

# NBA Topic Mining

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## Section 1

```
options(tinytex.verbose = TRUE)

#clear up memory, set working directory and seeds
rm(list = ls())
setwd("/Users/syu/Library/CloudStorage/OneDrive-
St.JudeChildren'sResearchHospital/UDrive/Documents_syu_Backup/Github_deposit/
TextMining")

#Load twitter package
library(twitterR)
library(bitops)
library(RCurl)
library(ROAuth)

knitr::opts_chunk$set(echo = TRUE)

#1.Retrieve tweets from Twitter with the hashtag #nba #
#Assign Twitter consumer key, secret and access token and secret
consumer_key <- "QLmWyDb30miMi7kkWta68F5rd"
consumer_secret <- "7YmvWUwlj6VwqA1B5P1TDetEelfJJnaqOyqGjIKisgvKFvXeib"
access.token <- "913200731829698560-N8rWlg3JqjK473rMWppqEcvi8nHWC1B"
access.secret <- "Ka7zH3edvoOULrJC4CoudLZmqJiTxoI9JlkGOxBNjbGw2"

#connect to twitter and search tweets #nba
setup_twitter_oauth(consumer_key, consumer_secret, access.token, access.secret)
nba.tweets <- searchTwitter("#nba", n = 320, lang = "en")

#strip retweets and check the number of tweets afterward
nba.nort <- strip_retweets(nba.tweets, strip_manual = T, strip_mt = T)
length(nba.nort)

#convert the tweets to dataframe and check out associated attributes
nba.df <- twListToDF(nba.nort)
```

```
colnames(nba.df)
```

```
#save tweets to csv
```

```
write.csv(nba.df, file = "NBA_tweets.csv", na = "NA")
```

## Section 2

```
options(tinytex.verbose = TRUE)
```

```
# 2. Clean up tweets
```

```
tweet.tb <- read.csv("NBA_tweets.csv", header = T, sep = ",", as.is = T)
```

```
nba.text <- gettext(tweet.tb$text)
```

```
# Replace @UserName with one space
```

```
# One space replacement is to avoid words being glued together
```

```
nba.modify <- gsub("@\\w{1,20}", " ", nba.text)
```

```
# Replace control character "\n" and "\n\n" with one space
```

```
nba.modify <- gsub("[:cntrl:]{1,10}", " ", nba.modify)
```

```
# Replace https links with one space
```

```
nba.modify <- gsub("(https)(://)(.*)"[/]\w+", " ", nba.modify)
```

```
# Replace punctuation with one space
```

```
nba.modify <- gsub("[:punct:]{1,20}", " ", nba.modify)
```

```
# Replace non graphical character with space
```

```
nba.modify <- gsub("[^[:graph:]]", " ", nba.modify)
```

```
# Replace tab and extra space introduced early with one space
```

```
nba.modify <- gsub("[ |\t]{2,}", " ", nba.modify)
```

```
nba.modify <- gsub("\\s+", " ", nba.modify)
```

```
# Remove extra blank space at the beginning and the end
```

```
nba.modify <- gsub("^ +", "", nba.modify)
```

```
nba.modify <- gsub(" $+", "", nba.modify)
```

```
# 3. Preprocess tweets further for analysis
```

```
library(NLP)
```

```
library("tm")
```

```
library(RColorBrewer)
```

```
library(wordcloud)
```

```
library("SnowballC")
```

```
library("lsa")
```

```
# generate corpus for the cleaned nba tweets and check out the corpus length
```

```
nba.corpus <- VCorpus(VectorSource(nba.modify))
```

```
length(nba.corpus)
```

```
## [1] 207

# transform the corpus to lower case, remove punctuation and numbers and
# randomly check sample
trans.nbacorp <- tm_map(nba.corpus, content_transformer(tolower)) #convert to
# lower cases
trans.nbacorp <- tm_map(trans.nbacorp, removePunctuation) # remove
# punctuation
trans.nbacorp <- tm_map(trans.nbacorp, removeNumbers) # remove numbers
trans.nbacorp <- tm_map(trans.nbacorp, stripWhitespace)

# remove stop words
input.nbacorp <- tm_map(trans.nbacorp, removeWords,
  c(stopwords("english"), "can", "don", "just", "nba", "via",
    "e", "s", "y"))
#find an empty entry
inspect(input.nbacorp[[4]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 0

# 4. Generate a word cloud with the NBA tweets
set.seed(1234)

#generate document-term matrix in order to remove empty documents
nbacorp.dtm <- DocumentTermMatrix(input.nbacorp)
row.total <- apply(nbacorp.dtm, 1, sum)

#Correspondingly, remove the same empty entries from the corpus and document-
#term matrix
input.nbacorp.noemp <- input.nbacorp[which(row.total > 0)]
nbacorp.docterm <- DocumentTermMatrix(input.nbacorp.noemp)
# or the following code will generate the same doc-term matrix with empty
# entries removed
nbacorp.docterm <- nbacorp.dtm[which(row.total > 0),]

#The index of the matrix shifts accordingly, but the doc entry index remains
#the same
inspect(nbacorp.docterm[15:16,])

## <<DocumentTermMatrix (documents: 2, terms: 772)>>
## Non-/sparse entries: 6/1538
## Sparsity : 100%
## Maximal term length: 18
## Weighting : term frequency (tf)
## Sample :
## Terms
## Docs aaron absolutely accident account bizarre girlfriend scandals sex
# wags
```

```
##      16      0      0      0      0      0      0      1      0      0
1
##      17      0      0      0      0      0      1      0      1      1
0
##      Terms
## Docs watson
##      16      1
##      17      0
```

```
# generate the term-document Matrix from the cleaned document-term matrix
nbacorp.terdoc <- t(nbacorp.docterm)
inspect(nbacorp.terdoc)
```

```
## <<TermDocumentMatrix (terms: 772, documents: 201)>>
## Non-/sparse entries: 1404/153768
## Sparsity           : 99%
## Maximal term length: 18
## Weighting          : term frequency (tf)
## Sample            :
##
##      Docs
## Terms      1 10 121 181 201 56 63 70 73 88
## basketball 0 0 0 0 0 0 0 0 0 0
## curry       0 0 0 1 1 0 1 0 0 0
## game        0 1 0 0 0 1 0 0 0 0
## kings       0 0 0 0 0 0 1 1 0 1
## nfl         0 1 0 0 0 0 0 0 1 0
## nhl         0 0 0 0 0 0 0 0 1 0
## suns        0 0 0 0 0 0 0 2 0 0
## warriors    0 0 0 1 1 0 0 0 0 0
## win         0 0 0 0 0 0 0 1 0 0
## wizards     0 0 0 0 0 0 0 0 0 0
```

```
# Find frequency of terms in term-doc matrix with frequency over 3
findFreqTerms(nbacorp.terdoc, lowfreq = 3)
```

```
## [1] "actually"      "aldridge"      "amp"           "assists"
## [5] "back"          "ball"          "basketball"    "bell"
## [9] "bledsoe"       "buckle"        "bucks"         "cavs"
## [13] "chriss"        "collegefootball" "conference"    "consoles"
## [17] "curry"         "daily"         "dallas"        "dcfamily"
## [21] "denver"        "detroit"       "devin"         "dfs"
## [25] "double"        "dubnation"     "edm"           "eric"
## [29] "ers"           "first"         "follow"        "foot"
## [33] "fox"           "game"          "games"         "garrett"
## [37] "get"           "giphy"         "gleaguealum"   "going"
## [41] "golden"        "good"          "got"           "grizzlies"
## [45] "guard"         "half"          "harris"        "hornets"
## [49] "james"         "jokic"         "jordan"        "kings"
## [53] "lakers"        "last"          "latest"        "league"
## [57] "leaguepassalert" "left"         "let"           "like"
## [61] "live"          "looks"         "love"          "makes"
```

```
## [65] "mavericks"      "memphis"      "michael"      "mike"
## [69] "mlb"            "music"        "mvp"          "nephew"
## [73] "nfl"            "nhl"          "night"        "now"
## [77] "nowplaying"     "nuggets"      "past"         "periscope"
## [81] "phx"            "play"         "podcast"      "point"
## [85] "points"         "preview"      "pts"          "raptors"
## [89] "rebs"          "recap"        "return"       "road"
## [93] "rockets"        "sac"          "sacramentokings"
"sacramentoproud"
## [97] "scores"         "season"       "see"          "shot"
## [101] "simmons"        "sports"       "spurs"        "star"
## [105] "state"          "steph"        "stephen"      "suns"
## [109] "swj"            "team"         "temple"       "thanks"
## [113] "tonight"        "two"          "usa"          "wall"
## [117] "warriors"       "washington"   "watson"       "week"
## [121] "win"            "wire"         "wizards"      "worldseries"
```

*#sort the term by frequency and plot terms of frequency over 3 in a word cloud*

```
nbacorp.terdoc.matrix <- as.matrix(nbacorp.terdoc)
nbaterm.freqbydoc <- sort(rowSums(nbacorp.terdoc.matrix), decreasing = T,
na.last = NA)
wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq = 3)
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
```

```
## kings could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
```

```
## basketball could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
```

```
## dcfamily could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
```

```
## warriors could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
```

```
## curry could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
```

```
## collegefootball could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
```

```
## season could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## nowplaying could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## points could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## left could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## sacramentoproud could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## mlb could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## james could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## golden could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## memphis could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## detroit could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## consoles could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## garrett could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## harris could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## pts could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## leaguepassalert could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## preview could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## live could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## suns could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## love could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## music could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## wall could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## stephen could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## sacramentokings could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## daily could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## follow could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## game could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## mike could not be fit on page. It will not be plotted.
```

```
## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## road could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## washington could not be fit on page. It will not be plotted.

## Warning in wordcloud(names(nbaterm.freqbydoc), nbaterm.freqbydoc, min.freq
= 3):
## dfs could not be fit on page. It will not be plotted.
```



```
# subset the terms with a frequency over 5 and generate a barplot
V.minfreq6 <- rowSums(nbacorp.terdoc.matrix) > 5
nbaterm.minfreq6 <- sort(rowSums(nbacorp.terdoc.matrix)[V.minfreq6],
decreasing = T)
term.barplot <- barplot(nbaterm.minfreq6, horiz = F, col =
rainbow(length(nbaterm.minfreq6)))

legend(20, 20.5, legend = names(nbaterm.minfreq6), fill =
rainbow(length(nbaterm.minfreq6)),
      cex = 0.75, ncol = 3, x.intersp = 0.2, y.intersp = 0.7, text.width = 9,
      bty = "n")
```



# 5. Identify the top three pairs of tweets and the most frequently used terms among these pairs

```
library(reshape2)
library(Matrix)
```

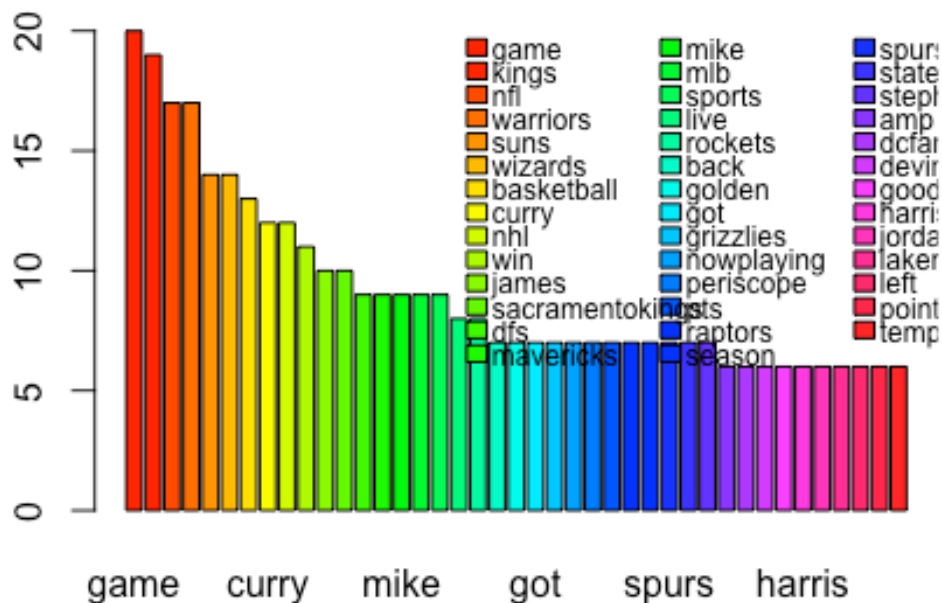
```
##
```

```
## Attaching package: 'Matrix'
```

```
## The following object is masked from 'package:bitops':
```

```
##
```

```
##      %&%
```



```
library("lsa")
```

```
#create cosine similarity matrix and check result
```

```
nbacorp.cosi <- as.matrix(cosine(nbacorp.terdoc.matrix))
```

```
nbacorp.cosi[1:9, 1:9]
```

```
##      1      2 3      5 6      7      8      9      10
## 1  1 0.00000000 0 0.00000000 0 0.00000000 0.00000000 0.00000000 0.00000000
## 2  0 1.00000000 0 0.00000000 0 0.00000000 0.00000000 0.00000000 0.09805807
## 3  0 0.00000000 1 0.00000000 0 0.00000000 0.00000000 0.00000000 0.00000000
## 5  0 0.00000000 0 1.00000000 0 0.1005038 0.1348400 0.00000000 0.08362420
```

```
## 6 0 0.00000000 0 0.00000000 1 0.00000000 0.00000000 0.00000000 0.00000000
## 7 0 0.00000000 0 0.1005038 0 1.00000000 0.00000000 0.00000000 0.00000000
## 8 0 0.00000000 0 0.1348400 0 0.00000000 1.00000000 0.1581139 0.12403473
## 9 0 0.00000000 0 0.00000000 0 0.00000000 0.1581139 1.00000000 0.00000000
## 10 0 0.09805807 0 0.0836242 0 0.00000000 0.1240347 0.00000000 1.00000000
```

*#replace all the diagonal value from 1 to NA*

```
diag.replace <- function(x){
  for (i in 1:nrow(x)){
    if (x[i, i] == 1 | x[i, i] == 0)
      { x[i,i] <- NA }
  }
  return(x)
}
```

```
nbacorp.cosmod <- diag.replace(nbacorp.cosi)
nbacorp.cosmod[1:6, 1:6]
```

```
##      1  2  3      5  6      7
## 1 NA  0  0 0.0000000 0 0.0000000
## 2 0 NA  0 0.0000000 0 0.0000000
## 3 0 0 NA 0.0000000 0 0.0000000
## 5 0 0 0      NA 0 0.1005038
## 6 0 0 0 0.0000000 NA 0.0000000
## 7 0 0 0 0.1005038 0      NA
```

*#convert the sparse matrix into a molten data frame and sort it based on the cosine value*

```
nbacorp.cosmolten <- melt(nbacorp.cosmod, na.rm = T, c("m.row.doc",
"m.col.doc"))
nbacorp.cosmolten <- nbacorp.cosmolten[order(nbacorp.cosmolten$value,
decreasing = T),]
nbacorp.cosmolten[1:40,]
```

```
##      m.row.doc m.col.doc      value
## 2628         16         15 1.0000000
## 2828         15         16 1.0000000
## 8098         61         42 1.0000000
## 8496         57         44 1.0000000
## 10696        44         57 1.0000000
## 10933        82         58 1.0000000
## 10942        92         58 1.0000000
## 11498        42         61 1.0000000
## 15645       172         81 1.0000000
## 15733        58         82 1.0000000
## 15766        92         82 1.0000000
## 16364        87         86 1.0000000
## 16564        86         87 1.0000000
## 17542        58         92 1.0000000
## 17566        82         92 1.0000000
## 18990       100         99 1.0000000
```

```
## 19190      99      100 1.0000000
## 21617     114     112 1.0000000
## 22017     112     114 1.0000000
## 24040     125     124 1.0000000
## 24240     124     125 1.0000000
## 28304     168     145 1.0000000
## 32904     145     168 1.0000000
## 33645      81     172 1.0000000
## 36768     191     188 1.0000000
## 37368     188     191 1.0000000
## 38382     198     197 1.0000000
## 38582     197     198 1.0000000
## 35570     200     182 0.9486833
## 38970     182     200 0.9486833
## 8490       50      44 0.8944272
## 9490       44      50 0.8944272
## 9501       57      50 0.8944272
## 10701      50      57 0.8944272
## 25460     138     131 0.8593378
## 26860     131     138 0.8593378
## 2322      115      13 0.7715167
## 22122      13     115 0.7715167
## 22277     171     115 0.7715167
## 29312     171     150 0.7715167
```

*#inspect tweet pairs with cosine similarity of 1 --> These tweets seems to be repost*

```
inspect(input.nbacorp[[15]])
```

```
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 30
##
## c j watson girlfriend wags
```

```
inspect(input.nbacorp[[16]])
```

```
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 30
##
## c j watson girlfriend wags
```

```
inspect(input.nbacorp[[42]])
```

```
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 42
##
## basket toops rs rock star michael jordan
```

```

inspect(input.nbacorp[[61]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 42
##
## basket toops rs rock star michael jordan

inspect(input.nbacorp[[44]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 31
##
## shot mike james gleaguealum

inspect(input.nbacorp[[57]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 31
##
## shot mike james gleaguealum

#After empty entries removed, the doc index numbers in the matrix shift from doc entry numbers
typeof(row.names(nbacorp.docterm)) # doc entry number in the doc-term matrix are characters

## [1] "character"

# Therefore, the character value instead of numeric values can correctly index doc entries
inspect(nbacorp.docterm[c("15", "16", "61", "42", "57", "44"),])

## <<DocumentTermMatrix (documents: 6, terms: 772)>>
## Non-/sparse entries: 26/4606
## Sparsity : 99%
## Maximal term length: 18
## Weighting : term frequency (tf)
## Sample :
## Terms
## Docs basket girlfriend gleaguealum james jordan michael mike rock shot
star
## 15 0 1 0 0 0 0 0 0 0
## 16 0 1 0 0 0 0 0 0 0
## 42 1 0 0 0 1 1 0 1 0
## 44 0 0 1 1 0 0 1 0 1
0

```

```
##      57      0      0      1      1      0      0      1      0      1
0
##      61      1      0      0      0      1      1      0      1      0
1
```

*#coerce the doc-term matrix to R matrix*

```
nbacorp.docterm.matrix <- as.matrix(nbacorp.docterm)
```

*#subset the matrix with reposted tweets*

```
nbacorp.repost.matrix <-
nbacorp.docterm.matrix[c("15", "16", "61", "42", "57", "44"),]
nbacorp.repost.matrix[, 1:20] #although subsetting, matrix inherited every
term from all the tweets
```

```
##      Terms
## Docs aaron absolutely accident account across action actions actually
addiction
##      15      0      0      0      0      0      0      0      0
0
##      16      0      0      0      0      0      0      0      0
0
##      61      0      0      0      0      0      0      0      0
0
##      42      0      0      0      0      0      0      0      0
0
##      57      0      0      0      0      0      0      0      0
0
##      44      0      0      0      0      0      0      0      0
0
```

```
##      Terms
## Docs addition airmax aldrige alex algorithm alive alley ally already
##      15      0      0      0      0      0      0      0      0
##      16      0      0      0      0      0      0      0      0
##      61      0      0      0      0      0      0      0      0
##      42      0      0      0      0      0      0      0      0
##      57      0      0      0      0      0      0      0      0
##      44      0      0      0      0      0      0      0      0
```

```
##      Terms
## Docs amicohoops amp
##      15      0      0
##      16      0      0
##      61      0      0
##      42      0      0
##      57      0      0
##      44      0      0
```

*#which() & apply() index the terms that are only in the repost docs/tweets*

```
term.inrepost <- names(which(apply(nbacorp.repost.matrix, 2, sum) > 0))
```

*#The top 10 most used terms from all the tweets*

```

top10.term <- names(nbaterm.freqbydoc[1:10])

#write a function to check whether any of the top 10 terms included in
subsetting similar tweets
identical.term <- function(x, y){
  for (i in 1: length(x)){
    if(length(grep(x[i], y)) > 0)
      {print(c(x[i],grep(x[i], y, value = T)))}
  }
}

top10.term

## [1] "game"      "kings"      "nfl"      "warriors"   "suns"
## [6] "wizards"   "basketball" "curry"    "nhl"       "win"

term.inrepost

## [1] "basket"      "girlfriend" "gleaguealum" "james"      "jordan"
## [6] "michael"     "mike"       "rock"       "shot"       "star"
## [11] "toops"      "wags"      "watson"

identical.term(term.inrepost, top10.term)

## [1] "basket"      "basketball"

##inspect tweet pairs with cosine similarity less than 1
inspect(input.nbacorp[[182]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 66
##
## john wall guides washwizards road win points assists dcfamily

inspect(input.nbacorp[[200]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 77
##
## john wall guides washwizards road win points assists dcfamily
basketball

inspect(input.nbacorp[[50]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 42
##
## shot mike james gleaguealum basketball

```

```

inspect(input.nbacorp[[44]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 31
##
## shot mike james gleaguealum

inspect(input.nbacorp[[138]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 95
##
## nowplaying live periscope nfl mlb amp indie music nfl worldseries
collegefootball edm hiphop

inspect(input.nbacorp[[131]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 99
##
## nowplaying live periscope sports amp music unite nfl worldseries
collegefootball edm hiphop indie

#subset the matrix with docs of cosine similarity
nbacorp.similar.matrix <- nbacorp.docterm.matrix[c("182", "200", "50", "44",
"138", "131"), ]
nbacorp.similar.matrix[, 1:20] #although subsetted, matrix inherited every
term from all the tweets

##      Terms
## Docs  aaron absolutely accident account across action actions actually
## 182      0          0          0          0          0          0          0
## 200      0          0          0          0          0          0          0
## 50       0          0          0          0          0          0          0
## 44       0          0          0          0          0          0          0
## 138      0          0          0          0          0          0          0
## 131      0          0          0          0          0          0          0
##      Terms
## Docs  addiction addition airmax aldridge alex algorithm alive alley ally
## 182      0          0          0          0          0          0          0
## 200      0          0          0          0          0          0          0
## 50       0          0          0          0          0          0          0
## 44       0          0          0          0          0          0          0
## 138      0          0          0          0          0          0          0
## 131      0          0          0          0          0          0          0
##      Terms
## Docs  already amicohoops amp
## 182      0          0      0

```

```
##      200      0      0      0
##      50      0      0      0
##      44      0      0      0
##     138      0      0      1
##     131      0      0      1

#which() & apply() index the terms that are only in the similar docs/tweets
term.insicular <- names(which(apply(nbacorp.similar.matrix, 2, sum) > 0))

#Check whether any of the top 10 terms are included in the similar tweets
top10.term

## [1] "game"      "kings"      "nfl"      "warriors"   "suns"
## [6] "wizards"   "basketball" "curry"    "nhl"        "win"

term.insicular

## [1] "amp"      "assists"    "basketball"
## [5] "dcfamily" "edm"        "gleaguealum" "guides"
## [9] "hiphop"   "indie"      "james"      "john"
## [13] "live"     "mike"       "mlb"        "music"
## [17] "nfl"      "nowplaying" "periscope"  "points"
## [21] "road"     "shot"       "sports"     "unite"
## [25] "wall"     "washwizards" "win"        "worldseries"

identical.term(term.insicular, top10.term)

## [1] "basketball" "basketball"
## [1] "nfl" "nfl"
## [1] "win" "win"

# 6. Identify terms with the highest weighted tf-idf among the top three
pairs of tweets
#calculate the tfidf of the document-term matrix created during # 4
nbacorp.dttfidf <- weightTfIdf(nbacorp.docterm)
inspect(nbacorp.dttfidf[1:6,])

## <<DocumentTermMatrix (documents: 6, terms: 772)>>
## Non-/sparse entries: 52/4580
## Sparsity           : 99%
## Maximal term length: 18
## Weighting          : term frequency - inverse document frequency
(normalized) (tf-idf)
## Sample            :
##      Terms
## Docs  brooks  dillon    fail  fanuel  nobody  paying    pts
survived
##      1 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 1.059572
0.000000
##      2 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
```



```
##      3 0.000000 0.000000 0.000000 0.000000 1.912763 1.912763 0.000000
0.000000
##      5 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
##      6 1.275175 1.275175 1.275175 1.275175 0.000000 0.000000 0.000000
1.275175
##      7 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
0.000000
##      Terms
## Docs      tix      won
##      1 0.000000 0.000000
##      2 0.000000 0.000000
##      3 1.912763 1.912763
##      5 0.000000 0.000000
##      6 0.000000 0.000000
##      7 0.000000 0.000000
```

*#convert the document-term matrix to numeric matrix and calculate a total tfidf of each document*

```
nbacorp.dttfidf.matrix <- as.matrix(nbacorp.dttfidf)
nbadoc.countfidf <- sort(rowSums(nbacorp.dttfidf.matrix), decreasing = T)
nbadoc.countfidf[1:20]
```

```
##      195      3      39      49      97      141      17      146
## 7.651052 7.651052 7.651052 7.651052 7.651052 7.651052 7.651052 7.651052
##      166      207      179      164      29      38      41      46
## 7.651052 7.451052 7.365337 7.317718 7.251052 7.251052 7.251052 7.239892
##      23      117      123      143
## 7.222480 7.220225 7.208368 7.175132
```

*#write a function to find the identical sum of tfidf of each document/tweets*

```
same.tweets <- function(x) {
  temp.x <- x
  names(temp.x) <- NULL
  for(i in 1:length(temp.x))
  {
    if(identical(temp.x[i], temp.x[i+1]) == T)
    {print(x[c(i,i+1)])}
  }
}
```

```
same.tweets(nbadoc.countfidf)
```

```
##      3      39
## 7.651052 7.651052
##      39      49
## 7.651052 7.651052
##      49      97
## 7.651052 7.651052
##      97      141
```

```
## 7.651052 7.651052
##      17      146
## 7.651052 7.651052
##      146      166
## 7.651052 7.651052
##      29      38
## 7.251052 7.251052
##      38      41
## 7.251052 7.251052
##      143      148
## 7.175132 7.175132
##       2      133
## 7.129811 7.129811
##      133      161
## 7.129811 7.129811
##      109      163
## 7.110811 7.110811
##      110      185
## 7.051052 7.051052
##      32      33
## 6.901052 6.901052
##      59      75
## 6.85857 6.85857
##      24      60
## 6.772588 6.772588
##      25      134
## 6.727012 6.727012
##      145      168
## 6.651052 6.651052
##      168      190
## 6.651052 6.651052
##      52      120
## 6.525237 6.525237
##      80      189
## 6.504811 6.504811
##      15      16
## 6.456064 6.456064
##      16      51
## 6.456064 6.456064
##      86      87
## 6.43073 6.43073
##      137      188
## 6.35857 6.35857
##      188      191
## 6.35857 6.35857
##      74      98
## 6.264064 6.264064
##      99      100
## 6.151052 6.151052
##      100      154
```

```
## 6.151052 6.151052
##      42      61
## 6.122731 6.122731
##      81     172
## 6.04053 6.04053
##     112     114
## 5.929735 5.929735
##     152     170
## 5.572588 5.572588
##     197     198
## 5.447529 5.447529
##     124     125
## 5.370881 5.370881
##      58      82
## 4.996012 4.996012
##      82      92
## 4.996012 4.996012
##      44      57
## 4.947606 4.947606
```

```
# Inspect the content of the highest score of tweets
inspect(input.nbacorp[[3]])
```

```
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 25
##
## nobody paying won tix
```

```
inspect(input.nbacorp[[39]])
```

```
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 24
##
## overweight people
```

```
inspect(input.nbacorp[[49]])
```

```
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 19
##
## meanwhile phoenix
```

```
inspect(input.nbacorp[[29]])
```

```
## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 39
##
## remember players spoke mind twitter
```

```

inspect(input.nbacorp[[38]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 42
##
## wtf gatorade tonight everybody wilding

inspect(input.nbacorp[[143]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 68
##
## say much hate season already injuries irvingdiva coachesfired

inspect(input.nbacorp[[148]])

## <<PlainTextDocument>>
## Metadata: 7
## Content: chars: 57
##
## process servers back ready hand child support orders

#calculate tfidf of all the terms and convert results to R matrix
nbacorp.tertfidf.matrix <- as.matrix(weightTfIdf(nbacorp.terdoc, normalize =
T))

#subset the matrix with 3 pairs of tweets having the highest tfidf sum
top3tweet.tfidf.matrix <- nbacorp.tertfidf.matrix[, c("3", "39", "29", "38",
"143", "148")]
top3tweet.tfidf.matrix[1:10,]#terms used in other tweets were inherited in
the subsetted matrix

##           Docs
## Terms      3 39 29 38 143 148
## aaron      0 0 0 0 0 0
## absolutely 0 0 0 0 0 0
## accident   0 0 0 0 0 0
## account    0 0 0 0 0 0
## across     0 0 0 0 0 0
## action     0 0 0 0 0 0
## actions    0 0 0 0 0 0
## actually   0 0 0 0 0 0
## addiction  0 0 0 0 0 0
## addition   0 0 0 0 0 0

term.top3tweet <- names(which(apply(top3tweet.tfidf.matrix, 1, sum) > 0))

#Harvest the top 10 terms of highest tfidf values
top10.tfidfterm <- sort(rowSums(nbacorp.tertfidf.matrix), decreasing =
T)[1:10]
top10.tfidfterm <- names(top10.tfidfterm)

```

*#check the overlapped term with identical.term function*

term.top3tweet

```
## [1] "already"      "back"          "child"          "coachesfired"
"everybody"
## [6] "gatorade"     "hand"          "hate"           "injuries"
"irvingdiva"
## [11] "mind"         "much"          "nobody"         "orders"
"overweight"
## [16] "paying"       "people"        "players"        "process"        "ready"
## [21] "remember"    "say"           "season"         "servers"        "spoke"
## [26] "support"     "tix"           "tonight"        "twitter"        "wilding"
## [31] "won"          "wtf"
```

top10.tfidfterm

```
## [1] "suns"         "game"          "basketball"    "kings"          "win"
## [6] "chriss"      "nfl"           "warriors"      "dfs"            "wizards"
```

identical.term(term.top3tweet, top10.tfidfterm)

*# 7. Determine the optimal numbers of clusters for the tweets*

*# Compute kmean and plot wss from k = 1 to k = 20.*

set.seed(2345)

k.max <- 15

```
tot.wss <- sapply(2:k.max, simplify = T,
  function(k){kmeans(nbacorp.docterm.matrix, k, nstart = 50, iter.max =
100)$tot.withinss})
```

## Warning: did not converge in 100 iterations

## Warning: did not converge in 100 iterations

## Warning: did not converge in 100 iterations

```
bet.ss <- sapply(2:k.max, simplify = T,
  function(k){kmeans(nbacorp.docterm.matrix, k, nstart = 50, iter.max =
100)$betweenss})
```

## Warning: did not converge in 100 iterations

## Warning: did not converge in 100 iterations

## Warning: did not converge in 100 iterations

## Warning: did not converge in 100 iterations

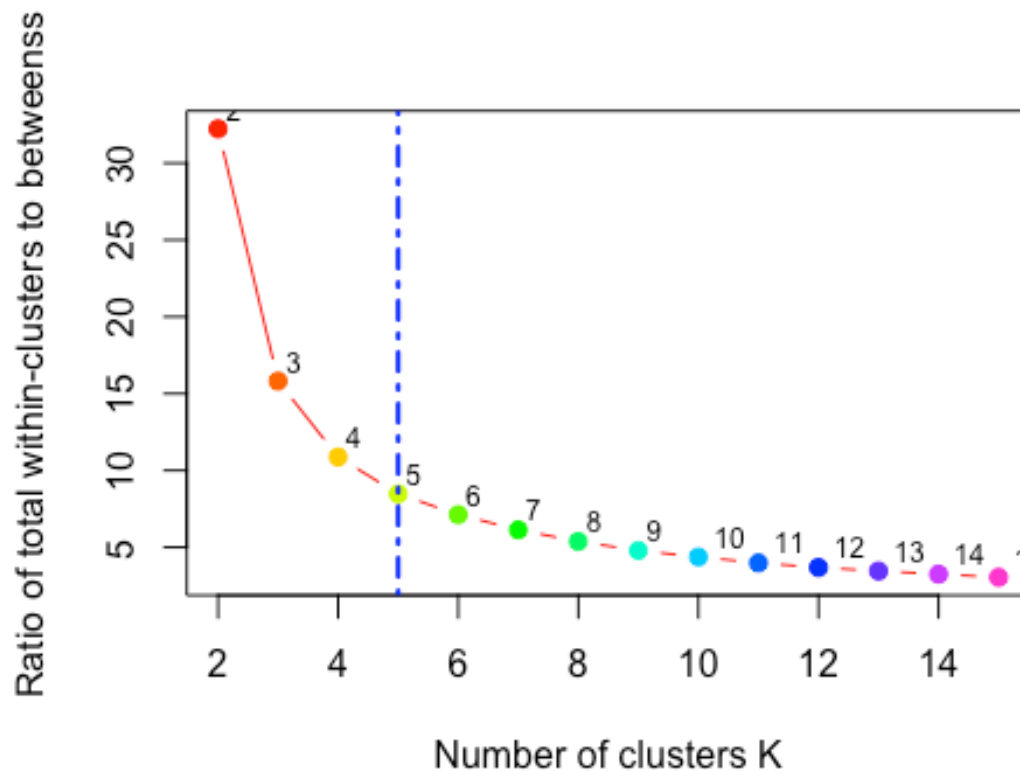
tot.wss

```
## [1] 1466.000 1421.599 1384.195 1351.455 1324.348 1298.576 1271.605
1252.922
## [9] 1229.817 1209.329 1189.088 1170.138 1155.059 1135.621

bet.ss

## [1] 45.48259 89.88310 127.28802 159.40431 185.85846 211.55301 236.31668
## [8] 261.37400 281.27125 303.25596 322.36029 338.26111 354.67941 372.48345

plot(2:k.max, tot.wss/bet.ss,
     type = "b", pch = 19, frame = T, lwd = 1, col= rainbow(k.max),
     xlab = "Number of clusters K", ylab = "Ratio of total within-clusters to
betweeness")
text(2:k.max, tot.wss/bet.ss, labels = 2:k.max, adj = c(-0.5, -0.5), cex =
0.75)
abline(v = 5, lwd = 2, lty = 4, col = "blue")
```



```
# 8. Identify the groups of tweets having similar characteristics
#pick up k-cluster at 6
set.seed(2345)
nbacorp.cluster <- kmeans(nbacorp.docterm.matrix, 5, nstart = 30, iter.max =
50)
nbacorp.cluster$cluster
```

```

## 1 2 3 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 21
## 1 1 1 1 1 3 1 1 5 1 1 5 5 1 1 1 1 4
1 1
## 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
40 41
## 1 1 1 1 3 1 1 1 1 1 1 1 5 1 1 1 1 1
1 1
## 42 43 44 46 47 48 49 50 51 52 53 55 56 57 58 59 60 61
62 63
## 1 1 1 1 1 1 1 1 1 1 1 1 1 1 4 1 1 1
4 3
## 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81
82 83
## 4 4 4 3 4 1 4 1 1 5 1 1 1 1 1 4 1 1
4 4
## 84 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102
103 104
## 5 1 1 2 1 4 4 4 1 1 1 4 1 5 1 1 1 1
1 1
## 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122
123 124
## 1 1 1 1 1 1 1 1 1 1 5 1 1 1 3 1 1 1
1 1
## 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142
143 144
## 1 1 1 1 3 1 5 1 1 1 1 5 1 5 4 1 1 1
1 1
## 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162
163 164
## 1 1 1 1 1 5 1 1 1 1 1 1 1 1 1 1 1 1
1 1
## 165 166 167 168 169 170 171 172 174 175 176 177 178 179 180 181 182 183
184 185
## 1 1 3 1 1 1 5 1 1 1 1 1 1 1 1 3 1 1
1 1
## 186 187 188 189 190 191 193 194 195 196 197 198 199 200 201 202 203 204
205 206
## 1 1 1 1 1 1 5 1 1 5 5 5 1 1 3 1 1 1
1 1
## 207
## 1

```

*#use apply to extract the text from corpus*

```
inputcorp.text <- t(data.frame(sapply(input.nbacorp.noemp, "[", "content")))
```

*#index out empty entries of corpus from original tweets and extracted text,*

*#and combine the extract text, original tweet text and cluster vector*

```
row.total.dataframe <- names(which(row.total > 0))
```

```
tweet.txtclust <- data.frame(tweet.tb[c(row.total.dataframe),]$text,
```

```

as.character(inputcorp.text),
nbacorp.cluster$cluster)

#change the column names and organize the table by clusters
names(tweet.txtclust) <- c("original tweets", "cleaned tweets", "K-clusters")
tweet.txtclust <- tweet.txtclust[order(tweet.txtclust$`K-clusters`,
decreasing = F),]

#subset cleaned tweet text data by clusters.
tweet.txtK1 <- tweet.txtclust[tweet.txtclust$`K-clusters` == 1, ]$`cleaned
tweets`
tweet.txtK2 <- tweet.txtclust[tweet.txtclust$`K-clusters` == 2, ]$`cleaned
tweets`
tweet.txtK3 <- tweet.txtclust[tweet.txtclust$`K-clusters` == 3, ]$`cleaned
tweets`
tweet.txtK4 <- tweet.txtclust[tweet.txtclust$`K-clusters` == 4, ]$`cleaned
tweets`
tweet.txtK5 <- tweet.txtclust[tweet.txtclust$`K-clusters` == 5, ]$`cleaned
tweets`

as.character(tweet.txtK1)

## [1] "houston rockets memphis grizzlies eric gordon pts harden pts asts
marc gasol pts taps ennis rebs"
## [2] " re playing name ny player happened gold mlb yankees knicks"
## [3] "nobody paying won tix"
## [4] " trailblazers game worn portland trail blazers summer league
jersey terrel harris xl"
## [5] "survived dillon brooks fail dfs fanuel"
## [6] "torantoraptors game follow basketball raptors"
## [7] "watching now brutal bc guys basketball iq absolutely
horrendous smh"
## [8] " best back court wall beal"
## [9] "well looking like win season nbakings "
## [10] " c j watson girlfriend wags"
## [11] " c j watson girlfriend wags"
## [12] " bizarre sex scandals"
## [13] " love follow basketball"
## [14] " trade rumors la lakers like trade luol deng dnp cd treatment
continue lakers"
## [15] "giannis antetokounmpo vs hornets pts reb ast average pts reb ast
stl fearthedeer"
## [16] " t wanna disrespected t turn amp get back defense warriors"
## [17] " sorry mavs beat pts blame rookie dun"
## [18] "g anteto yes gon mvp season "
## [19] "welcome back nikola jokic amp nikola jokic den"
## [20] "michael jordan graphicdesign basketball posterdesign"
## [21] " wizards better record teams including warriors cavaliers
time alive dcfamily nbatwitter"
## [22] "remember players spoke mind twitter"

```



## [23] " game follow basketball bostonceltics"  
## [24] "steals finishes dcfamily milehighbasketball nbapanel"  
## [25] "hurry blow lead go swj "  
## [26] " changed swj yokedjokic unihistory"  
## [27] "good half fast open court nuts see live swj wasvsden "  
## [28] " sick outlet pass swj yokedjokic wasvsden "  
## [29] "nasty fam nbaisback jordanbell warriors dubnation goldenstate bayarea gswin gswvsdal mavericks"  
## [30] "wtf gatorade tonight everybody wilding "  
## [31] " overweight people "  
## [32] "trust process ers simmons roty joel markelle"  
## [33] "shit players tweeted twitter blew "  
## [34] " basket toops rs rock star michael jordan "  
## [35] " undefeated team east great team wizards "  
## [36] " shot mike james gleaguealum "  
## [37] "new promo hidden hours directed dari arrington < < < basketball lakeshow"  
## [38] "go win "  
## [39] " shot mike james gleaguealum couponsgod sports news trending fanclub "  
## [40] "meanwhile phoenix "  
## [41] " shot mike james gleaguealum basketball"  
## [42] "wall vs ball wednesday "  
## [43] "told ll never dunk dubnation mavericks nbapanel"  
## [44] "aldridge murray tow spurs past raptors "  
## [45] "deaaron fox special "  
## [46] "joerger ve played bogi less since bogi first game joerger needs play small less "  
## [47] " shot mike james gleaguealum"  
## [48] " streets league"  
## [49] " many close games season loving "  
## [50] " basket toops rs rock star michael jordan "  
## [51] "mike james ball ve telling suns"  
## [52] "marcador basquet pistons ers heat hawks rockets grizzlies bucks hornets mavericks warriors"  
## [53] "mike james gt eric bledsoe dfs"  
## [54] " fox real one ll hit game winner "  
## [55] " latest mib chronicles thanks ad "  
## [56] " amicohoops cavs interest eric bledsoe well interest talked "  
## [57] " picture tonight game detroit head coach said president trump brazenly racist"  
## [58] " games soooooo good pointgame go"  
## [59] "garrett temple fire letsgoooooooooo"  
## [60] "ben simmons got first triple double looks terrifying"  
## [61] " announces two incorrect calls oklahoma city t"  
## [62] " announces two incorrect calls oklahoma city t"  
## [63] "mondayz draftkings nfl dfs"  
## [64] "willie cauley stein looks like robs night pay weed addiction sacramentoproud"

## [65] "otto porter tim frazier kelly oubre key wizards win denver dcfamily "  
## [66] "temple booker going back forth love basketball"  
## [67] "kicks i illustration art japan drawing sketch graphic artist model popart fasion nike airmax"  
## [68] " middleton scores "  
## [69] "middleton scores "  
## [70] "basketball season everything 2"  
## [71] " ll let know week "  
## [72] "swishh amp ball movement going strong missed 2 nbalive wethenorth raptors spursnation"  
## [73] " latest pages flipper daily thanks heretolearn "  
## [74] "marquese chriss suns sunsat "  
## [75] " good game big plays shots rebs happy see finding form dcfamily "  
## [76] "pregame warriors radio sports basketball hoops media credentials"  
## [77] " washingtonwizards denvernuggets wizards bradley beal puntos rebotes "  
## [78] "previewing ers versus pistons matchu torontoraptors bensimmons philadelphiaers"  
## [79] "definitely real deal greekfreak bucks "  
## [80] "usa denver nuggets washington wizards "  
## [81] " published preview eastern conference cavs celtics wizards ers theprocess "  
## [82] "last tweet tonight haven t chance check weekly podcast "  
## [83] " published preview eastern conference cavs celtics wizards ers theprocess "  
## [84] " latest kurt bradley daily thanks wwetlc"  
## [85] "imagine became sniper shudders fearthedeer mvp "  
## [86] "washington wizards three takeaways wizards deny denver nuggets first stop "  
## [87] "rt miamiheat points assists captaindragon last night"  
## [88] "milos teodosic los angeles clippers teodosic sustained plantar fascia injury left foot timetable return "  
## [89] "elfrid payton orlando magic payton sustained left hamstring strain timetable return dfs"  
## [90] "derrick rose cleveland cavaliers rose battling sprained ankle likely return beginning november dfs"  
## [91] " preview western conference warriors okcthunder rockets lonzo lakers spurs curry"  
## [92] " preview western conference warriors okcthunder rockets lonzo lakers spurs curry"  
## [93] "aldridge ibaka go spurs raptors toronto sanantonio"  
## [94] " see ur effort work ethic shooting game believe stan work inside detroitbasketball nbatwitter"  
## [95] "harmless love warriors"  
## [96] "mike james devin booker sunsat"  
## [97] "lakers come back pelicans hold "  
## [98] "week mvp rook th man dpw omw thisiswhyweplay sportscenter"  
## [99] "week season books killed swipe right see picks "

## [100] "steph curry throws mouthpiece direction official gets fine gets games "  
## [101] "steph curry hypes mouthguard "  
## [102] "jordan bell lit way give fans action "  
## [103] " addition football winning lines nascar sunday pm info works"  
## [104] " danny green scores points w five blocks danny green sa"  
## [105] " say much hate season already injuries irvingdiva coachesfired"  
## [106] " wire rick carlisle good nd quarter despite loss golden state"  
## [107] " labissiere putback"  
## [108] "bronx domestic violence suspect nabbed slipping cuffs"  
## [109] " pts rebs roll antetokounmpo powers past gt gt"  
## [110] "process servers back ready hand child support orders "  
## [111] " now came across dsj draymond interaction love kind gamesmanship guys "  
## [112] " shocked kevin durant gsw giphy"  
## [113] " shocked stephen curry gsw giphy"  
## [114] "wizards clippers grizzlies still undefeated "  
## [115] " expression giphy"  
## [116] " ya go suns dfs"  
## [117] " five wizards starters reached double figures remain unbeaten holding nuggets"  
## [118] " expression phi joel embiid giphy"  
## [119] "jamesharden squared grizzlies rockets "  
## [120] "basketball gt metta world peace joins lakers g league team "  
## [121] "yo suns put mike james bitch unless want get bunzed dfs"  
## [122] "jordan bell went window alley oop kd reaction says "  
## [123] "bensimmons making interested years watching game"  
## [124] "completely understand bledsoe thought playing much stat stuffing p"  
## [125] "precedent set going rain mouth guards "  
## [126] "usa san antonio spurs toronto raptors "  
## [127] "icymi brooklyn buzz ep d lo j lin bench nets"  
## [128] "labissiere putback"  
## [129] "d aaron fox t let phx beat phxsuns v sacramentoproud"  
## [130] "usa houston rockets memphis grizzlies "  
## [131] "ben simmons got first triple double looks terrifying"  
## [132] "eric gordon balling season houstonrockets "  
## [133] " videos game recap warriors mavericks "  
## [134] "wizards nuggets final score washington starts road trip win beats denver "  
## [135] " suns take fultz bledsoe "  
## [136] "zomg phxsuns might actually win game tonight "  
## [137] "former star goes self ally top goducks "  
## [138] "nbatv onebighaitian put back sacramentokings "  
## [139] "john wall guides washwizards road win points assists dcfamily "  
## [140] " special devin harris nephew lost dad good "  
## [141] " dubnation daily stories dubnation"  
## [142] " take fine give ca firevictims need "

```

## [143] "james harden mario chalmers mix heated scuffle grizzlies
rockets memvshou grindcity"
## [144] "open account get nhl action "
## [145] "chriss lays "
## [146] " wire bucks fastbreak giannis "
## [147] "jokic one"
## [148] " chriss lays "
## [149] " video bell dunk javale mcgee tips pass jordan bell tosses
backboard slamm"
## [150] " talks cover extra drama part"
## [151] " recap ov hornets bucks un wizards nuggets wizards ytd "
## [152] "john wall guides washwizards road win points assists dcfamily
basketball"
## [153] "draymond asking actually recognizable outside "
## [154] "warriors follow uneven first half overwhelming dallas halftime "
## [155] " phx vs sac garrett temple got assist dfs"
## [156] " phx vs sac alex len got rebound dfs"
## [157] " good night everyone dm questions line ups tomorrow
draftkings basketball fantasy"
## [158] "dallasmavs pg dennis smith jr postgame loss "

```

```
as.character(tweet.txtK2)
```

```

## [1] "garrett temple makes foot pointer garrett temple makes foot point
jumper garrett temple makes foot point jumper kings"

```

```
as.character(tweet.txtK3)
```

```

## [1] "steph curry shared heartwarming moment devin harris nephew
warriors "
## [2] "repost stephen curry consoles devin harris nephew lost father
car accident l"
## [3] "video stephen curry consoles grieving nephew dallas mavericks guard
devin harris sacramentokings kings "
## [4] "stephen curry golden state warriors guard fined throwing mouthpiece
sacramentokings kings "
## [5] "golden state warriors blow dallas mavericks might worst team ever
golden state"
## [6] "warriors stephen curry andre iguodala fined actions memphis "
## [7] "usa dallas mavericks golden state warriors "
## [8] " golden state warriors used second half surge behind stephen curry
kevin durant rout mavericks"
## [9] "golden state warriors star stephen curry consoles grieving nephew
dallas mavericks guard devin harris "

```

```
as.character(tweet.txtK4)
```

```

## [1] " heart hustle inspiring point shot looking nice appreciate
sac vet kings "
## [2] " buckle ve got two point game suns sacramentokings left play
leaguepassalert"

```

```
## [3] " sacramento kings go win tie road kings phoenixsuns"
## [4] "gasol leads grizzlies win rockets sacramentokings kings "
## [5] "aldridge murray power spurs past raptors sacramentokings kings "
## [6] "game recap spurs raptors sacramentokings kings "
## [7] "monday suns fire watson banish bledsoe sacramentokings kings "
## [8] "mike james hits clutch suns kings chance tie win scores suns
kingsupdate sacramentoproud"
## [9] "balling right now vs suns secs left th snglv kings"
## [10] "buckle ve got two point game suns sacramentokings left play
leaguepassalert "
## [11] " sacramento kings game driving insane comeback kings let
finish "
## [12] " freakin game man kings sacramentoproud "
## [13] "ok game js js kings suns sunsvskings"
## [14] "buckle ve got two point game suns sacramentokings left play
leaguepassalert "
## [15] "sac kings vs suns game going wire "
## [16] " love kings team fox bogdanovic lt kings "
```

```
as.character(tweet.txtK5)
```

```
## [1] "sure nfl boring game except cowboys sports analytics hardly
statistics bring mlb data"
## [2] "nowplaying live periscope nfl worldseries dtongradio newmusic"
## [3] "nhl collegefootball nfl algorithm units yet documented"
## [4] "nowplaying live periscope sports amp music unite"
## [5] "gymrant myth needs end conjugate conjugatemethod bjj jiujitsu nogi
mma judo wrestling nhl nfl"
## [6] " rules errors wolves last second win æ sports nfl mlb ncaaf nhl"
## [7] "great breaks tickets prices nfl nhl"
## [8] "nowplaying live periscope nfl worldseries musicmonday np rt"
## [9] "nowplaying live periscope sports amp music unite nfl worldseries
collegefootball edm hiphop indie"
## [10] "tuesday vip mlb nhl rc plays nhl nhl incl best bet run tgtbfc"
## [11] "nowplaying live periscope nfl mlb amp indie music nfl worldseries
collegefootball edm hiphop"
## [12] "nowplaying live periscope nfl edm musicnmonday np rt"
## [13] "nowplaying live periscope nfl worldseries edm trance"
## [14] " dominant dodgers actually world series underdogs æ sports nfl
mlb ncaaf nhl"
## [15] "every day gameday fantasydraft dailyfantasy nfl mlb nhl pga"
## [16] "sporgy itunes podcast sports humor mlb nfl nhl detroit"
## [17] "sporgy itunes podcast sports humor mlb nfl nhl detroit"
```

```
knitr::opts_chunk$set(echo = TRUE)
```