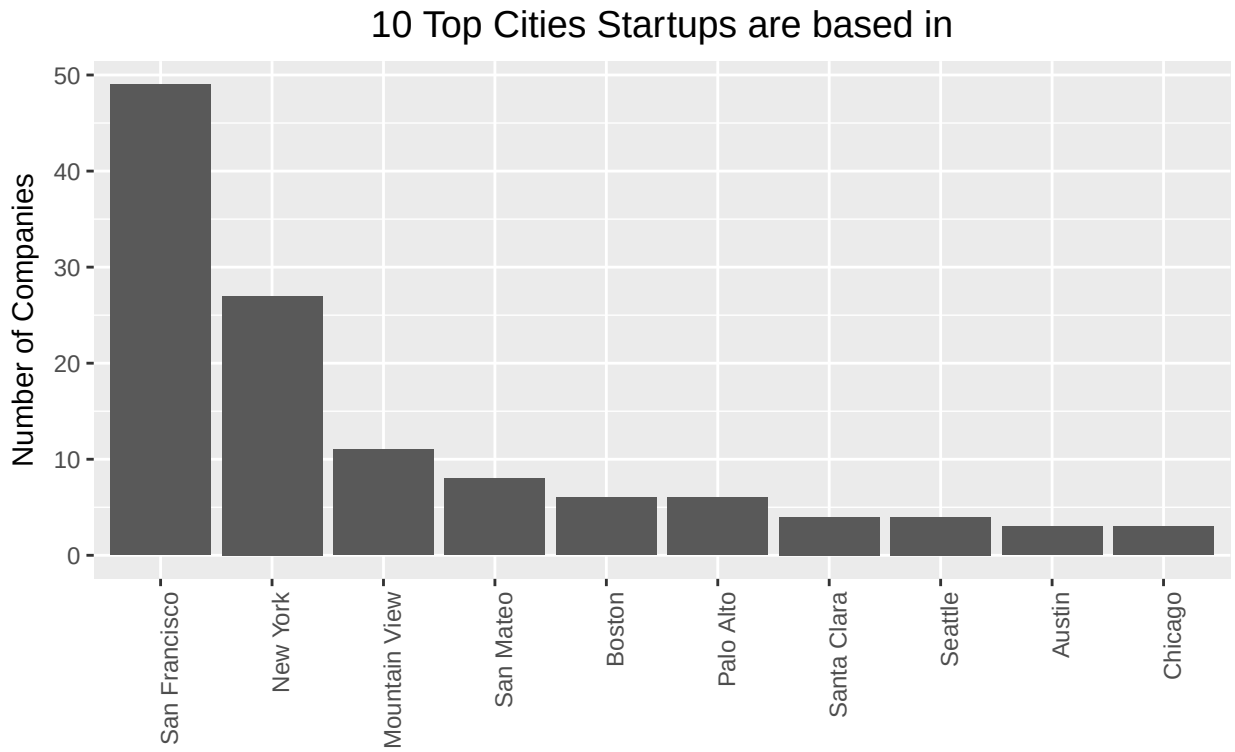
```
prop.table(counts)
```

```
##
##        Belgium         Brazil         Canada          China        Denmark
##    0.004310345    0.004310345    0.017241379    0.004310345    0.004310345
##         France        Germany          India           iran         Israel
##    0.004310345    0.034482759    0.017241379    0.004310345    0.004310345
##          Italy          Japan          Korea    New Zealand         Norway
##    0.004310345    0.004310345    0.004310345    0.004310345    0.004310345
##         Poland         Russia      Singapore         Sweden       Thailand
##    0.004310345    0.004310345    0.017241379    0.004310345    0.004310345
##         Turkey United Kingdom  United States
##    0.004310345    0.073275862    0.767241379
```

- City

```
detach(package:plyr)
data %>%
  group_by(City) %>%
  summarize(n = n()) %>%
  arrange(desc(n)) %>%
  filter(City != "") %>%
  slice(1:10) %>%
  ggplot(., aes(x = reorder(City, -n), y = n)) +
  geom_bar(stat = "identity") +
  ggtitle("10 Top Cities Startups are based in") +
  theme(plot.title = element_text(hjust = 0.5, size=14)) +
  theme(axis.text.x = element_text(angle = 90, hjust = 1)) +
  theme(axis.title.x=element_blank()) +
```

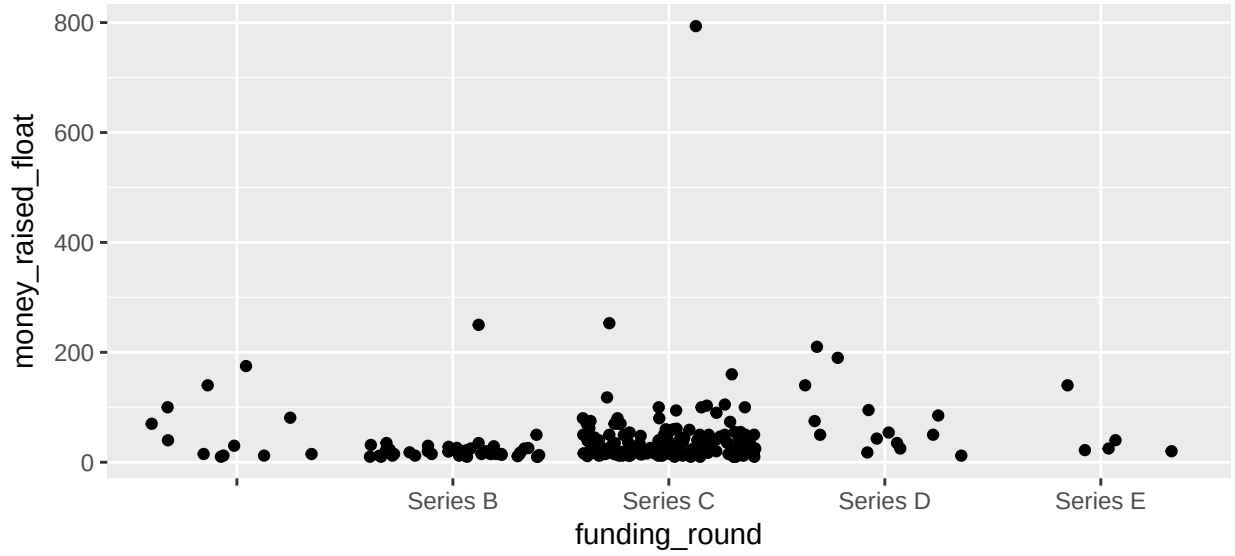
```
  ylab("Number of Companies")
```



Bivariate Analysis

- Funding_round x money_raised

```
ggplot(data = data, aes(x= funding_round, y = money_raised_float)) +
  geom_jitter()
```

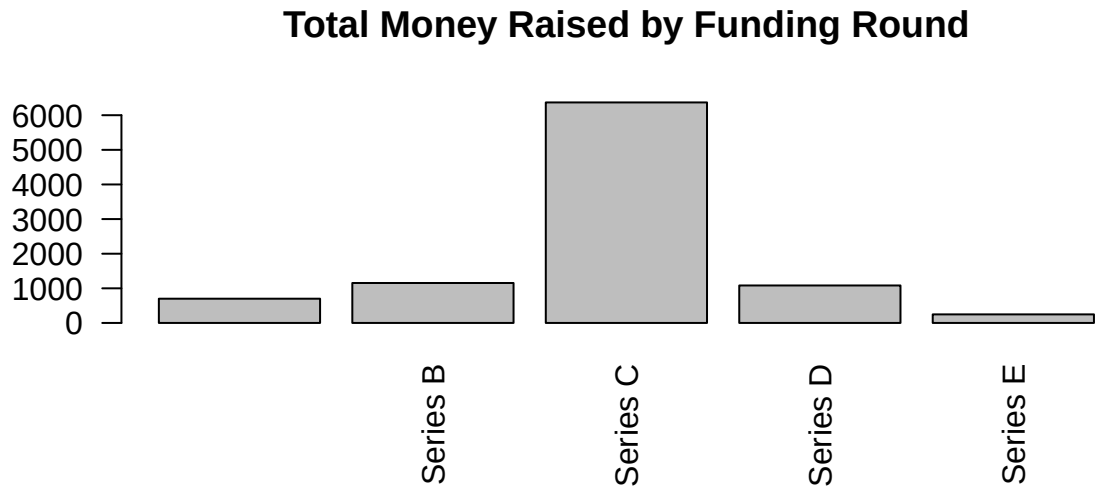


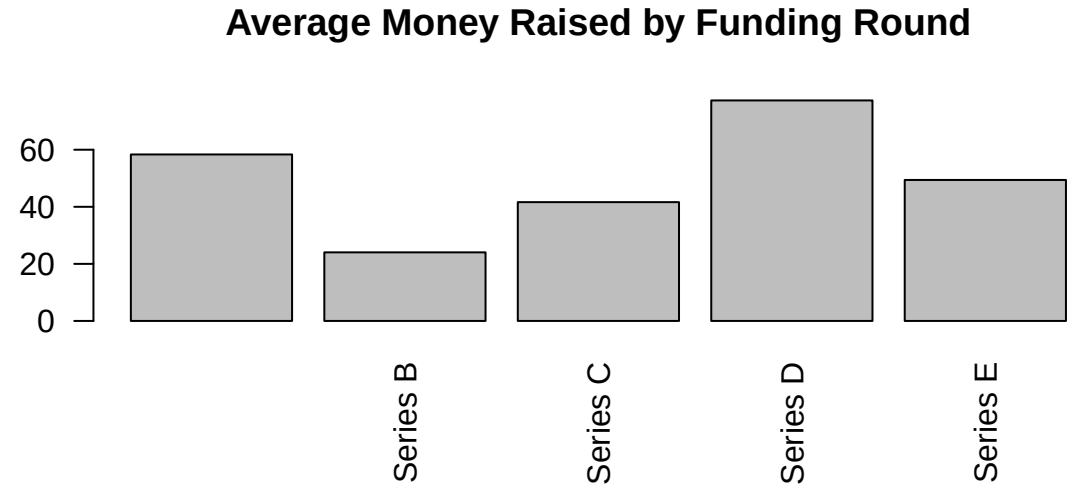
The table below shows mean and standard deviaiton of money raised for companies in each funding round. It makes sense that the mean increases as funding round progresses. Series E has lower mean than Series D. This might be because Series E is more of extension of Series D to sustain funding and not a funding round to drive a company to next level. Also note that stand devidations are quite larger for each round.

```
par(mfrow=c(2,1))

money = data %>%
  group_by(funding_round) %>%
  summarize(sum = sum(money_raised_float), mean = mean(money_raised_float), sd = sd(money_raised_float))
money
```

```
## # A tibble: 5 × 4
##   funding_round    sum     mean       sd
##          <fctr>  <dbl>    <dbl>    <dbl>
## 1                700.0 58.33333 55.75161
## 2      Series B 1153.8 24.03750 34.28641
## 3      Series C 6369.2 41.62876 68.57037
## 4      Series D 1081.8 77.27143 62.11565
## 5      Series E  247.0 49.40000 51.25232
```

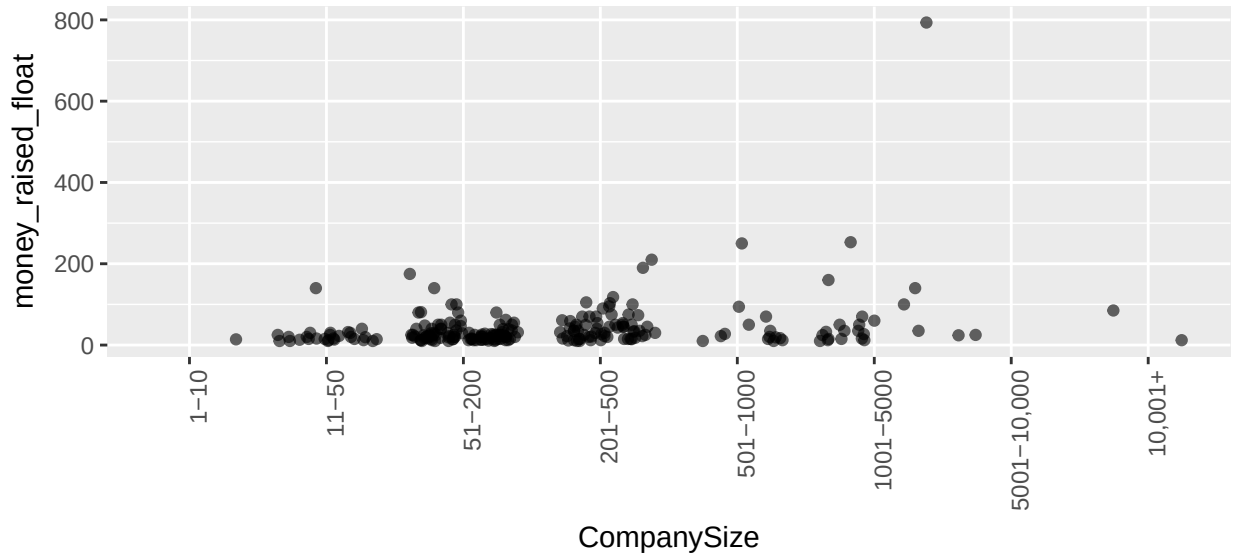
```
counts = money$sum
names(counts) = money$funding_round
barplot(counts, las = 2, main = "Total Money Raised by Funding Round")

counts = money$mean
names(counts) = money$funding_round
barplot(counts, las = 2, main = "Average Money Raised by Funding Round")
```



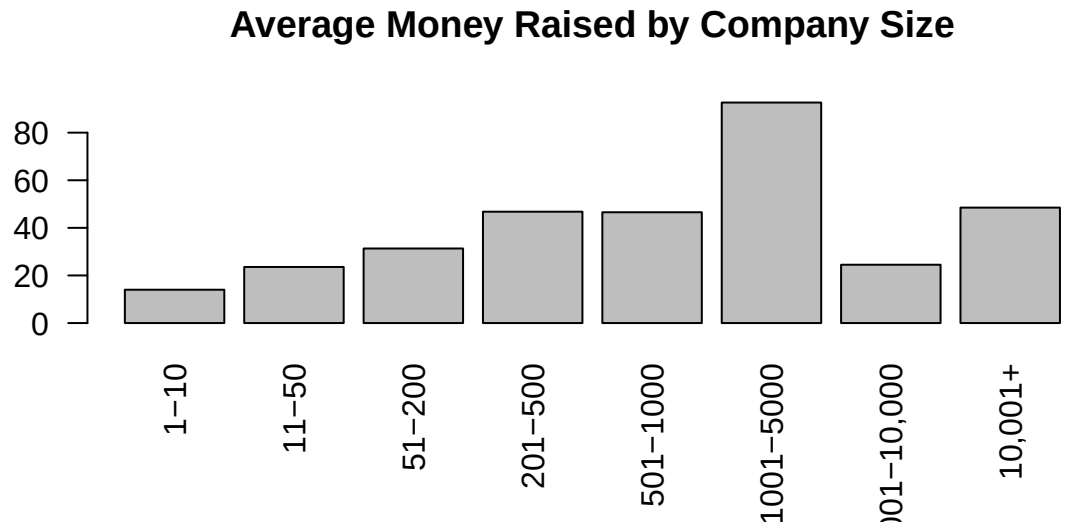


- Company size x money_raised

```
ggplot(data = data, aes(x= CompanySize, y = money_raised_float)) +
  geom_jitter(alpha = 0.6) +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))
```




```
money = data %>%
  group_by(CompanySize) %>%
  summarize(mean = mean(money_raised_float), sd = sd(money_raised_float))

counts = money$mean
names(counts) = money$CompanySize
barplot(counts, las = 2, main = "Average Money Raised by Company Size")
```



Location

```
# Set the center of map

all_states <- map_data("state")
```

```
ggplot() + geom_polygon(data = all_states, aes(x=long, y = lat, group = group),
                        colour="white", fill="grey10") +
  coord_fixed(1.3) +
  geom_jitter(data = data, mapping = aes(
    x = longitude, y = latitude, color = "Orangered" ,size = money_raised_float),
              alpha = 0.4, width = 0.7, height = 0.7) +
  scale_size(range = c(2, 12)) +
  ggtitle("Company Location with Money Raised") +
  theme(plot.title = element_text(hjust = 0.5, size=18)) +
  labs(x=NULL, y=NULL) +
  theme(panel.border = element_blank())
```