test

2022-11-06

```r
#test4
# df = read.csv("amazon_review_polarity_csv/train.csv", header = FALSE)
```

```r
N = 100000
N_t = 0.8*N
reviews_text<-readLines("amazon_review_polarity_csv/train.csv", n = N)
reviews_text<-data.frame(reviews_text)
```

```r
library(tidyr)
reviews_text<-separate(data = reviews_text, col = reviews_text, into = c("Sentiment", "SentimentText"),
```

```r
# Retaining only alphanumeric values in the sentiment column
reviews_text$Sentiment<-gsub("[^[:alnum:] ]","",reviews_text$Sentiment)
# Retaining only alphanumeric values in the sentiment text
reviews_text$SentimentText<-gsub("[^[:alnum:] ]"," ",reviews_text$SentimentText)
# Replacing multiple spaces in the text with single space
reviews_text$SentimentText<-gsub("(?<=[\\s])\\s*|^\\s+|\\s+$", "", reviews_text$SentimentText, perl=TRUE
# Writing the output to a file that can be consumed in other projects
write.table(reviews_text,file = "Sentiment Analysis Dataset.csv",row.names = F,col.names = T,sep=',')
```

```r
# reading the first 1000 reviews from the dataset
reviews_text<-readLines('amazon_review_polarity_csv/train.csv', n = N)
# basic EDA to confirm that the data is read correctly
print(class(reviews_text))
```

```
## [1] "character"
```

```r
print(length(reviews_text))
```

```
## [1] 100000
```

```r
print(head(reviews_text,2))
```

```
## [1] "\"2\",\"Stuning even for the non-gamer\",\"This sound track was beautiful! It paints the senery
## [2] "\"2\",\"The best soundtrack ever to anything.\",\"I'm reading a lot of reviews saying that this
```

```r
# replacing the positive sentiment value 2 with __label__2
reviews_text<-gsub("\\\"2\\\",","__label__2 ",reviews_text)
# replacing the negative sentiment value 1 with __label__1
reviews_text<-gsub("\\\"1\\\",","__label__1 ",reviews_text)
```

```r
# removing the unnecessary \" characters
reviews_text<-gsub("\\\"","",reviews_text)
# replacing multiple spaces in the text with single space
reviews_text<-gsub("(?<=[\\s])\\s*|^\\s+|\\s+$", "", reviews_text, perl=TRUE)
# Basic EDA post the required processing to confirm input is as desired
print("EDA POST PROCESSING")
```

```
## [1] "EDA POST PROCESSING"
```

```r
print(class(reviews_text))
```

```
## [1] "character"
```

```r
print(length(reviews_text))
```

```
## [1] 100000
```

```r
print(head(reviews_text,2))
```

```
## [1] "__label__2 Stuning even for the non-gamer , This sound track was beautiful! It paints the senery
## [2] "__label__2 The best soundtrack ever to anything. , I'm reading a lot of reviews saying that this
```

```r
# writing the revamped file to the directory so we could use it with
# fastText sentiment analyzer project
fileConn<-file("Sentiment Analysis Dataset_ft.txt")
writeLines(reviews_text, fileConn)
close(fileConn)
```

BoW approach

```r
# including the required libraries
library(SnowballC)
library(tm)
```

```
## Loading required package: NLP
```

```r
# setting the working directory where the text reviews dataset is located
# reading the transformed file as a dataframe
text <- read.table(file='Sentiment Analysis Dataset.csv', sep=',', header = TRUE)
# checking the dataframe to confirm everything is in tact
print(dim(text))
```

```
## [1] 100000      2
```

```r
# View(text)
```

```r
# transforming the text into volatile corpus
train_corp = VCorpus(VectorSource(text$SentimentText))
print(train_corp)
```

```
## <<VCorpus>>
## Metadata:  corpus specific: 0, document level (indexed): 0
## Content:  documents: 100000
```

```r
# creating document term matrix
dtm_train <- DocumentTermMatrix(train_corp, control = list( tolower = TRUE,removeNumbers = TRUE, stopwo
# Basic EDA on dtm
inspect(dtm_train)
```

```
## <<DocumentTermMatrix (documents: 100000, terms: 74760)>>
## Non-/sparse entries: 3399444/7472600556
## Sparsity           : 100%
## Maximal term length: 188
## Weighting          : term frequency (tf)
## Sample             :
##        Terms
## Docs    book get good great just like movi one read time
##   1250     0   0    0     0    0    0    0   0    0    0
##   56817    0   0    0     0    0    0    0   0    0    0
##   63995    0   2    1     1    0    2    0   2    0    1
##   6785     0   7    1     0    0    1    0   1    0    0
##   69262    0   0    0     0    0    0    0   0    0    0
##   73633    1   0    0     2    0    3    0   2    0    2
##   79144    0   0    0     0    0    0    0   0    0    0
##   80872    0   0    0     0    0    0    0   0    0    0
##   85894    0   1    0     0    0    1    0   1    0    0
##   87875    0   0    0     0    0    0    0   0    0    0
```

```r
# Removing sparse terms
dtm_train = removeSparseTerms(dtm_train, 0.99)
inspect(dtm_train)
```

```
## <<DocumentTermMatrix (documents: 100000, terms: 645)>>
## Non-/sparse entries: 2131029/62368971
## Sparsity           : 97%
## Maximal term length: 10
## Weighting          : term frequency (tf)
## Sample             :
##        Terms
## Docs    book get good great just like movi one read time
##   34297    0   1    0     0    2    5    0   3    0    0
##   38984    6   0    0     1    1    0    0   1    0    1
##   42051    3   0    1     0    2    1    0   3    5    1
##   56269    0   1    0     0    1    0    1   1    0    1
##   65117    0   1    1     1    1    0    0   1    0    0
##   65135    0   0    1     2    0    4    0   0    1    0
##   6785     0   7    1     0    0    1    0   1    0    0
##   80366    0   3    1     1    1    1    0   8    0    0
```

```
##   87149    6   0    1     0    0    1    0   2    1    0
##   90397    0   2    1     0    3    3    0   2    0    0
```

```
# splitting the train and test DTM
dtm_train_train <- dtm_train[1:N_t, ]
dtm_train_test <- dtm_train[(N_t+1):N, ]
dtm_train_train_labels <- as.factor(as.character(text[1:N_t, ]$Sentiment))
dtm_train_test_labels <- as.factor(as.character(text[(N_t+1):N, ]$Sentiment))
```

```
cellconvert<- function(x) { x <- ifelse(x > 0, "Y", "N") }
```

```
# applying the function to rows in training and test datasets
dtm_train_train <- apply(dtm_train_train, MARGIN = 2,cellconvert)
dtm_train_test <- apply(dtm_train_test, MARGIN = 2,cellconvert)
# inspecting the train dtm to confirm all is in tact
# View(dtm_train_train)
```

training model

```
# training the naive bayes classifier on the training dtm
library(e1071)
nb_senti_classifier=naiveBayes(dtm_train_train,dtm_train_train_labels)
# printing the summary of the model created
summary(nb_senti_classifier)
```

```
##           Length Class  Mode
## apriori     2    table  numeric
## tables    645    -none- list
## levels      2    -none- character
## isnumeric 645    -none- logical
## call        3    -none- call
```

```
# making predictions on the test data dtm
nb_predicts <- predict(nb_senti_classifier, dtm_train_test,type="class")
# printing the predictions from the model
print(nb_predicts)
```

```
##   [1] 1 2 2 1 1 1 1 2 2 2 1 2 1 1 2 1 2 2 1 2 2 2 1 2 2 2 1 2 2 2 2 2 1 2 2 2
##  [37] 2 2 2 2 2 1 2 2 2 2 2 2 2 2 1 2 1 1 1 2 2 2 1 2 2 2 2 2 1 1 1 1 1 2 2 2 1
##  [73] 2 2 1 1 1 1 2 2 2 2 2 2 2 2 2 2 1 2 2 2 1 2 2 2 2 1 2 2 2 1 1 2 1 2 1 2
## [109] 1 2 1 2 1 1 1 2 2 1 1 1 1 2 2 1 1 1 2 2 1 1 2 1 2 2 1 1 1 2 1 1 1 1 1 1
## [145] 2 1 2 1 2 2 2 1 1 2 2 1 1 2 1 1 2 1 1 2 2 1 1 2 1 2 1 1 1 1 2 1 2 1 2 2
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## [217] 2 2 2 1 1 1 2 1 1 2 2 2 2 1 1 2 2 2 2 2 1 1 1 2 1 2 1 1 1 1 2 2 2 2 1 2
## [253] 1 2 1 1 2 2 2 2 1 2 1 1 2 2 1 1 2 2 1 2 1 2 1 2 1 1 1 1 2 2 2 2 2 2 2 1
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## [433] 1 2 2 1 2 1 1 1 1 2 1 1 1 2 1 2 2 1 1 1 1 2 2 2 2 1 1 1 1 1 2 1 1 2 2 2
```

```
##   [469] 2 2 2 2 2 1 1 2 1 2 1 1 2 2 1 1 2 2 2 1 2 2 2 1 2 2 1 1 2 2 1 2 2 2 2 1
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##   [685] 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 2 2 2 2 2 1 1 2 2 2 2 1 2 2
##   [721] 2 2 2 2 2 2 1 1 1 2 2 2 2 2 2 2 2 2 1 2 1 2 2 2 2 2 2 2 1 2 2 1 2 2 2 2
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##   [793] 2 1 2 2 2 2 1 2 2 2 2 1 2 1 2 2 2 1 2 2 2 2 2 2 1 2 1 1 1 1 2 2 2 2 2 2
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##   [865] 2 2 1 2 2 2 2 1 1 1 1 1 1 1 1 2 1 2 2 2 2 2 1 2 2 1 2 1 2 2 1 2 2 2 1 2
##   [901] 2 2 2 1 2 1 1 1 1 1 1 2 1 1 1 1 2 2 1 2 1 1 1 1 1 2 2 1 2 2 2 2 1 1 1 1
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##   [973] 2 1 2 2 2 2 1 2 2 2 1 1 2 2 1 2 1 1 2 1 2 1 2 2 2 2 2 1 1 1 2 2 1 1 2 1
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##  [1081] 2 2 2 2 2 2 2 2 2 2 2 1 2 1 2 2 2 2 2 1 1 2 1 2 2 1 2 1 1 1 1 2 2 2 1 2
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##  [1297] 1 2 1 1 1 1 2 2 2 1 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 1 2 1 1 2 1
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```
##   [2413] 2 2 2 2 1 1 2 2 2 2 2 1 2 2 1 2 2 1 1 2 2 2 1 2 1 2 2 1 2 2 1 1 1 2 1 2
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##   [2593] 2 1 2 1 1 2 1 2 1 2 2 2 1 1 1 1 1 2 2 2 2 2 1 1 1 2 2 2 2 2 2 2 1 2 2 2
##   [2629] 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 1 2 2 2 2 1 2 1 2 2 2 1 2 1 2 1 1 1 1 1 1
##   [2665] 2 2 2 2 1 2 1 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 1 2 2 2 2 2 2 1 2 2 1 2 2 2
##   [2701] 2 2 2 1 1 1 1 1 2 1 1 2 1 1 1 1 1 1 2 2 1 2 2 1 1 2 2 1 1 2 2 1 1 1 1 2
##   [2737] 2 2 2 2 2 2 2 1 1 1 2 2 2 2 2 2 1 2 1 2 1 2 2 2 2 2 2 2 2 1 2 1 1 2 2 2
##   [2773] 2 1 1 2 2 2 1 2 2 2 2 2 2 2 2 1 2 2 1 1 2 2 2 1 1 2 2 2 2 2 2 1 2 2 2 1
##   [2809] 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 1 2 1 2 1 1 2 2 1 2
##   [2845] 2 2 1 1 1 2 2 1 1 1 1 1 1 1 1 1 1 2 2 1 1 1 1 1 2 2 2 1 2 2 2 2 2 2 2 2
##   [2881] 2 2 2 1 2 1 2 2 2 2 2 1 1 1 2 1 2 2 1 2 1 1 1 1 1 1 2 1 1 1 1 2 2 2 2 1
##   [2917] 2 2 1 1 2 2 2 2 1 2 2 2 2 2 1 1 2 2 1 1 2 2 1 1 1 2 2 2 2 1 2 2 2 2 2 2
##   [2953] 1 2 2 1 2 2 2 2 2 2 1 1 1 2 1 2 2 2 2 1 2 2 1 2 1 2 2 2 2 2 2 2 1 2 1 2
##   [2989] 1 2 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 1 2 2 2 2 2 2 2 2 2 1 2
##   [3025] 2 2 2 2 1 1 1 1 1 1 1 2 2 2 2 2 1 1 1 1 2 1 2 2 1 2 2 2 2 2 2 1 2 1 2 1
##   [3061] 1 2 2 2 1 2 1 2 2 2 1 1 2 2 1 1 2 2 2 1 1 1 1 1 2 1 1 1 1 2 1 2 2 1 1 1
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##   [3205] 2 2 2 2 2 2 2 2 1 2 2 1 1 1 2 2 2 2 2 2 2 2 1 2 2 1 2 2 1 1 1 2 1 2 1 1
##   [3241] 1 2 1 2 2 1 1 1 1 2 2 1 2 2 1 1 2 1 1 1 2 2 2 2 2 2 1 2 1 2 1 1 2 2 2 2
##   [3277] 2 2 2 1 1 1 2 2 1 1 2 2 1 1 2 1 2 2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 1
##   [3313] 2 2 2 2 2 2 2 2 1 1 1 1 2 2 2 2 2 2 2 1 1 1 2 2 1 2 2 1 1 1 1 1 1 1 1 1
##   [3349] 2 1 1 2 2 2 2 2 1 1 1 1 2 2 2 2 1 1 1 1 1 2 2 2 2 2 1 1 1 1 2 1 1 1 1 1
##   [3385] 1 2 2 2 2 2 1 1 1 2 2 2 2 2 1 2 2 2 1 1 2 1 2 2 2 2 2 2 2 2 2 1 2 2 2 1
##   [3421] 1 2 1 2 1 2 2 1 1 2 2 2 2 1 2 1 1 1 2 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 2 2
##   [3457] 2 1 1 1 2 1 2 2 1 1 1 1 1 2 1 1 2 1 1 2 1 1 1 2 1 1 2 2 1 1 1 1 2 2 1 2
##   [3493] 2 2 2 2 1 2 2 2 2 2 2 1 1 2 2 1 1 1 1 1 2 1 1 2 1 1 1 2 1 1 1 1 1 2 1 1
##   [3529] 1 1 1 1 1 1 2 1 1 2 2 1 1 2 2 2 2 1 1 2 1 1 1 2 1 2 2 2 2 2 2 2 2 1 2 2
##   [3565] 2 2 1 2 1 2 2 1 1 1 2 2 2 2 2 1 2 1 2 1 2 1 2 2 2 1 1 1 2 2 2 2 1 1 1 1
##   [3601] 1 1 2 1 2 2 2 1 1 1 1 1 2 1 1 2 1 2 2 2 2 2 1 2 1 1 1 1 2 1 1 2 2 1 2 2
##   [3637] 2 2 1 1 1 1 2 2 2 2 2 2 1 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 2 1
##   [3673] 1 2 2 1 2 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 2 1 1 2 1 2 2 2 1 2 1 2 1 2 1 1
##   [3709] 1 1 1 1 1 2 2 1 1 2 1 1 2 2 1 2 1 1 2 2 2 2 1 1 2 2 1 2 1 1 1 1 2 1 2 2
##   [3745] 2 2 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 1 1 2 2 2 2 1 2 1 2 1
##   [3781] 2 2 1 1 2 1 2 1 2 2 1 1 2 2 2 1 1 1 2 1 1 2 2 1 2 2 1 1 1 1 1 1 1 1 2 1
##   [3817] 1 1 1 2 2 2 2 1 1 1 1 2 2 1 1 1 1 1 1 1 1 2 2 1 2 1 1 1 1 1 1 1 1 2 2 1
##   [3853] 1 2 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 1 1 1 2 1 2 2 2 2 2 2 2 2 1 1 2 2 2 2
##   [3889] 2 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1
##   [3925] 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 2 1 1 2 2 2 2 2 1 2 2 2 2 2 2 2 1 2
##   [3961] 2 1 2 2 2 1 2 1 1 2 2 2 1 1 1 2 2 2 1 2 2 2 2 2 1 2 2 2 2 2 2 2 1 2 2 2
##   [3997] 2 2 1 1 1 2 2 2 1 2 1 2 2 1 2 1 1 2 2 1 2 2 1 2 2 2 2 1 1 2 1 1 2 1 2 1
##   [4033] 2 1 1 2 2 1 1 2 1 1 1 2 1 2 2 1 1 2 2 2 2 1 1 2 1 1 2 1 1 1 1 1 2 2 2 1
##   [4069] 2 1 2 1 1 2 1 1 2 2 1 2 2 2 2 1 1 2 2 2 2 2 2 2 2 2 1 2 1 2 2 2 2 2 2 2
##   [4105] 1 1 1 2 2 2 1 1 2 1 2 2 2 2 1 2 2 2 2 2 1 2 1 2 1 1 2 1 2 2 2 1 2 2 2 1
##   [4141] 2 2 2 2 1 2 1 1 2 1 1 1 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 1 2 1 2 2 2 2 2 1
##   [4177] 2 2 2 2 2 2 2 1 2 1 1 2 1 1 2 1 2 2 1 2 2 1 2 1 2 1 2 2 1 1 2 1 2 2 1 2
##   [4213] 1 1 1 1 2 2 2 2 2 2 2 1 2 1 2 1 2 2 2 1 2 1 2 2 1 1 2 1 1 1 1 1 1 1 2 1
##   [4249] 2 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 2 1 1 2 1 1 1 2 1 1 2 1 1 1 1 1 1
##   [4285] 1 1 1 1 1 1 1 1 2 2 2 1 2 1 2 2 2 1 1 1 2 1 2 1 1 1 2 1 1 1 1 1 2 2 2 1
##   [4321] 1 1 1 1 1 1 2 1 2 2 2 1 1 2 1 1 2 2 2 1 1 2 2 1 2 1 1 2 1 2 2 1 1 2 2 2
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## [4357] 2 1 1 1 1 1 1 1 1 1 1 2 1 1 2 1 2 1 2 1 1 1 2 1 2 2 1 1 2 2 2 2 2 2 1 1
## [4393] 2 1 2 1 1 1 1 2 2 2 2 2 2 2 2 2 2 1 2 2 1 2 2 2 2 1 2 1 2 1 2 1 2 1 2 1
## [4429] 2 2 2 1 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 1 1 1 1 2 2 2 1 2 1 1 1 1 1 1
## [4465] 1 1 2 1 1 1 1 1 1 1 1 2 2 1 2 2 1 1 1 2 2 1 2 2 1 1 1 1 1 1 1 2 1 2 1 1
## [4501] 2 1 2 2 2 2 2 1 1 2 2 1 1 2 2 1 1 2 1 1 1 2 2 2 2 1 2 2 2 1 1 1 1 1 2 2
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## [18037] 1 1 2 2 2 2 2 1 2 1 1 2 2 1 1 1 1 1 1 1 1 2 2 1 1 1 1 1 1 1 1 2 2 2 1 1
## [18073] 1 2 1 2 2 1 1 1 1 1 1 2 1 1 2 2 2 1 2 1 1 2 2 2 2 2 1 1 1 2 1 2 2 2 1 1
## [18109] 2 1 1 2 2 1 2 1 2 1 1 2 1 1 1 2 1 1 1 2 2 2 2 2 2 2 1 1 1 1 2 2 2 2 1 1
## [18145] 2 1 1 2 2 2 1 2 1 1 2 2 2 1 1 1 2 1 2 2 1 2 1 1 1 1 1 1 2 2 1 1 2 1 1 1
## [18181] 1 1 1 1 2 2 1 2 1 1 1 1 1 1 1 1 1 2 1 1 1 2 2 1 1 2 2 2 2 1 1 1 2 1 2 1
## [18217] 2 2 2 2 1 2 1 1 2 2 1 2 2 2 2 1 2 2 2 1 1 1 1 2 1 1 2 1 2 2 1 1 1 1 1 1
## [18253] 1 2 1 2 2 2 1 1 2 1 1 2 2 1 2 2 1 1 2 2 2 2 1 1 1 2 1 2 2 2 2 2 2 2 2 1
## [18289] 2 2 2 1 2 2 2 2 1 1 1 2 2 2 2 2 2 2 1 2 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2
## [18325] 2 2 2 2 1 1 2 1 1 1 2 2 2 2 2 1 2 2 2 1 1 2 1 1 1 1 1 2 1 1 1 1 2 2 2 2
## [18361] 2 2 2 2 2 1 2 1 2 1 1 1 1 1 2 1 1 1 1 1 1 2 1 2 2 2 2 1 2 1 2 1 2 2 1 1
## [18397] 2 1 1 1 1 2 2 1 1 1 1 1 1 2 1 1 2 2 2 2 2 1 2 2 2 2 1 2 2 2 2 1 2 1 2 1
## [18433] 1 1 1 2 1 1 1 2 2 1 1 2 1 1 1 1 1 1 2 1 1 1 2 2 2 1 2 2 2 2 2 2 1 2 1 1
## [18469] 2 2 2 2 2 2 2 2 2 1 1 2 1 2 2 2 2 1 1 2 1 1 1 1 1 2 1 1 2 1 1 1 1 2 2 1
## [18505] 2 2 2 2 1 2 2 2 2 1 1 1 1 1 1 1 2 2 1 1 2 2 2 1 1 1 1 1 1 2 2 2 2 1 2 2
## [18541] 2 1 2 1 1 1 2 2 2 2 1 2 2 2 1 2 2 2 2 2 2 2 1 2 2 2 1 2 2 2 2 2 1 1 1 1
## [18577] 2 2 2 2 2 2 1 2 1 1 2 2 2 2 2 1 2 2 2 2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 1 2
## [18613] 2 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 1 1 2 1 2 2 2 2 1 1 2 1 1 2 2 1 2
## [18649] 2 1 2 1 1 2 2 2 2 2 2 1 1 1 2 2 2 2 2 2 1 2 1 2 1 1 2 2 2 2 2 2 2 2 2 2
## [18685] 1 1 2 1 1 1 2 2 2 2 1 1 2 1 1 1 2 1 2 1 1 2 2 2 2 2 2 2 2 1 2 1 1 1 2 1
## [18721] 1 2 1 2 1 2 1 1 2 2 2 2 1 2 1 2 1 2 2 1 1 2 1 2 1 1 2 1 2 2 2 2 2 2 1 1
## [18757] 1 1 2 2 1 2 2 2 2 1 1 2 2 2 1 1 1 2 2 2 2 2 1 1 2 2 2 2 1 2 1 1 2 1 1 2
## [18793] 1 2 2 1 2 2 2 2 1 1 2 1 1 2 2 2 2 2 1 2 1 2 1 1 1 2 2 1 1 1 2 1 1 2 1 1
## [18829] 1 1 1 1 1 2 2 2 1 2 2 2 1 1 1 2 2 2 1 2 1 2 1 2 2 2 2 2 2 1 2 2 1 2 1 1
## [18865] 2 2 2 2 2 2 2 1 2 2 2 2 2 2 1 2 1 1 1 2 2 1 2 2 2 2 1 2 1 1 1 2 2 1 1 2
## [18901] 2 2 2 1 2 1 2 2 2 2 2 1 2 2 2 2 2 2 2 2 1 2 1 1 1 2 2 2 1 2 1 2 1 1 1 2
## [18937] 2 1 1 2 2 2 1 2 1 1 1 2 1 2 1 1 2 1 2 2 2 1 2 2 2 1 2 1 1 1 1 1 1 2 1 1
## [18973] 1 1 1 1 2 1 1 2 1 2 1 1 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 2 1 2 1 2 2 2 2
## [19009] 2 1 1 2 2 2 2 2 2 1 1 2 2 2 2 2 2 1 1 2 1 1 2 1 1 2 1 1 2 2 2 2 2 2 2 2
## [19045] 2 1 1 1 2 2 1 1 2 2 2 1 1 2 1 1 2 2 2 1 1 2 2 1 1 2 1 2 2 2 1 1 1 1 2 2
## [19081] 1 2 2 1 2 1 2 1 1 2 1 1 2 1 1 2 1 1 2 2 1 2 2 2 2 2 1 2 1 1 1 1 1 1 1 1
## [19117] 1 2 1 1 2 2 2 2 1 2 2 2 2 1 1 2 2 1 2 2 2 2 1 2 2 1 2 1 2 2 2 2 1 2 2 1
## [19153] 1 1 2 1 2 2 1 1 2 1 1 1 2 1 2 2 2 2 2 1 2 2 2 2 2 2 1 2 2 1 2 2 2 2 2 2
## [19189] 2 2 2 2 2 2 1 1 1 1 1 2 2 2 2 2 2 1 1 2 1 2 2 2 2 1 2 2 2 1 1 1 1 1 1 2
## [19225] 2 2 2 1 1 1 1 1 2 2 1 2 1 2 1 1 2 2 2 2 1 1 1 2 1 2 2 2 2 2 2 2 2 2 2 2
## [19261] 2 2 1 1 1 2 1 1 1 1 2 2 1 2 2 2 2 2 1 2 2 2 2 2 1 1 2 2 2 2 1 2 1 1 1 1
## [19297] 1 2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 1 2 2 2 2 2 2 2 2 2 2 2 1 1 1
## [19333] 1 1 2 1 2 2 2 2 2 1 2 2 2 1 1 1 2 2 2 2 2 2 2 1 2 2 2 2 2 1 2 2 2 2 2 2
## [19369] 2 2 2 2 1 2 2 2 1 1 2 1 1 1 1 2 2 2 2 1 1 1 2 1 2 2 2 1 1 2 1 1 1 2 1 1
## [19405] 1 2 1 1 1 1 2 1 2 1 2 1 1 2 1 1 1 1 1 1 2 2 1 1 1 1 2 2 2 2 2 2 2 1 2 1
## [19441] 2 1 2 2 2 1 2 1 1 1 2 1 2 2 2 1 2 1 1 1 2 2 1 1 1 2 2 2 1 2 2 1 1 1 2 2
## [19477] 2 1 1 1 1 2 1 2 1 2 2 1 1 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 1
## [19513] 2 1 1 1 1 1 2 1 2 2 1 2 2 2 2 2 2 2 2 1 1 2 2 1 2 2 2 2 2 1 2 2 1 2 2 2
## [19549] 2 2 2 2 2 2 2 2 1 2 2 2 2 1 2 2 2 2 2 2 1 2 1 2 1 1 2 2 2 2 2 1 2 1 2 1
## [19585] 1 2 2 2 1 2 2 1 2 2 1 2 1 1 1 2 1 1 2 2 2 1 2 2 2 1 2 2 1 2 1 2 2 1 2 2
## [19621] 1 1 2 2 2 2 1 1 1 1 2 1 1 1 1 1 2 2 1 1 1 1 2 2 2 1 2 2 1 1 1 2 1 1 1 1
## [19657] 1 1 1 1 1 2 1 2 1 1 1 1 2 1 1 1 1 2 1 1 2 2 1 1 2 1 1 1 1 1 2 1 2 1 1 1
## [19693] 1 1 2 1 2 1 1 2 1 1 1 1 1 1 1 1 1 2 1 2 1 1 2 2 2 1 1 1 1 2 1 2 2 2 2 2
## [19729] 2 2 2 1 2 2 2 1 2 2 2 1 2 2 2 1 1 1 2 2 1 2 1 2 1 2 2 1 1 2 2 1 1 1 2 2
## [19765] 1 2 1 2 1 1 2 2 2 2 1 2 1 2 1 2 1 1 2 2 1 2 2 1 1 2 2 2 1 1 2 2 2 2 2 2
## [19801] 2 2 2 1 1 1 2 1 2 2 1 1 1 1 2 2 1 2 1 2 1 1 2 1 1 1 1 1 1 1 1 1 2 1 2 2
## [19837] 1 2 1 2 1 2 2 2 1 2 1 2 2 2 2 2 2 2 2 1 1 2 2 2 1 1 1 1 1 1 2 1 1 1 1 1
## [19873] 1 2 2 2 2 2 2 1 2 2 2 2 1 2 2 2 1 2 2 1 2 2 1 2 2 2 1 2 2 2 1 1 2 2 2 1
```

```
## [19909] 1 1 1 2 2 2 2 1 2 1 1 2 2 2 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 2 2 1 1
## [19945] 1 1 2 2 1 1 1 1 2 2 1 2 2 1 2 1 1 1 1 1 1 2 1 1 1 2 1 1 1 2 1 1 1 1 1 2
## [19981] 1 2 1 1 1 1 2 2 2 1 2 2 2 2 2 2 2 2 1 1
## Levels: 1 2
```

```r
# computing accuracy of the model
library(rminer)
print(mmetric(nb_predicts, dtm_train_test_labels, c("ACC")))
```

```
## [1] 81.19
```

pretrained word2vec word embedding

```r
# including the required library
# install.packages("https://cran.r-project.org/src/contrib/Archive/softmaxreg/softmaxreg_1.2.tar.gz",re
library(softmaxreg)
```

```
##
## Attaching package: 'softmaxreg'

## The following object is masked from 'package:e1071':
##
##     sigmoid
```

```r
# importing the word2vec pretrained vector into memory
data(word2vec)
# View(word2vec)
dim(word2vec)
```

```
## [1] 12853    21
```

```r
# function to get word vector for each review
docVectors = function(x) { wordEmbed(x, word2vec, meanVec = TRUE) }
text = read.csv(file='Sentiment Analysis Dataset.csv', header = TRUE)
# applying the docVector function on each of the reviews
# storing the matrix of word vectors as temp
temp=t(sapply(text$SentimentText, docVectors))
# visualizing the word vectors output
# View(temp)
dim(temp)
```

```
## [1] 100000     20
```

```r
# splitting the dataset into train and test
temp_train=temp[1:N_t,]
temp_test=temp[(N_t+1):N,]
labels_train=as.factor(as.character(text[1:N_t,]$Sentiment))
labels_test=as.factor(as.character(text[(N_t+1):N,]$Sentiment))
# including the random forest library
library(randomForest)
```

```
## randomForest 4.7-1.1

## Type rfNews() to see new features/changes/bug fixes.
```

```r
# training a model using random forest classifier with training dataset
# observe that we are using 20 trees to create the model
rf_senti_classifier=randomForest(temp_train, labels_train,ntree=20)
print(rf_senti_classifier)
```

```
##
## Call:
##  randomForest(x = temp_train, y = labels_train, ntree = 20)
##                Type of random forest: classification
##                      Number of trees: 20
## No. of variables tried at each split: 4
##
##         OOB estimate of  error rate: 39.84%
## Confusion matrix:
##       1     2 class.error
## 1 23717 15262   0.3915442
## 2 16609 24400   0.4050087
```

```r
# making predictions on the dataset
rf_predicts<-predict(rf_senti_classifier, temp_test)
library(rminer)
print(mmetric(rf_predicts, labels_test, c("ACC")))
```

```
## [1] 62.45
```

GloVe word embedding

```r
# including the required library
library(text2vec)
```

```
##
## Attaching package: 'text2vec'

## The following object is masked from 'package:rminer':
##
##     fit
```

```r
# reading the dataset
text = read.csv(file='Sentiment Analysis Dataset.csv', header = TRUE)
# subsetting only the review text so as to create Glove word embedding
wiki = as.character(text$SentimentText)
# Create iterator over tokens
tokens = space_tokenizer(wiki)
# Create vocabulary. Terms will be unigrams (simple words).
it = itoken(tokens, progressbar = FALSE)
```

```
vocab = create_vocabulary(it)
# consider a term in the vocabulary if and only if the term has appeared at least three times in the da
vocab = prune_vocabulary(vocab, term_count_min = 3L)
# Use the filtered vocabulary
vectorizer = vocab_vectorizer(vocab)
# use window of 5 for context words and create a term co-occurance matrix
tcm = create_tcm(it, vectorizer, skip_grams_window = 5L)
# create the glove embedding for each in the vocab and
# the dimension of the word embedding should set to 50
# x_max is the maximum number of co-occurrences to use in the weighting
# function
# note that training the word embedding is time consuming - be patient
glove = GlobalVectors$new(rank = 50, x_max = 100)
wv_main = glove$fit_transform(tcm, n_iter = 10, convergence_tol = 0.01)
```

```
## INFO  [10:46:07.657] epoch 1, loss 0.0501
## INFO  [10:46:13.366] epoch 2, loss 0.0318
## INFO  [10:46:19.122] epoch 3, loss 0.0267
## INFO  [10:46:24.884] epoch 4, loss 0.0240
## INFO  [10:46:30.769] epoch 5, loss 0.0222
## INFO  [10:46:36.731] epoch 6, loss 0.0209
## INFO  [10:46:42.568] epoch 7, loss 0.0199
## INFO  [10:46:48.392] epoch 8, loss 0.0191
## INFO  [10:46:54.229] epoch 9, loss 0.0185
## INFO  [10:47:00.146] epoch 10, loss 0.0179
```

```
# Glove model learns two sets of word vectors - main and context.
# both matrices may be added to get the combined word vector
wv_context = glove$components
word_vectors = wv_main + t(wv_context)
# converting the word_vector to a dataframe for visualization
word_vectors=data.frame(word_vectors)
# the word for each embedding is set as row name by default
# using the tibble library rownames_to_column function, the rownames is copied as first column of the d
# we also name the first column of the dataframe as words
library(tibble)
word_vectors=rownames_to_column(word_vectors, var = "words")
# View(word_vectors)
```

```
library(softmaxreg)
docVectors = function(x) { wordEmbed(x, word_vectors, meanVec = TRUE) }
# applying the function docVectors function on the entire reviews dataset
# this will result in word embedding representation of the entire reviews
# dataset
temp=t(sapply(text$SentimentText, docVectors))
# View(temp)
```

```
# splitting the dataset into train and test portions
temp_train=temp[1:N_t,]
temp_test=temp[(N_t+1):N,]
labels_train=as.factor(as.character(text[1:N_t,]$Sentiment))
labels_test=as.factor(as.character(text[(N_t+1):N,]$Sentiment))
```

```r
# using randomforest to build a model on train data library(randomForest)
rf_senti_classifier=randomForest(temp_train, labels_train,ntree=20)
print(rf_senti_classifier)
```

```
##
## Call:
##  randomForest(x = temp_train, y = labels_train, ntree = 20)
##                Type of random forest: classification
##                      Number of trees: 20
## No. of variables tried at each split: 7
##
##         OOB estimate of  error rate: 32.13%
## Confusion matrix:
##       1     2 class.error
## 1 26652 12328   0.3162648
## 2 13376 27634   0.3261644
```

```r
# predicting labels using the randomforest model created
rf_predicts<-predict(rf_senti_classifier, temp_test)
# estimating the accuracy from the predictions
library(rminer)
print(mmetric(rf_predicts, labels_test, c("ACC")))
```

```
## [1] 71.755
```

fastText word embedding

```r
# loading the required libary
library(fastTextR)
# reading the input reviews file
# recollect that fastText needs the file in a specific format and we created one compatiable file in
# "Understanding the Amazon Reviews Dataset" section of this chapter
text = readLines("Sentiment Analysis Dataset_ft.txt")
# Viewing the text vector for conformation
# View(text)
```

```r
# dividing the reviews into training and test
temp_train=text[1:N_t]
temp_test=text[(N_t+1):N]
# Viewing the train datasets for confirmation
# View(temp_train)
```

```r
# creating txt file for train and test dataset
# the fasttext function expects files to be passed for training and testing
fileConn<-file("train.ft.txt")
writeLines(temp_train, fileConn)
close(fileConn)
fileConn<-file("test.ft.txt")
writeLines(temp_test, fileConn)
close(fileConn)
```

```r
# creating a test file with no labels
# recollect the original test dataset has labels in it
# as the dataset is just a subset obtained from full dataset
temp_test_nolabel<- gsub("__label__1", "", temp_test, perl=TRUE)
temp_test_nolabel<- gsub("__label__2", "", temp_test_nolabel, perl=TRUE)
# View(temp_test_nolabel)
```

```r
fileConn<-file("test_nolabel.ft.txt")
writeLines(temp_test_nolabel, fileConn)
close(fileConn)
# training a supervised classification model with training dataset file
model<-ft_train("train.ft.txt", method = "supervised", control = ft_control(nthreads = 3L, seed = 1))
# Obtain all the words from a previously trained model=
words<-ft_words(model)
# viewing the words for confirmation. These are the set of words present in our training data
# View(words)
```

```r
# Obtain word vectors from a previously trained model.
word_vec<-ft_word_vectors(model, words)
# Viewing the word vectors for each word in our training dataset
# observe that the word embedding dimension is 5
# View(word_vec)
```

```r
# predicting the labels for the reviews in the no labels test dataset
# getting the predictions into a dataframe so as to compute performance measurement
ft_preds<-ft_predict(model, newdata = temp_test_nolabel)
# reading the test file to extract the actual labels
reviewstestfile<- readLines("test.ft.txt")
# extracting just the labels frm each line
library(stringi)
actlabels<-stri_extract_first(reviewstestfile, regex="\\w+")
# converting the actual labels and predicted labels into factors
actlabels<-as.factor(as.character(actlabels))
ft_preds<-as.factor(as.character(ft_preds$label))
# getting the estimate of the accuracy
library(rminer)
print(mmetric(actlabels, ft_preds, c("ACC")))
```

```
## [1] 86.495
```

Drug Data

```r
N_Drug = 146942
N_t_Drug = round(0.8*N_Drug)
reviews_text_Drug<-readLines("Drug Train.csv", n = N_Drug)
reviews_text_Drug<-data.frame(reviews_text_Drug)
```

```r
library(tidyr)
reviews_text_Drug<-separate(data = reviews_text_Drug, col = reviews_text_Drug, into = c("Sentiment", "S
```

```
reviews_text_Drug<-reviews_text_Drug[-1,]
N_Drug = N_Drug - 1
```

```
# Retaining only alphanumeric values in the sentiment column
reviews_text_Drug$Sentiment<-gsub("[^[:alnum:] ]","",reviews_text_Drug$Sentiment)
# Retaining only alphanumeric values in the sentiment text
reviews_text_Drug$SentimentText<-gsub("[^[:alnum:] ]"," ",reviews_text_Drug$SentimentText)
# Replacing multiple spaces in the text with single space
reviews_text_Drug$SentimentText<-gsub("(?<=[\\s])\\s*|^\\s+|\\s+$", "", reviews_text_Drug$SentimentText
# Writing the output to a file that can be consumed in other projects
write.table(reviews_text_Drug,file = "Sentiment Analysis Dataset_Drug.csv",row.names = F,col.names = T,
```

```
# reading the first 1000 reviews from the dataset
reviews_text_Drug<-readLines("Drug Train.csv", n = N_Drug)
# basic EDA to confirm that the data is read correctly
print(class(reviews_text_Drug))
```

```
## [1] "character"
```

```
print(length(reviews_text_Drug))
```

```
## [1] 146941
```

```
print(head(reviews_text_Drug,2))
```

```
## [1] "\"Sentiment\",\"SentimentText\""
## [2] "\"2\",\"Valsartan Left Ventricular Dysfunction It has no side effect I take it in combination o
```

```
# replacing the positive sentiment value 2 with __label__2
reviews_text_Drug<-gsub("\\\"2\\\",","__label__2 ",reviews_text_Drug)
# replacing the negative sentiment value 1 with __label__1
reviews_text_Drug<-gsub("\\\"1\\\",","__label__1 ",reviews_text_Drug)
# removing the unnecessary \" characters
reviews_text_Drug<-gsub("\\\""," ",reviews_text_Drug)
# replacing multiple spaces in the text with single space
reviews_text_Drug<-gsub("(?<=[\\s])\\s*|^\\s+|\\s+$", "", reviews_text_Drug, perl=TRUE)
# Basic EDA post the required processing to confirm input is as desired
print("EDA POST PROCESSING")
```

```
## [1] "EDA POST PROCESSING"
```

```
print(class(reviews_text_Drug))
```

```
## [1] "character"
```

```
print(length(reviews_text_Drug))
```

```
## [1] 146941
```

```
print(head(reviews_text_Drug,2))
```

```
## [1] "Sentiment , SentimentText"
## [2] "__label__2 Valsartan Left Ventricular Dysfunction It has no side effect I take it in combinatio
```

```
# writing the revamped file to the directory so we could use it with
# fastText sentiment analyzer project
fileConn<-file("Sentiment Analysis Dataset_ft_Drug.txt")
writeLines(reviews_text_Drug, fileConn)
close(fileConn)
```

BoW approach

```
# including the required libraries
library(SnowballC)
library(tm)
# setting the working directory where the text reviews dataset is located
# reading the transformed file as a dataframe
text_Drug <- read.table(file='Sentiment Analysis Dataset_Drug.csv', sep=',', header = TRUE)
# checking the dataframe to confirm everything is in tact
print(dim(text_Drug))
```

```
## [1] 146941      2
```

```
# View(text)
```

```
# transforming the text into volatile corpus
train_corp_Drug = VCorpus(VectorSource(text_Drug$SentimentText))
print(train_corp_Drug)
```

```
## <<VCorpus>>
## Metadata:  corpus specific: 0, document level (indexed): 0
## Content:  documents: 146941
```

```
# creating document term matrix
dtm_train_Drug <- DocumentTermMatrix(train_corp_Drug, control = list( tolower = TRUE,removeNumbers = TR
# Basic EDA on dtm
inspect(dtm_train_Drug)
```

```
## <<DocumentTermMatrix (documents: 146941, terms: 61384)>>
## Non-/sparse entries: 5387849/9014438495
## Sparsity           : 100%
## Maximal term length: 95
## Weighting          : term frequency (tf)
## Sample             :
##         Terms
## Docs      day effect get month pain start take week work year
##   102079   6      0   2     0    7     0    2    0    4    2
```

```
##    127353    9      1   1     1    1     3    5    1    1    5
##    128846   10      0   4     1    9     2    2    3    0    3
##    136794    5      3   5     2   11     1    6    2    2    3
##    139424    0      2   2     4    3     4    1    0    2    1
##    20066     6      0   2     0    7     0    2    0    4    2
##    39445     7      7   4     1    3     1    6    4    4    0
##    63207     7      7   4     1    3     1    6    4    4    0
##    69005     7      5   3     2    0     4    9    6    2    1
##    85059     0      2   2     4    3     4    1    0    2    1
```

```
# Removing sparse terms
dtm_train_Drug = removeSparseTerms(dtm_train_Drug, 0.99)
inspect(dtm_train_Drug)
```

```
## <<DocumentTermMatrix (documents: 146941, terms: 633)>>
## Non-/sparse entries: 3988263/89025390
## Sparsity           : 96%
## Maximal term length: 14
## Weighting          : term frequency (tf)
## Sample             :
##         Terms
## Docs     day effect get month pain start take week work year
##   127353    9      1   1     1    1     3    5    1    1    5
##   128846   10      0   4     1    9     2    2    3    0    3
##   136794    5      3   5     2   11     1    6    2    2    3
##   139424    0      2   2     4    3     4    1    0    2    1
##   39445     7      7   4     1    3     1    6    4    4    0
##   44457     0      6   4     0    2     0   10    0    5    0
##   63207     7      7   4     1    3     1    6    4    4    0
##   69005     7      5   3     2    0     4    9    6    2    1
##   85059     0      2   2     4    3     4    1    0    2    1
##   95250     3      4   3     1   10     4    3    5    6    1
```

```
# splitting the train and test DTM
dtm_train_train_Drug <- dtm_train_Drug[1:N_t_Drug, ]
dtm_train_test_Drug <- dtm_train_Drug[(N_t_Drug+1):N_Drug, ]
dim(dtm_train_Drug)
```

```
## [1] 146941    633
```

```
dtm_train_train_Drug_labels <- as.factor(as.character(text_Drug[1:N_t_Drug, ]$Sentiment))
dtm_train_test_Drug_labels <- as.factor(as.character(text_Drug[(N_t_Drug+1):N_Drug, ]$Sentiment))
```

```
cellconvert<- function(x) { x <- ifelse(x > 0, "Y", "N") }
```

```
# applying the function to rows in training and test datasets
dtm_train_train_Drug <- apply(dtm_train_train_Drug, MARGIN = 2,cellconvert)
dtm_train_test_Drug <- apply(dtm_train_test_Drug, MARGIN = 2,cellconvert)
# inspecting the train dtm to confirm all is in tact
# View(dtm_train_train)
```

training model

```
# training the naive bayes classifier on the training dtm
library(e1071)
nb_senti_classifier_Drug=naiveBayes(dtm_train_train_Drug,dtm_train_train_Drug_labels)
# printing the summary of the model created
summary(nb_senti_classifier_Drug)
```

```
##           Length Class  Mode
## apriori     2    table  numeric
## tables    633    -none- list
## levels      2    -none- character
## isnumeric 633    -none- logical
## call        3    -none- call
```

```
# making predictions on the test data dtm
nb_predicts_Drug <- predict(nb_senti_classifier_Drug, dtm_train_test_Drug,type="class")
# printing the predictions from the model
print(nb_predicts_Drug)
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## [26893] 2 2 1 2 2 2 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 1 2 2 2 2 2 1 1 2 2 2 1
## [26929] 2 2 1 2 1 1 2 1 2 1 2 2 2 2 2 1 2 2 1 2 2 2 1 2 2 1 2 2 2 2 2 1 2 1 2 2
## [26965] 1 2 1 1 2 2 2 2 2 1 1 2 2 1 2 2 2 2 2 2 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2
## [27001] 2 1 2 2 2 2 2 2 1 1 2 1 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 1 1 2
## [27037] 2 2 2 2 2 1 2 2 2 2 2 2 2 1 2 2 1 2 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2
## [27073] 2 1 2 1 2 2 2 2 2 1 1 1 2 2 1 1 2 2 1 2 2 2 2 1 2 1 1 2 2 2 2 2 2 1 2 2
## [27109] 2 1 2 1 2 1 2 2 2 2 2 2 2 2 1 1 2 1 1 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 1
## [27145] 2 2 2 1 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 1 2 2 2 2 2 1 2 1 2 2 2 1 2
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## [27217] 2 2 2 2 2 1 1 2 1 1 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 1 2 1 2 2 2 2 2 2 2 2
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## [27289] 1 2 2 1 1 1 1 2 2 2 2 1 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 2 1 2 2 2
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## [27361] 2 2 2 1 2 2 2 2 1 2 1 1 1 2 2 2 2 2 2 2 2 2 1 1 2 1 2 2 2 2 1 1 1 2 2 2
## [27397] 2 2 2 2 1 1 2 2 2 1 2 2 2 1 2 2 2 1 2 1 2 2 1 2 2 2 2 2 1 2 1 2 2 2 2 2
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## [27469] 2 2 2 2 2 1 2 2 2 2 2 2 2 2 1 1 1 2 2 2 2 2 2 1 1 1 1 2 2 1 2 2 2 1 2 2
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## [27721] 2 1 2 2 1 1 2 1 2 1 2 2 2 1 2 2 2 2 2 2 1 1 2 2 2 2 2 1 2 1 1 2 1 2 2 1
## [27757] 2 2 1 2 2 2 2 1 2 2 1 2 2 2 2 2 1 1 2 2 2 2 1 1 2 1 1 2 2 2 2 1 2 2 2 2
## [27793] 1 2 1 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 1 2 1 2 1 1 2 2 1 2 2 2 1 1
## [27829] 2 2 2 1 2 2 2 2 2 2 1 2 2 2 2 2 2 1 2 2 2 1 2 2 2 1 1 2 2 1 2 2 2 2 2 2
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## [27937] 2 2 2 2 2 2 1 2 2 2 2 2 2 1 2 2 2 1 1 2 2 1 2 2 1 1 2 2 2 1 2 2 2 2 1 2
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```

```
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## [28693] 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 2 2 2 1 1
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## [28765] 2 2 1 2 1 2 2 2 2 2 1 1 2 2 2 1 2 2 2 2 2 2 2 2 2 1 2 2 2 1 2 2 2 2 1 2
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## [28837] 2 2 2 2 2 2 1 1 2 2 2 2 2 2 2 2 2 1 1 2 2 2 2 2 2 2 1 2 1 2 1 1 2 1 1
## [28873] 2 1 1 1 2 2 2 1 2 2 2 1 2 2 1 2 1 2 2 1 1 2 2 2 2 2 2 2 2 2 1 1 1 2 2 2
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## [28981] 2 2 2 2 2 2 2 2 1 2 1 2 1 2 2 1 1 1 2 2 2 2 2 1 2 2 1 1 2 1 2 2 2 2 2 2
## [29017] 2 2 2 2 1 2 2 2 2 2 2 2 2 2 1 2 2 2 2 2 2 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2
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## [29161] 2 2 2 2 2 2 2 2 2 1 2 2 2 1 2 2 1 1 2 1 2 1 2 2 1 1 1 2 2 1 2 2 1 2 2 2
## [29197] 2 2 1 2 2 2 2 2 2 1 2 1 2 2 1 2 1 1 2 2 2 2 2 2 2 2 2 2 2 1 1 1 2 2 2 2
## [29233] 2 1 2 2 2 2 1 1 1 2 2 2 2 2 1 1 2 1 2 2 2 2 2 2 2 2 1 1 1 2 2 2 2 2 2 2
## [29269] 2 1 1 2 2 1 2 2 1 2 1 1 2 2 2 2 2 2 1 2 2 1 2 1 2 2 1 1 1 1 1 2 2 1 1 2
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## [29341] 2 2 2 2 2 1 2 1 2 1 1 1 1 2 2 2 2 2 1 2 1 1 1 2 2 2 1 2 2 2 2 2 2 2 2 2
## [29377] 1 1 2 2 2 2 2 1 1 2 2
## Levels: 1 2
```

```r
# computing accuracy of the model
library(rminer)
print(mmetric(nb_predicts_Drug, dtm_train_test_Drug_labels, c("ACC")))
```

```
## [1] 79.11662
```

pretrained word2vec word embedding

```r
# including the required library
# install.packages("https://cran.r-project.org/src/contrib/Archive/softmaxreg/softmaxreg_1.2.tar.gz",re
library(softmaxreg)
# importing the word2vec pretrained vector into memory
data(word2vec)
# View(word2vec)
dim(word2vec)
```

```
## [1] 12853    21
```

```r
# function to get word vector for each review
docVectors = function(x) { wordEmbed(x, word2vec, meanVec = TRUE) }
text_Drug = read.csv(file='Sentiment Analysis Dataset_Drug.csv', header = TRUE)
# applying the docVector function on each of the reviews
# storing the matrix of word vectors as temp
temp_Drug=t(sapply(text_Drug$SentimentText, docVectors))
# visualizing the word vectors output
# View(temp)
dim(temp_Drug)
```

```
## [1] 146941     20
```

```r
# splitting the dataset into train and test
temp_train_Drug=temp_Drug[1:N_t_Drug,]
temp_test_Drug=temp_Drug[(N_t_Drug+1):N_Drug,]
labels_train_Drug=as.factor(as.character(text_Drug[1:N_t_Drug,]$Sentiment))
labels_test_Drug=as.factor(as.character(text_Drug[(N_t_Drug+1):N_Drug,]$Sentiment))
# including the random forest library
library(randomForest)
# training a model using random forest classifier with training dataset
# observe that we are using 20 trees to create the model
rf_senti_classifier_Drug=randomForest(temp_train_Drug, labels_train_Drug,ntree=20)
print(rf_senti_classifier_Drug)
```

```
##
## Call:
##  randomForest(x = temp_train_Drug, y = labels_train_Drug, ntree = 20)
##                Type of random forest: classification
##                      Number of trees: 20
## No. of variables tried at each split: 4
##
##         OOB estimate of  error rate: 19.88%
## Confusion matrix:
##       1     2 class.error
## 1 16142 15993  0.49768166
## 2  7373 78033  0.08632883
```

```r
# making predictions on the dataset
rf_predicts_Drug<-predict(rf_senti_classifier_Drug, temp_test_Drug)
library(rminer)
print(mmetric(rf_predicts_Drug, labels_test_Drug, c("ACC")))
```

```
## [1] 83.11839
```

GloVe word embedding

```r
# including the required library
library(text2vec)
# reading the dataset
text_Drug = read.csv(file='Sentiment Analysis Dataset_Drug.csv', header = TRUE)
```

```r
# subsetting only the review text so as to create Glove word embedding
wiki_Drug = as.character(text_Drug$SentimentText)
# Create iterator over tokens
tokens_Drug = space_tokenizer(wiki_Drug)
# Create vocabulary. Terms will be unigrams (simple words).
it_Drug = itoken(tokens_Drug, progressbar = FALSE)
vocab_Drug = create_vocabulary(it_Drug)
# consider a term in the vocabulary if and only if the term has appeared at least three times in the da
vocab_Drug = prune_vocabulary(vocab_Drug, term_count_min = 3L)
# Use the filtered vocabulary
vectorizer_Drug = vocab_vectorizer(vocab_Drug)
# use window of 5 for context words and create a term co-occurance matrix
tcm_Drug = create_tcm(it_Drug, vectorizer_Drug, skip_grams_window = 5L)
# create the glove embedding for each in the vocab and
# the dimension of the word embedding should set to 50
# x_max is the maximum number of co-occurrences to use in the weighting
# function
# note that training the word embedding is time consuming - be patient
glove = GlobalVectors$new(rank = 50, x_max = 100)
wv_main_Drug = glove$fit_transform(tcm_Drug, n_iter = 10, convergence_tol = 0.01)
```

```
## INFO  [10:59:21.808] epoch 1, loss 0.0859
## INFO  [10:59:25.239] epoch 2, loss 0.0541
## INFO  [10:59:28.638] epoch 3, loss 0.0442
## INFO  [10:59:32.137] epoch 4, loss 0.0390
## INFO  [10:59:35.568] epoch 5, loss 0.0358
## INFO  [10:59:39.045] epoch 6, loss 0.0335
## INFO  [10:59:42.449] epoch 7, loss 0.0318
## INFO  [10:59:45.933] epoch 8, loss 0.0305
## INFO  [10:59:49.589] epoch 9, loss 0.0294
## INFO  [10:59:52.981] epoch 10, loss 0.0285
```

```r
# Glove model learns two sets of word vectors - main and context.
# both matrices may be added to get the combined word vector
wv_context = glove$components
word_vectors_Drug = wv_main_Drug + t(wv_context)
# converting the word_vector to a dataframe for visualization
word_vectors_Drug=data.frame(word_vectors_Drug)
# the word for each embedding is set as row name by default
# using the tibble library rownames_to_column function, the rownames is copied as first column of the d
# we also name the first column of the dataframe as words
library(tibble)
word_vectors_Drug=rownames_to_column(word_vectors_Drug, var = "words")
# View(word_vectors)
```

```r
library(softmaxreg)
docVectors_Drug = function(x) { wordEmbed(x, word_vectors_Drug, meanVec = TRUE) }
# applying the function docVectors function on the entire reviews dataset
# this will result in word embedding representation of the entire reviews
# dataset
temp_Drug=t(sapply(text_Drug$SentimentText, docVectors_Drug))
# View(temp)
```

```r
# splitting the dataset into train and test portions
temp_train_Drug=temp_Drug[1:N_t_Drug,]
temp_test_Drug=temp_Drug[(N_t_Drug+1):N_Drug,]
labels_train_Drug=as.factor(as.character(text_Drug[1:N_t_Drug,]$Sentiment))
labels_test_Drug=as.factor(as.character(text_Drug[(N_t_Drug+1):N_Drug,]$Sentiment))
# using randomforest to build a model on train data library(randomForest)
rf_senti_classifier_Drug=randomForest(temp_train_Drug, labels_train_Drug,ntree=20)
print(rf_senti_classifier_Drug)
```

```
##
## Call:
##  randomForest(x = temp_train_Drug, y = labels_train_Drug, ntree = 20)
##                Type of random forest: classification
##                      Number of trees: 20
## No. of variables tried at each split: 7
##
##         OOB estimate of  error rate: 20.65%
## Confusion matrix:
##       1     2 class.error
## 1 15707 16430  0.51124872
## 2  7847 77557  0.09188094
```

```r
# predicting labels using the randomforest model created
rf_predicts_Drug<-predict(rf_senti_classifier_Drug, temp_test_Drug)
# estimating the accuracy from the predictions
library(rminer)
print(mmetric(rf_predicts_Drug, labels_test_Drug, c("ACC")))
```

```
## [1] 82.7815
```

fastText word embedding

```r
# loading the required libary
library(fastTextR)
# reading the input reviews file
# recollect that fastText needs the file in a specific format and we created one compatiable file in
# "Understanding the Amazon Reviews Dataset" section of this chapter
text_Drug = readLines("Sentiment Analysis Dataset_ft_Drug.txt")
# Viewing the text vector for conformation
# View(text)
```

```r
# dividing the reviews into training and test
temp_train_Drug=text_Drug[1:N_t_Drug]
temp_test_Drug=text_Drug[(N_t_Drug+1):N_Drug]
# Viewing the train datasets for confirmation
# View(temp_train)
```

```r
# creating txt file for train and test dataset
# the fasttext function expects files to be passed for training and testing
fileConn<-file("train_Drug.ft.txt")
```

```r
writeLines(temp_train_Drug, fileConn)
close(fileConn)
fileConn<-file("test_Drug.ft.txt")
writeLines(temp_test_Drug, fileConn)
close(fileConn)
# creating a test file with no labels
# recollect the original test dataset has labels in it
# as the dataset is just a subset obtained from full dataset
temp_test_Drug_nolabel<- gsub("__label__1", "", temp_test_Drug, perl=TRUE)
temp_test_Drug_nolabel<- gsub("__label__2", "", temp_test_Drug_nolabel, perl=TRUE)
# View(temp_test_nolabel)
```

```r
fileConn<-file("test_Drug_nolabel.ft.txt")
writeLines(temp_test_Drug_nolabel, fileConn)
close(fileConn)
# training a supervised classification model with training dataset file
model_Drug<-ft_train("train_Drug.ft.txt", method = "supervised", control = ft_control(nthreads = 3L, se
# Obtain all the words from a previously trained model=
words_Drug<-ft_words(model_Drug)
# viewing the words for confirmation. These are the set of words present in our training data
# View(words)
```

```r
# Obtain word vectors from a previously trained model.
word_vec_Drug<-ft_word_vectors(model_Drug, words_Drug)
# Viewing the word vectors for each word in our training dataset
# observe that the word embedding dimension is 5
# View(word_vec)
```

```r
# predicting the labels for the reviews in the no labels test dataset
# getting the predictions into a dataframe so as to compute performance measurement
ft_preds_Drug<-ft_predict(model_Drug, newdata = temp_test_Drug_nolabel)
# reading the test file to extract the actual labels
reviewstestfile_Drug<- readLines("test_Drug.ft.txt")
# extracting just the labels frm each line
library(stringi)
actlabels_Drug<-stri_extract_first(reviewstestfile_Drug, regex="\\w+")
# converting the actual labels and predicted labels into factors
actlabels_Drug<-as.factor(as.character(actlabels_Drug))
ft_preds_Drug<-as.factor(as.character(ft_preds_Drug$label))
# getting the estimate of the accuracy
library(rminer)
print(mmetric(actlabels_Drug, ft_preds_Drug, c("ACC")))
```

```
## [1] 86.26944
```