User Complaints Mining

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Preparing data

Load and clean the customer complaints data

The data should be downloaded from Kaggle's Consumer Complaints Database.

Loading and removing rows with no complaint narrative and unnecessary colimns:

```
if(!file.exists("./user-complaints-mining/df.Rds")) {
  df <- read_csv(file="../data/Consumer_Complaints.csv.zip",col_names = TRUE)
  df <- df[,-c(1,7,9:18)]
  df <- df[!is.na(df["Consumer complaint narrative"]),] #199,970
  df <- df[!is.na(df["Company"]),] # no NA's
  df <- df[!is.na(df["Product"]),] # no NA's
  df <- df[!is.na(df["Issue"]),] # no NA's
  df <- df[!is.na(df["Sub-product"]),] # 147,788 total left
  df <- df[!is.na(df["Sub-issue"]),]   # 81,940 total left

  # Converting all but narrative columns to factors
  df$Product <- as.factor(df$Product)
  df$`Sub-product` <- as.factor(df$`Sub-product`)
  df$Issue <- as.factor(df$Issue)
  df$`Sub-issue` <- as.factor(df$`Sub-issue`)
  df$Company <- as.factor(df$Company)
  saveRDS(df, file = "./user-complaints-mining/df.Rds")
  gc()
} else {
  df <- readRDS("./user-complaints-mining/df.Rds")
}
df
```

```
## # A tibble: 81,940 x 6
##    Product  `Sub-product`   Issue  `Sub-issue`  `Consumer complai~ Company
##    <fct>    <fct>           <fct>  <fct>        <chr>              <fct>
##  1 Debt co~ Other (i.e. ph~ Discl~ Not given e~ This company refu~ The CBE~
##  2 Debt co~ Credit card     Impro~ Talked to a~ "This complaint i~ SQUARET~
##  3 Debt co~ Credit card     Takin~ Sued w/o pr~ "I am writing to ~ Selip &~
##  4 Debt co~ Other (i.e. ph~ Cont'~ Debt result~ My identity was s~ Southwe~
##  5 Student~ Federal studen~ Can't~ Can't get f~ "I was dropped fr~ AES/PHE~
##  6 Debt co~ Credit card     Discl~ Not given e~ The first communi~ Blatt, ~
##  7 Debt co~ Other (i.e. ph~ Commu~ Frequent or~ "My complaint is ~ AR Reso~
##  8 Debt co~ I do not know   False~ Attempted t~ In a clearance in~ SANTAND~
##  9 Student~ Non-federal st~ Can't~ Can't tempo~ XXXX University, ~ Navient~
## 10 Student~ Non-federal st~ Deali~ Received ba~ I had attended XX~ CITIZEN~
## # ... with 81,930 more rows
```

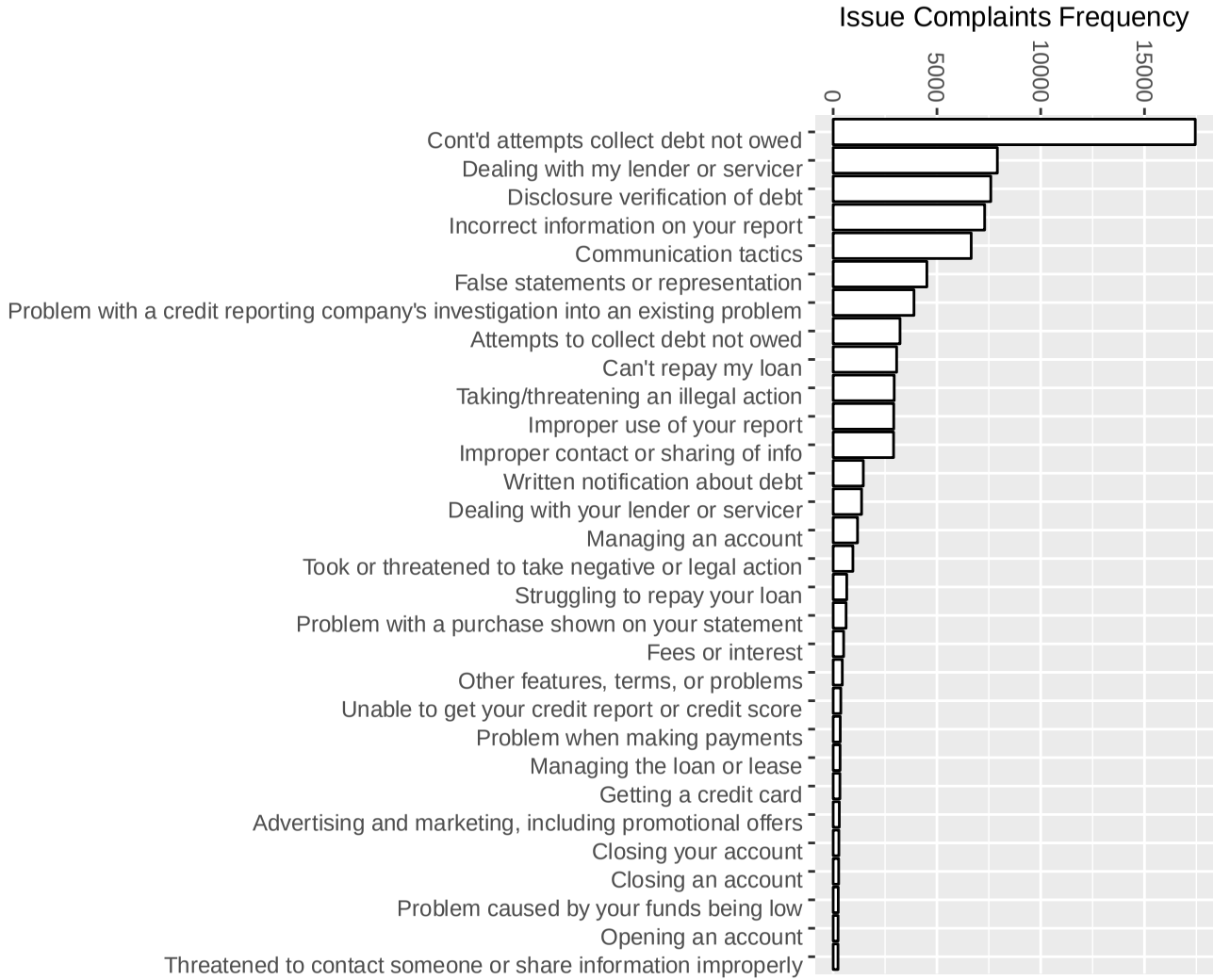
Converting all but narrative columns to factors:

```r
df$Product <- as.factor(df$Product)
df$`Sub-product` <- as.factor(df$`Sub-product`)
df$Issue <- as.factor(df$Issue)
df$`Sub-issue` <- as.factor(df$`Sub-issue`)
df$Company <- as.factor(df$Company)
```

Feature engineering

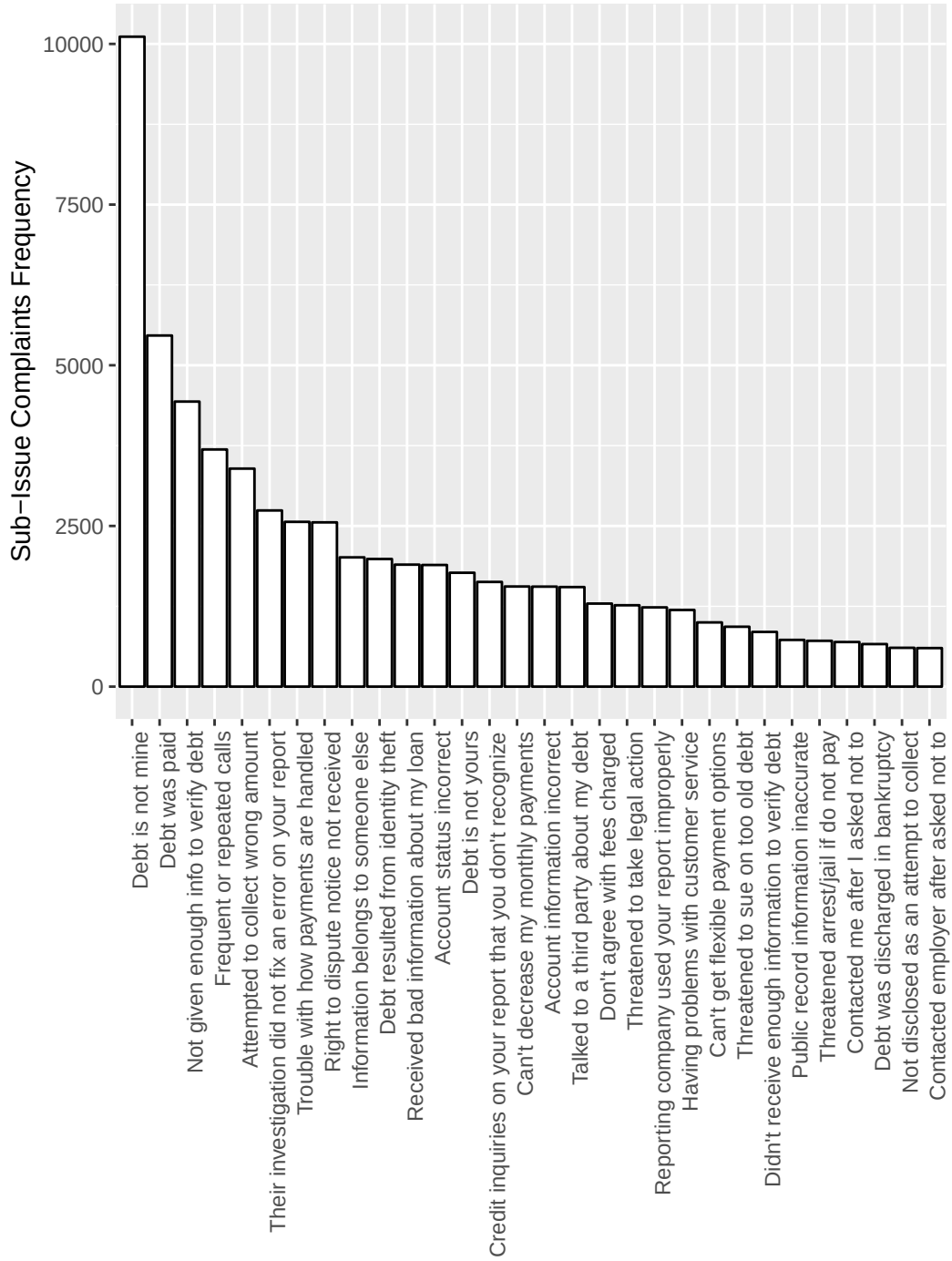
Distribution of the most frequent "Issue" complaints

```r
most_freq_issues_list <- levels(fct_infreq(df$Issue))[1:30]
ggplot() + aes(fct_infreq(df[df$Issue %in% most_freq_issues_list,]$Issue))+
  geom_histogram(colour="black", fill="white", stat = "count")+
  ylab("Issue Complaints Frequency") + xlab("")+
  theme(axis.text.x = element_text(angle =90, hjust = 1))
```


Issue Complaints Frequency
0
5000
10000
15000
Cont'd attempts collect debt not owed
Dealing with my lender or servicer
Disclosure verification of debt
Incorrect information on your report
Communication tactics
False statements or representation
Problem with a credit reporting company's investigation into an existing problem
Attempts to collect debt not owed
Can't repay my loan
Taking/threatening an illegal action
Improper use of your report
Improper contact or sharing of info
Written notification about debt
Dealing with your lender or servicer
Managing an account
Took or threatened to take negative or legal action
Struggling to repay your loan
Problem with a purchase shown on your statement
Fees or interest
Other features, terms, or problems
Unable to get your credit report or credit score
Problem when making payments
Managing the loan or lease
Getting a credit card
Advertising and marketing, including promotional offers
Closing your account
Closing an account
Problem caused by your funds being low
Opening an account
Threatened to contact someone or share information improperly

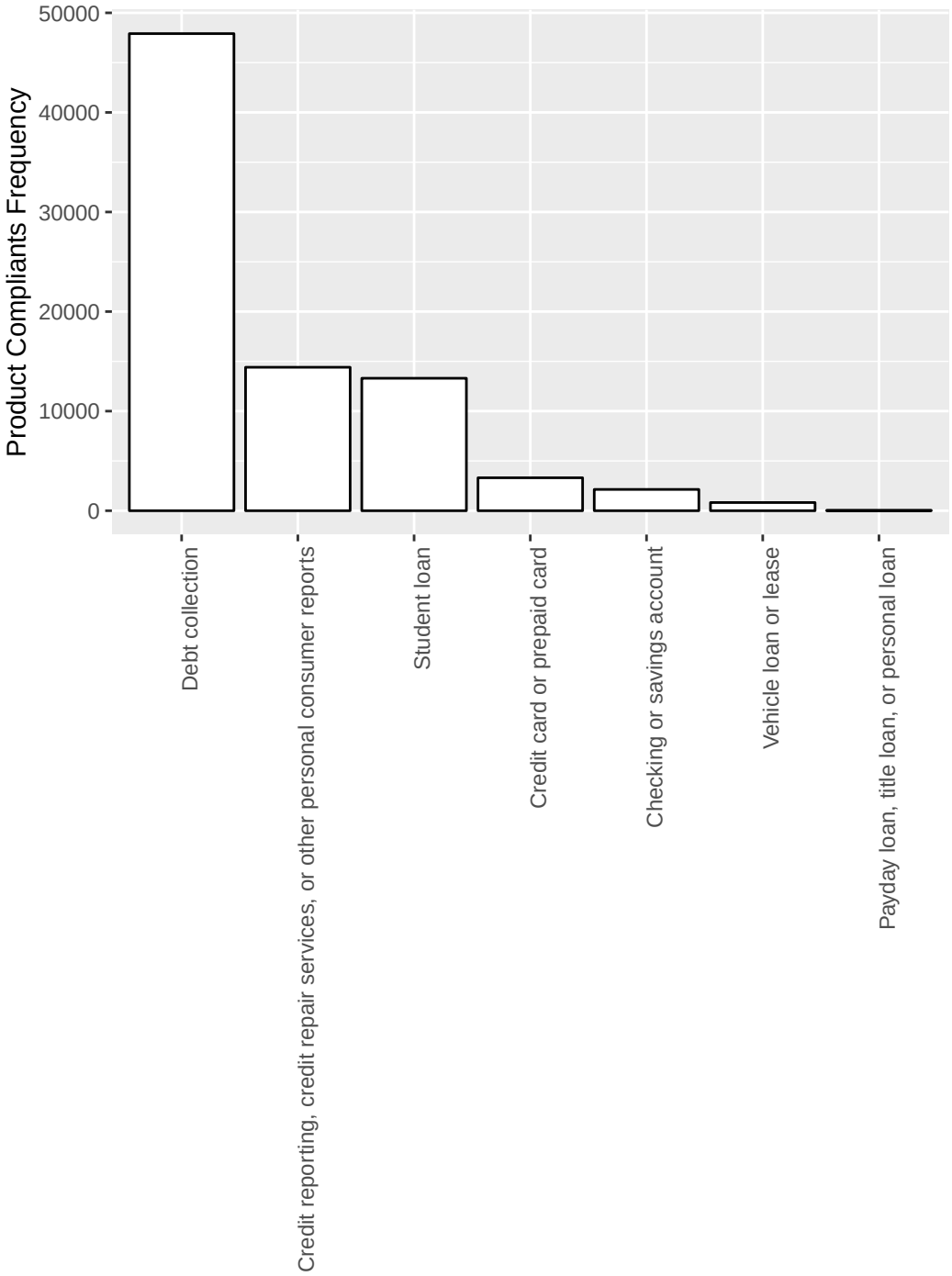
Distribution of the most frequent "Sub-issue" complaints

```
most_freq_subissues_list <- levels(fct_infreq(df$`Sub-issue`))[1:30]
ggplot() + aes(fct_infreq(df[df$`Sub-issue` %in% most_freq_subissues_list,]$`Sub-issue`))+
  geom_histogram(colour="black", fill="white", stat = "count")+
  ylab("Sub-Issue Complaints Frequency") + xlab("")+
  theme(axis.text.x = element_text(angle =90, hjust = 1))
```



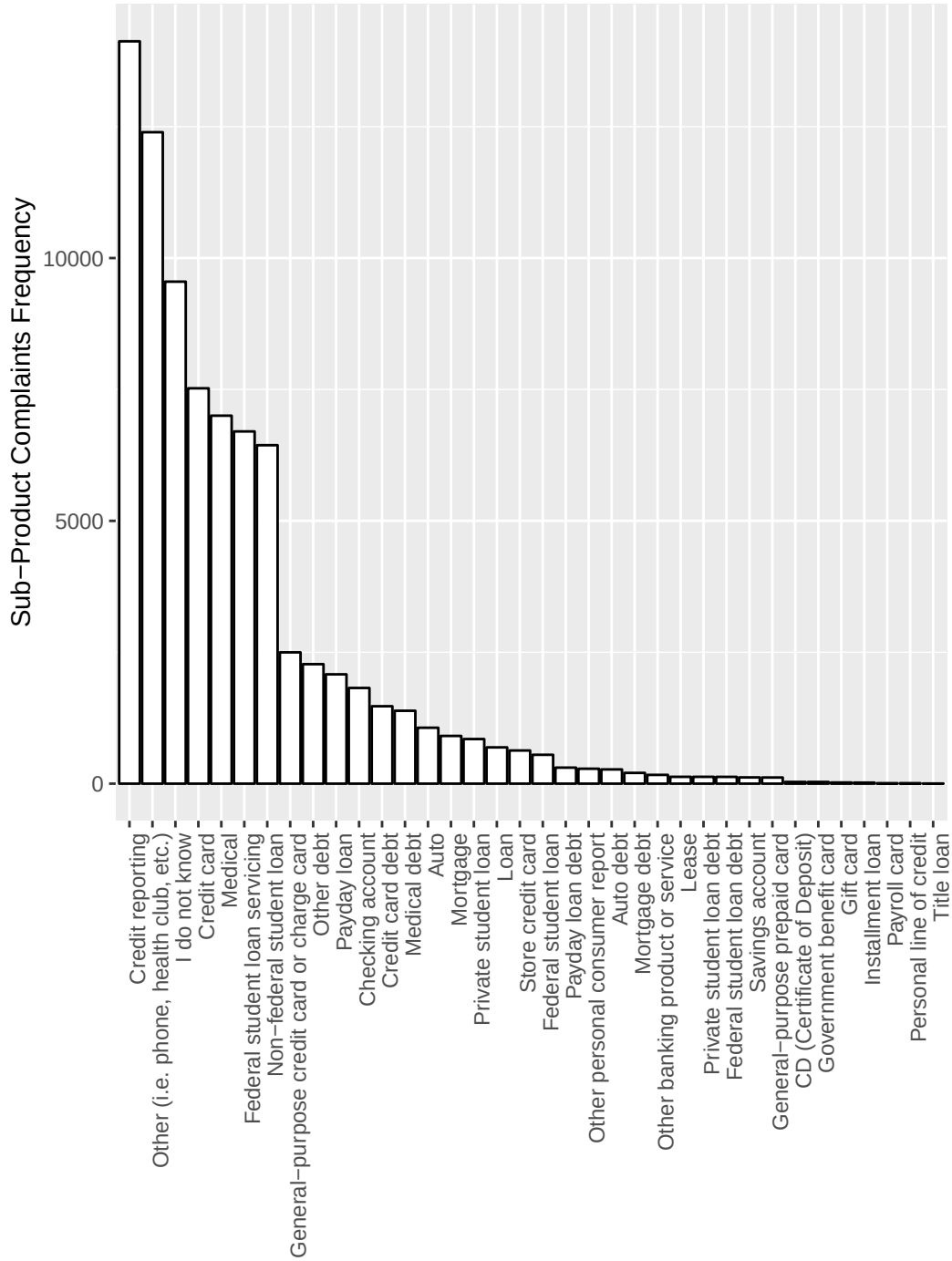
Distribution of the most frequent "Product" complaints

```
most_freq_product_list <- levels(fct_infreq(df$Product))[1:30]
ggplot() + aes(fct_infreq(df[df$Product %in% most_freq_product_list,]$Product))+
  geom_histogram(colour="black", fill="white", stat = "count")+
  ylab("Product Compliants Frequency") + xlab("")+
  theme(axis.text.x = element_text(angle =90, hjust = 1))
```



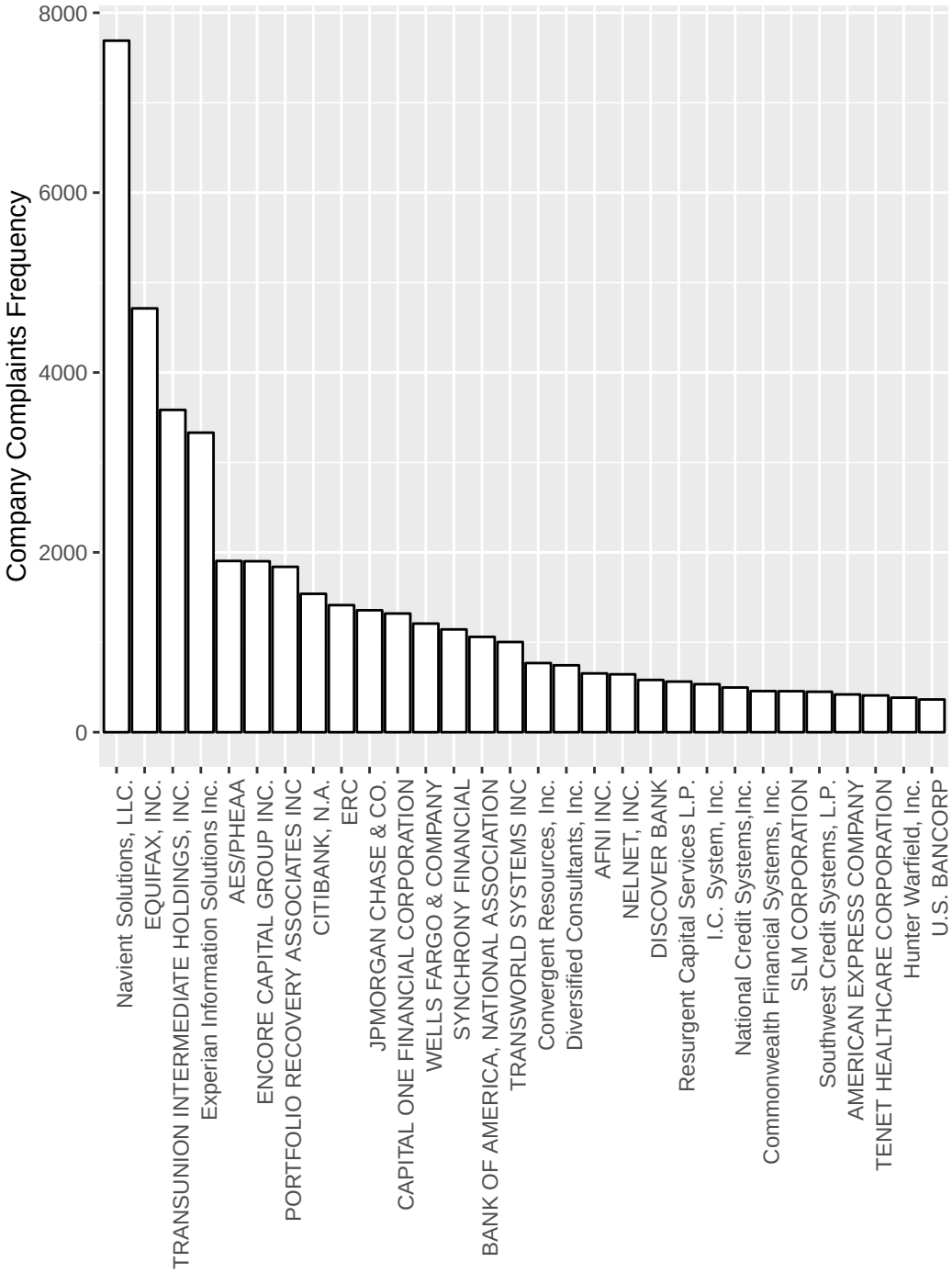
Distribution of the most frequent "Sub-product" complaints

```
most_freq_subproduct_list <- levels(fct_infreq(df$`Sub-product`))
ggplot() + aes(fct_infreq(df[df$`Sub-product` %in% most_freq_subproduct_list,]$`Sub-product`))+
  geom_histogram(colour="black", fill="white", stat = "count")+
  ylab("Sub-Product Complaints Frequency") + xlab("")+
  theme(axis.text.x = element_text(angle =90, hjust = 1))
```



Distribution of the most frequent "Company" complaints

```
most_freq_company_list <- levels(fct_infreq(df$Company))[1:30]
ggplot() + aes(fct_infreq(df[df$Company %in% most_freq_company_list,]$Company))+
  geom_histogram(colour="black", fill="white", stat = "count")+
  ylab("Company Complaints Frequency") + xlab("")+
  theme(axis.text.x = element_text(angle =90, hjust = 1))
```



Text Minig

Split data into test and train sets

```
set.seed(123)
sample = sample.split(df$`Consumer complaint narrative`, SplitRatio = .5)
train = subset(df, sample == TRUE)
test  = subset(df, sample == FALSE)
```

Word analysis

Building a corpus, which is a collection of text documents VectorSource specifies that the source is character vectors.After that, the corpus needs a couple of transformations, including changing letters to lower case, removing punctuations/numbers and removing stop words. The general English stop-word list is tailored by adding some words specific to the documents in question.

```
if(!file.exists("./user-complaints-mining/myCorpus.Rds")) {
  myCorpus <- Corpus(VectorSource(train$`Consumer complaint narrative`))
  myCorpus <- tm_map(myCorpus, removePunctuation)
  myCorpus <- tm_map(myCorpus, removeNumbers)
  myCorpus <- tm_map(myCorpus, tolower)
  myStopwords <- c(stopwords(language="en", source="smart"), "xxxx", "xxxxxxxxxxxx", "xxxxxxxx")
  myCorpus <- tm_map(myCorpus, removeWords, myStopwords)
  myCorpus <- tm_map(myCorpus, stripWhitespace)
  saveRDS(myCorpus, file = "./user-complaints-mining/myCorpus.Rds")
  gc()
} else {
  myCorpus <- readRDS("./user-complaints-mining/myCorpus.Rds")
}
print(myCorpus[1:5]$content)
```

```
## [1] " company refuses provide verification validation debt fdcpa debt mine"
## [2] " writing request assistance deceptive practices collection lawfirm appears
tactics violating consumer protection law debt collection practices depriving consumers
rights dispute received notice company day contacted offices instructed memo dated
instruct contact plaintiff attorney court instructions provided contacted plaintiff
attorney phone faxed letter disputing debt letter company responded letter dated sending
bill due date requested bill showing balance back made payment back disputing amount owed
disputing charges wrote back company faxed dispute letter continue dispute amount owed
company response furnished information disputing owe disputing balance inaccurate needed
proof charges activity account paragraph letter disputing amount send letter letter
company disputing balance requesting documents company responded letter communication
received letter copy default judgment filed court clerk office indicating failed respond
judgment facts judgment firm served original judgment attaching dispute letters showing
responded instructed office occasions plaintiff failed respond dispute furnish
information providedand unable obtain proof original debt credible legal procedure settle
debts utilized unfaithful dirty tactics violated rights court committed perjury law
filing false documents court defaulted judgment failed respond fact responded failed
furnish proof court house clerk office told company notify offices contact company told
court clerk office respond summons clerks office granted default judgement based false
information respond summons filed false affirmation clerk office"
## [3] " communication received debt collector court summons delivered mother laws home
```

```
received summons hand week summons stated alledgedly owed money debt collector advisement
dispute debt days demand debt collector validate debt attempted demand validation debt
online research certified letter days ago post office told today approximately certified
letter attempted delivered days mailed accepted debt collector today withoyut knowledge
information sufficient form opinion truth accuracy claim based deny generally
specifically claim debt collector"
## [4] " attended forced loan attend school loan interest rate make payments attended
school enrolled told classmates received reduction balance curious criteria receive
reduction"
## [5] "years ago harassed issue asked send application form signed understood charged
extra pet damages paid additional month pet covered damages wanted photos damages
property manager told walk left apartment thing scam money contacted requested
information"
```

Steming

```
dictCorpus <- myCorpus
myCorpus <- tm_map(myCorpus, stemDocument)
print(myCorpus[1:5]$content)
```

```
## [1] "compani refus provid verif valid debt fdcpa debt mine"
## [2] "write request assist decept practic collect lawfirm appear tactic violat consum
protect law debt collect practic depriv consum right disput receiv notic compani day
contact offic instruct memo date instruct contact plaintiff attorney court instruct
provid contact plaintiff attorney phone fax letter disput debt letter compani respond
letter date send bill due date request bill show balanc back made payment back disput
amount owe disput charg wrote back compani fax disput letter continu disput amount owe
compani respons furnish inform disput owe disput balanc inaccur need proof charg activ
account paragraph letter disput amount send letter letter compani disput balanc request
document compani respond letter communic receiv letter copi default judgment file court
clerk offic indic fail respond judgment fact judgment firm serv origin judgment attach
disput letter show respond instruct offic occas plaintiff fail respond disput furnish
inform providedand unabl obtain proof origin debt credibl legal procedur settl debt util
unfaith dirti tactic violat right court commit perjuri law file fals document court
default judgment fail respond fact respond fail furnish proof court hous clerk offic told
compani notifi offic contact compani told court clerk offic respond summon clerk offic
grant default judgement base fals inform respond summon file fals affirm clerk offic"
## [3] "communic receiv debt collector court summon deliv mother law home receiv summon
hand week summon state alledg owe money debt collector advis disput debt day demand debt
collector valid debt attempt demand valid debt onlin research certifi letter day ago post
offic told today approxim certifi letter attempt deliv day mail accept debt collector
today withoyut knowledg inform suffici form opinion truth accuraci claim base deni
general specif claim debt collector"
## [4] "attend forc loan attend school loan interest rate make payment attend school
enrol told classmat receiv reduct balanc curious criteria receiv reduct"
## [5] "year ago harass issu ask send applic form sign understood charg extra pet damag
paid addit month pet cover damag want photo damag properti manag told walk left apart
thing scam money contact request inform"
```

Building a Document-Term Matrix

This operation requiers 64GB of RAM. To avoid calculation, the pre-build myDtm object will be loaded from the file system. To recalculate it needs to be removed from the file system first.

```
if(!file.exists("./user-complaints-mining/myDtm.Rds")) {
  myDtm <- TermDocumentMatrix(myCorpus, control = list(minWordLength = 1))
  rowTotals <- apply(myDtm , 1, sum) #Find the sum of words in each Document
  myDtm <- myDtm[rowTotals > 0, ] #remove all docs without words
  saveRDS(myDtm, file = "./user-complaints-mining/myDtm.Rds")
  gc()
} else {
  myDtm <- readRDS("./user-complaints-mining/myDtm.Rds")
}
inspect(myDtm)
```

```
## <<TermDocumentMatrix (terms: 27440, documents: 40970)>>
## Non-/sparse entries: 1585496/1122631304
## Sparsity           : 100%
## Maximal term length: 124
## Weighting          : term frequency (tf)
## Sample             :
##          Docs
## Terms     11425 11904 31399 31930 33039 34137 35502 35599 36932 9698
##   account    26    21    60    62    18    64     5     8     0    6
##   call        3    10     2     0    18     0     3     0     2    7
##   collect     0     0     5     0     0     4     0     6     0   21
##   credit      3     1     0     0     0     2    13     2     2    0
##   debt        0     0     1     1     0     1     0     0     3   68
##   inform     11     5     8     8     6     8    10    73     5    9
##   loan        5     0     2     0    11     0     2     0     3    0
##   payment     2    12    27    27    24    27     7     0     0    1
##   receiv      4     2     0     0    25     0     1     0     8   10
##   report      1     0    25    27     1    28    26     8     0    0
```

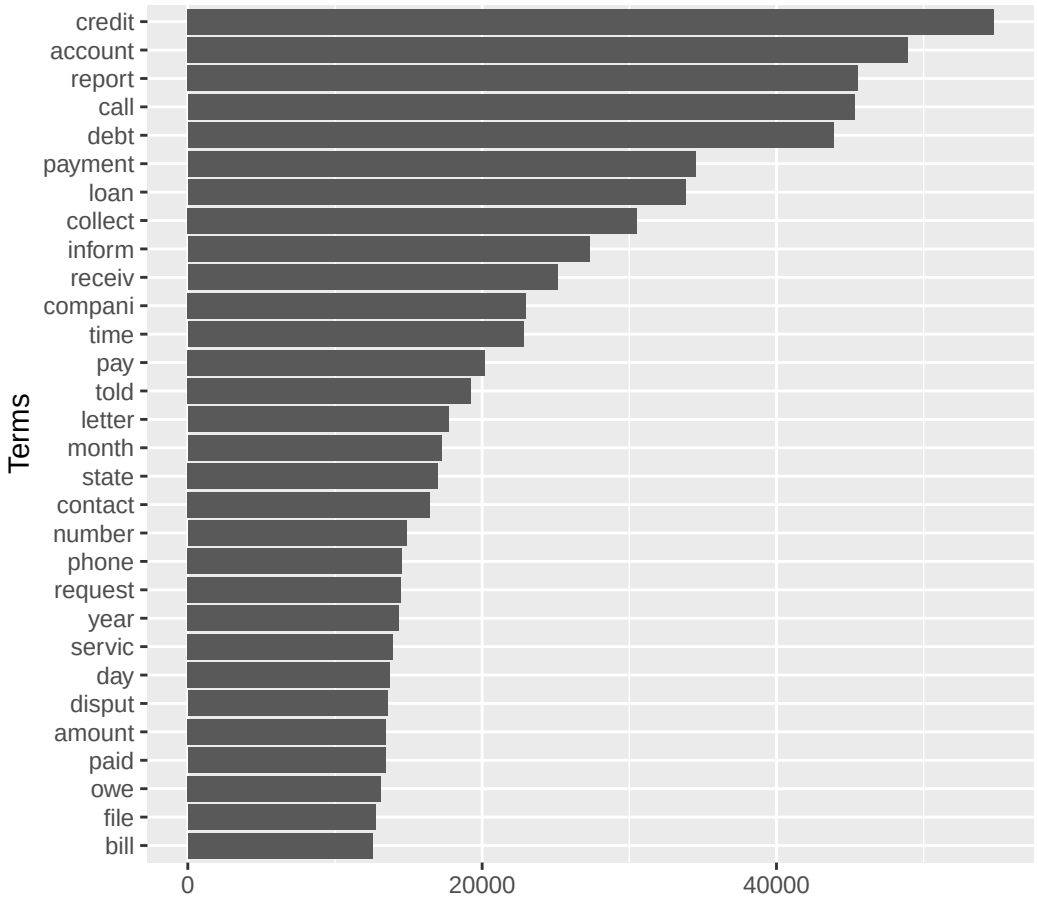


Figure 1: 30 Most Frequent Terms

Frequent Terms and Association

```
freq.terms <- findFreqTerms(myDtm, lowfreq=5)
term.freq <- rowSums(as.matrix(myDtm))
term.freq <- subset(term.freq, term.freq >= 5)
```

```
dfTerms <- data.frame(term = names(term.freq), freq = term.freq)
ggplot(dfTerms[order(-dfTerms$freq),][1:30,], aes(x = reorder(term, freq), y = freq)) +
  geom_bar(stat = "identity") + xlab("Terms") + ylab("") + coord_flip()
```

Which words are associated with term "loan"?

```
findAssocs(myDtm, 'loan', 0.30)
```

```
## $loan
##  student  payment   privat  navient interest consolid    month    repay
##     0.60     0.40     0.39     0.39     0.38     0.36     0.33     0.33
##   school      pay     make
```

```
##      0.32      0.32      0.31
```

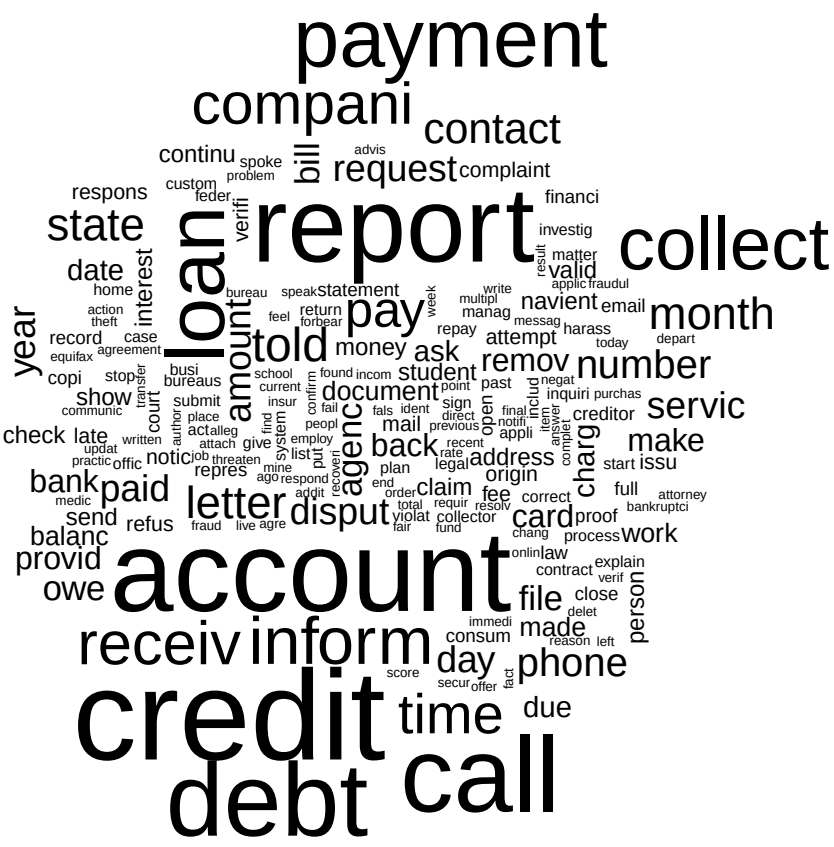


Figure 2: Words Cloud of Complaints

Building word cloud:

```
library(wordcloud)
m <- as.matrix(myDtm)
v <- sort(rowSums(m), decreasing=TRUE)
myNames <- names(v)
d <- data.frame(word=myNames, freq=v)
wordcloud(d$word, d$freq, min.freq=20, scale=c(4,.2), max.words = 200)
```