Automatic sampling and Analysis of YouTube Data

Basic Text Analysis of User Comments

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Required Libraries for This Session

```
library(tidyverse)
library(lubridate)
library(tuber)
library(quanteda)
library(wordcloud)
```

We also need two libraries that are only available from *GitHub*. You can install them using the `install_github()` function from the `devtools` package.

```
library(devtools)
install_github("dill/emoGG")
install_github("hadley/emo")
library(emoGG)
library(emo)
```

Collect & Parse the Data

Note: To save time and your *YouTube* API quota limit you might not want to "code along" in this session

```
Comments <- get_all_comments(video_id="r8pJt4dK_s4") # takes a while
source("yt_parse.R") # yt_parse.R needs to be in the working directo
FormattedComments <- yt_parse(Comments) # this will take a while
```

As an alternative to sourcing the `yt_parse.R` file you can also run the code from the slides for the session on *Processing and Cleaning User Comments* on the collected comments.

Comments Over Time: Data Wrangling

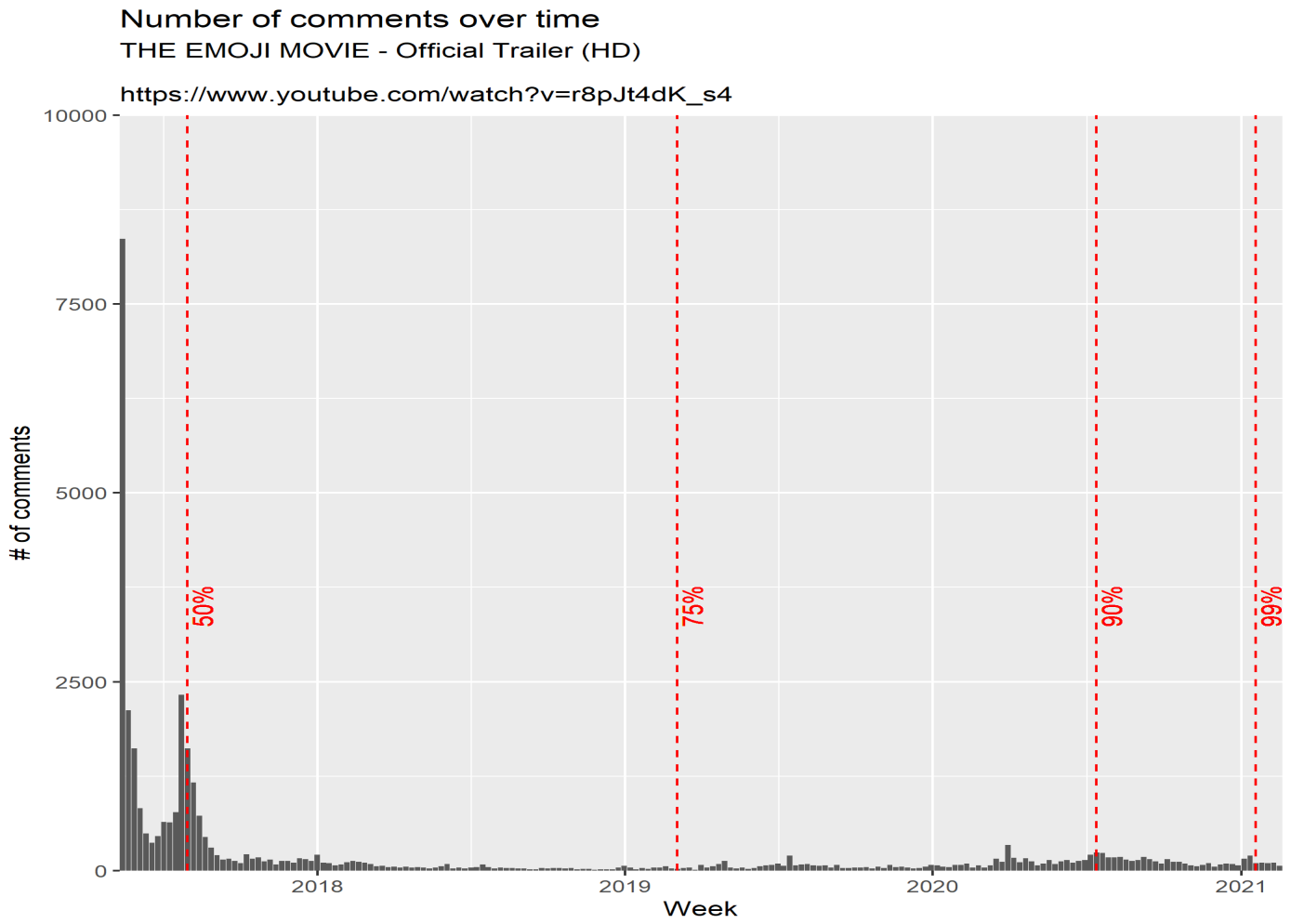
For a first exploratory plot, we want to plot the development of the number of comments per week over time and show until when 50%, 75%, 90%, and 99% of the comments had been posted. This requires some data wrangling.

```
FormattedComments <- FormattedComments %>%
  arrange(Published) %>%
  mutate(date = date(Published),
         week = floor_date(date,
                           unit = "week",
                           week_start = getOption("lubridate.week.sta
         counter = 1)

weekly_comments <- FormattedComments %>%
  count(week) %>%
  mutate(cumulative_count = cumsum(n))

PercTimes <- round(quantile(cumsum(FormattedComments$counter),
                            probs = c(0.5, 0.75, 0.9, 0.99)))
```

Comments Over Time: Plot

```
weekly_comments %>%
  ggplot(aes(x = week, y = n)) +
  geom_bar(stat = "identity") +
  scale_x_date(expand = c(0,0)) +
  scale_y_continuous(expand = c(0,0),
                     limits = c(0,10000)) +
  labs(title = "Number of comments over time",
       subtitle = "THE EMOJI MOVIE - Official Trailer (HD)
       \nhttps://www.youtube.com/watch?v=r8pJt4dK_s4",
       x = "Week",
       y = "# of comments") +
  geom_vline(xintercept = FormattedComments$week[PercTimes],linetype
  geom_text(aes(x = FormattedComments$week[PercTimes][1], label = "50
            colour="red", angle=90, vjust = 1.2) +
  geom_text(aes(x = FormattedComments$week[PercTimes][2], label = "75
            colour="red", angle=90, vjust = 1.2) +
  geom_text(aes(x = FormattedComments$week[PercTimes][3], label = "90
            colour="red", angle=90, vjust = 1.2) +
  geom_text(aes(x = FormattedComments$week[PercTimes][4], label = "99
            colour="red", angle=90, vjust = 1.2)
```

Number of Comments Over Time: Plot



Most Popular Comments

Which comments received the highest number of likes?

```
FormattedComments %>%
  arrange(-LikeCount) %>%
  head(10) %>%
  select(Text, LikeCount, Published)
```

Most Popular Comments

Which comments received the highest number of likes?

```
##                                                                                                                                                  Text
## 1                                                                                                                    Will they show Snapchat nudes in the movie?
## 2                                                                                                 Lmao the egg plant emoji never gets used? Do your research lmao
## 3                                                                                                                                The Meme Movie: Coming 2020
## 4                                                                                                                    The eggplant emoji never used? Suuuuuree.
## 5  So, this thing is still a thing? Ugh, I can't really still believe that you cancelled that Popeye movie...
## 6                                                                                                    I didn't even watched the movie but i want my money back
## 7                                                                                                                                 This is the best part 2:38
## 8                                                                I love how they switched it to New Comments and not Top Comments. Very Classy Sony.
## 9                                                                                                                                Why are all the comments so recent
## 10                                                                This movie is the best! I would LOVE TO SEE a sequel! \n\n\n\n\n*said no one ever*
##    LikeCount           Published
## 1       4477 2017-05-16 15:38:40
## 2       3011 2017-05-16 23:55:38
## 3       2594 2017-10-16 04:08:12
## 4       1431 2017-05-17 03:10:34
## 5       1318 2017-05-16 15:32:41
## 6        685 2020-07-06 05:25:33
## 7        667 2020-06-08 18:29:03
## 8        631 2020-04-04 03:31:10
## 9        577 2020-08-20 11:25:50
## 10       482 2020-01-17 02:53:33
```

Text Mining

In this session, we will discuss some basic exploratory analyses of *YouTube* user comments. We will explore the use of words as well as the use of emojis.

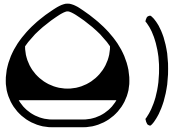
An introduction to text mining is beyond the scope of this workshop, but there are many great introductions available (for free) online. For example:

- Text Mining with R - A Tidy Approach by Julia Silge & David Robinson: A tidy(verse) approach
- Tutorials for the package `quanteda`
- Text mining for humanists and social scientists in R by Andreas Niekler & Gregor Wiedemann
- Text Mining in R by Jan Kirenz

In the following, we will very briefly introduce some key terms and steps in text mining, and then go through some examples of exploring *YouTube* comments (text + emojis).

Popular Text Mining Packages

- tm: the first comprehensive text mining package for R
- tidytext: tidyverse tools & tidy data principles
- **quanteda**: very powerful text mining package with extensive documentation

Text as Data (in a )

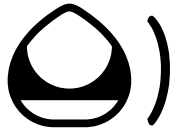
Document = collection of strings (+ metadata about the documents)

Corpus = collection of documents

Token = part of a text that is a meaningful unit of analysis (often individual words)

Vocabulary = list of all distinct words form a corpus

Document-term matrix (DTM) or **Document-feature matrix (DFM)** = matrix with *n* = # of documents rows and *m* = size of vocabulary columns where each cell contains the count of a particular word for a particular document

Preprocessing (in a )

For our examples in this session, we will go through the following preprocessing steps:

1. **Basic string operations**:
    - Transforming to lower case
    - Detecting and removing certain patterns in strings (e.g., punctuation, numbers or URLs)
2. **Tokenization**: Splitting up strings into words (could also be combinations of multiple words: n-grams)
3. **Stopword removal**: Stopwords are very frequent words that appear in almost all texts (e.g., "a","but","it", "the") but have low informational value for most analyses (at least in the social sciences)

NB: There are many other preprocessing options that we will not use for our examples, such as stemming, lemmatization or natural language processing pipelines (e.g., to detect and select specific word types, such as nouns and adjectives). Keep in mind that the choice and order of these preprocessing steps is important and should be informed by your research question.

Tokenization

Before we tokenize the comments, we want to remove newline commands from the strings.

```
FormattedComments <- FormattedComments %>%
  mutate(TextEmojiDeleted = str_replace_all(TextEmojiDeleted,
                                            pattern = "\\n",
                                            replacement = " "))
```

Tokenization

Now we can tokenize the comments and remove punctuation, symbols, numbers, and URLs.

```
toks <- FormattedComments %>%
  pull(TextEmojiDeleted) %>%
  char_tolower() %>%
  tokens(remove_numbers = TRUE,
                remove_punct = TRUE,
                remove_separators = TRUE,
                remove_symbols = TRUE,
                split_hyphens = TRUE,
                remove_url = TRUE)
```

Document-Feature Matrix

With the tokens we can create a document-feature matrix (DFM) and remove stopwords.

```
commentsDfm <- dfm(toks,
                   remove = quanteda::stopwords("english"))
```

Most Frequent Words

```
TermFreq <- textstat_frequency(commentsDfm)
head(TermFreq, n = 20)
```

```
##    feature frequency rank docfreq group
## 1    movie     11393    1    8655   all
## 2    emoji      3161    2    2770   all
## 3     like      2683    3    2355   all
## 4     just      2436    4    2154   all
## 5      nom      2239    5       1   all
## 6     sony      1515    6    1404   all
## 7   people      1415    7    1223   all
## 8      bad      1316    8    1210   all
## 9     good      1271    9    1164   all
## 10     one      1192   10    1081   all
## 11  emojis      1119   11     997   all
## 12    hate      1075   12     993   all
## 13     see      1066   13     939   all
## 14   watch      1027   14     951   all
## 15    make      1002   15     904   all
## 16  popeye       965   16     888   all
## 17   think       941   17     866   all
## 18    know       917   18     838   all
## 19     can       901   19     767   all
## 20 trailer       883   20     827   all
```

Removing Tokens

We may want to remove additional words (that are not included in the stopwords list) if we consider them irrelevant for our analyses.

```
custom_stopwords <- c("nom", "can", "get")
commentsDfm <- dfm(toks, remove = c(quanteda::stopwords("english"),
                                    custom_stopwords))
TermFreq <- textstat_frequency(commentsDfm)
```

For more options for selecting or removing tokens, see the quanteda documentation.

Wordclouds

```
wordcloud(words = TermFreq$feature,
          freq = TermFreq$frequency,
          min.freq = 10,
          max.words = 50,
          random.order = FALSE,
          rot.per = 0.35,
          colors = brewer.pal(8, "Dark2"))
```

Note: You can adjust what is plotted by, e.g., changing the minimum frequency (`min.freq`) or the maximum # of words (`max.words`). Check `?wordcloud` for more customization options.

Wordclouds

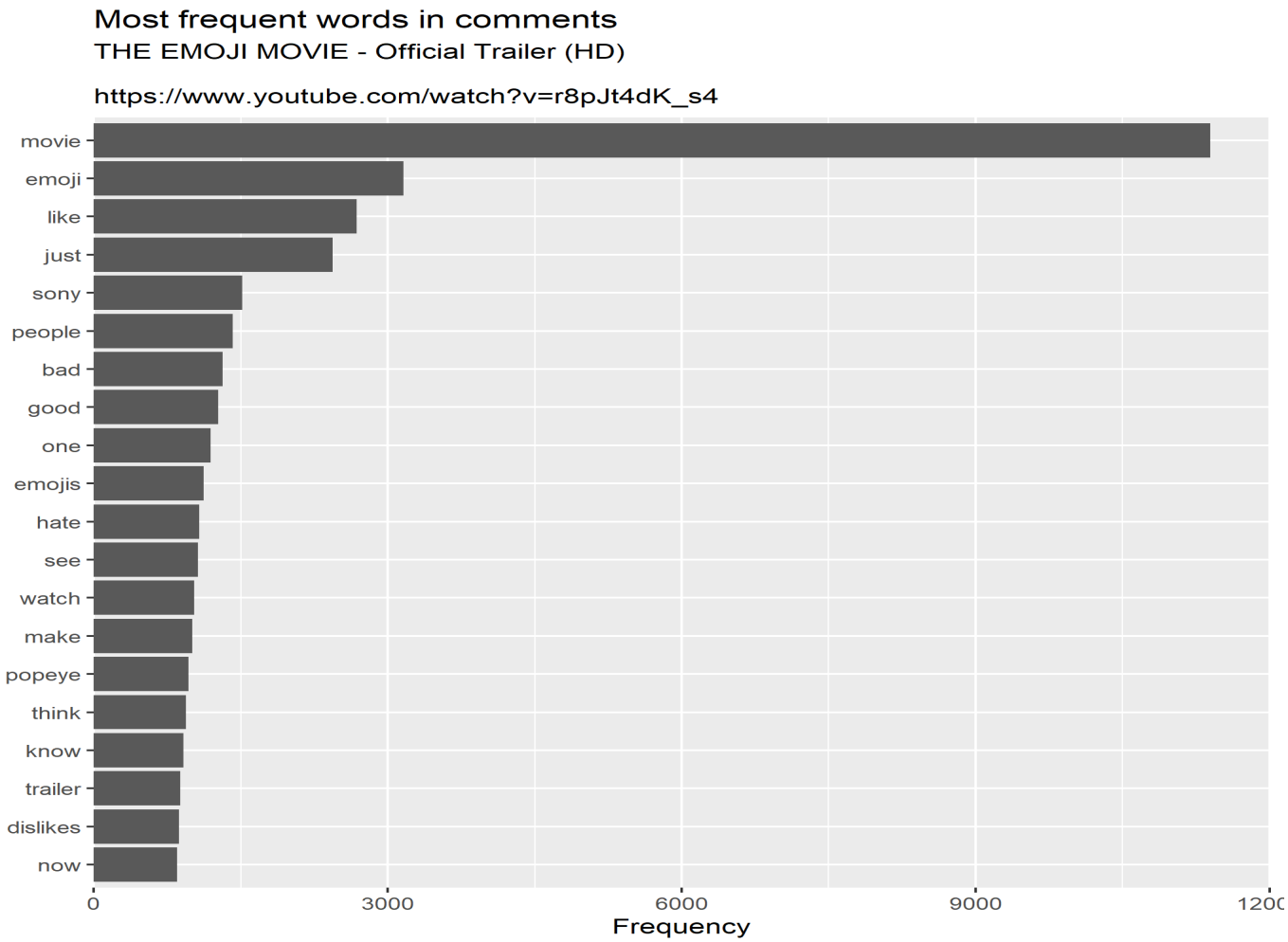

movie
emoji
just
like
sony
people
one
hate
emojis
dislikes
dislike
popeye
cancer
ralph
time
see
ever
love
used
still
worst
kids
money
better
much
now
actually
looks
inside
movies
trailer
film
bad
good
make
lol
think
watch
know
want
made
wreck
really
fucking
even
big
god
going

Don't Let Your Words Cloud Your Plots!

Plot Most Frequent Words

```
TermFreq %>%
head(n = 20) %>%
  ggplot(aes(x = reorder(feature, frequency), y = frequency)) +
  geom_bar(stat="identity") +
  labs(title = "Most frequent words in comments",
       subtitle = "THE EMOJI MOVIE - Official Trailer (HD)
       \nhttps://www.youtube.com/watch?v=r8pJt4dK_s4",
       x = "",
       y = "Frequency") +
  scale_y_continuous(expand = c(0,0),
                     limits = c(0,12000)) +
  coord_flip()
```

Plot Most Frequent Words

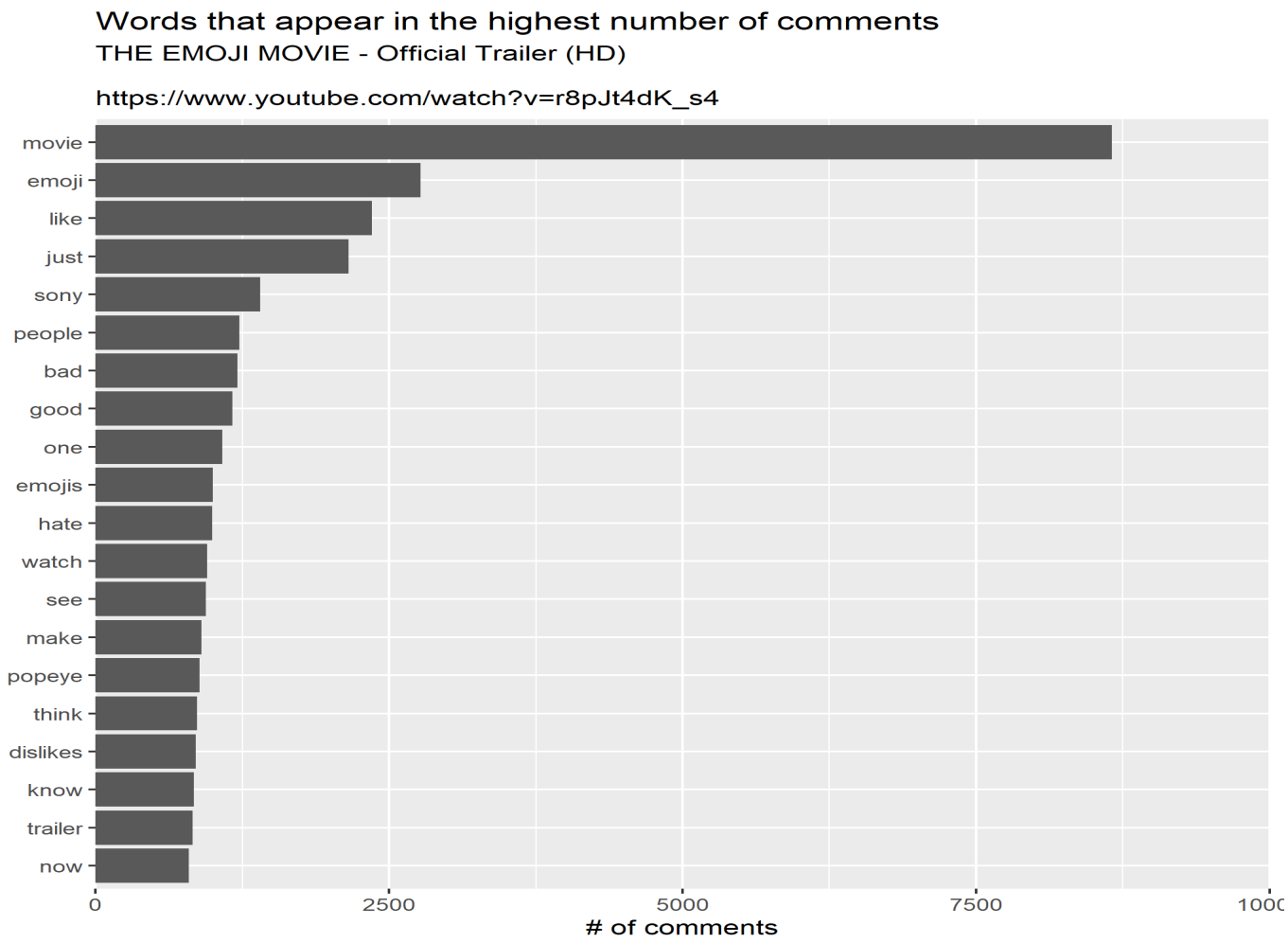


Plot Docfreq

Instead of the raw frequency of words we can also look at the number of comments that a particular word appears in. This metric takes into account that words might be used multiple times in the same comment.

```
TermFreq %>%
head(n = 20) %>%
  ggplot(aes(x = reorder(feature, docfreq), y = docfreq)) +
  geom_bar(stat="identity") +
  labs(title = "Words that appear in the highest number of comments",
       subtitle = "THE EMOJI MOVIE - Official Trailer (HD)
       \nhttps://www.youtube.com/watch?v=r8pJt4dK_s4",
       x = "",
       y = "# of comments") +
  scale_y_continuous(expand = c(0,0),
                     limits = c(0,10000)) +
  coord_flip()
```

Plot Docfreq



Emojis

In most of the research studying user-generated text from social media, emojis have, so far, been largely ignored. However, emojis convey emotions and meaning, and can, thus, provide additional information or context when working with textual data.

In the following, we will do some exploratory analysis of emoji frequencies in *YouTube* comments. Before we can start, we first need to do some data cleaning again, then tokenize the emojis as some comments include more than one emoji, and create an emoji DFM.

```
emoji_toks <- FormattedComments %>%
  mutate(Emoji = na_if(Emoji, "NA")) %>% # define missings
  mutate (Emoji = str_trim(Emoji)) %>% # remove spaces
  filter(!is.na(Emoji)) %>% # only keep comments with emojis
  pull(Emoji) %>% # pull out column cotaining emoji labels
  tokens(what = "fastestword") # tokenize emoji labels

EmojiDfm <- dfm(emoji_toks) # create DFM for emojis
```

Most Frequent Emojis

```
EmojiFreq <- textstat_frequency(EmojiDfm)
head(EmojiFreq, n = 10)
```

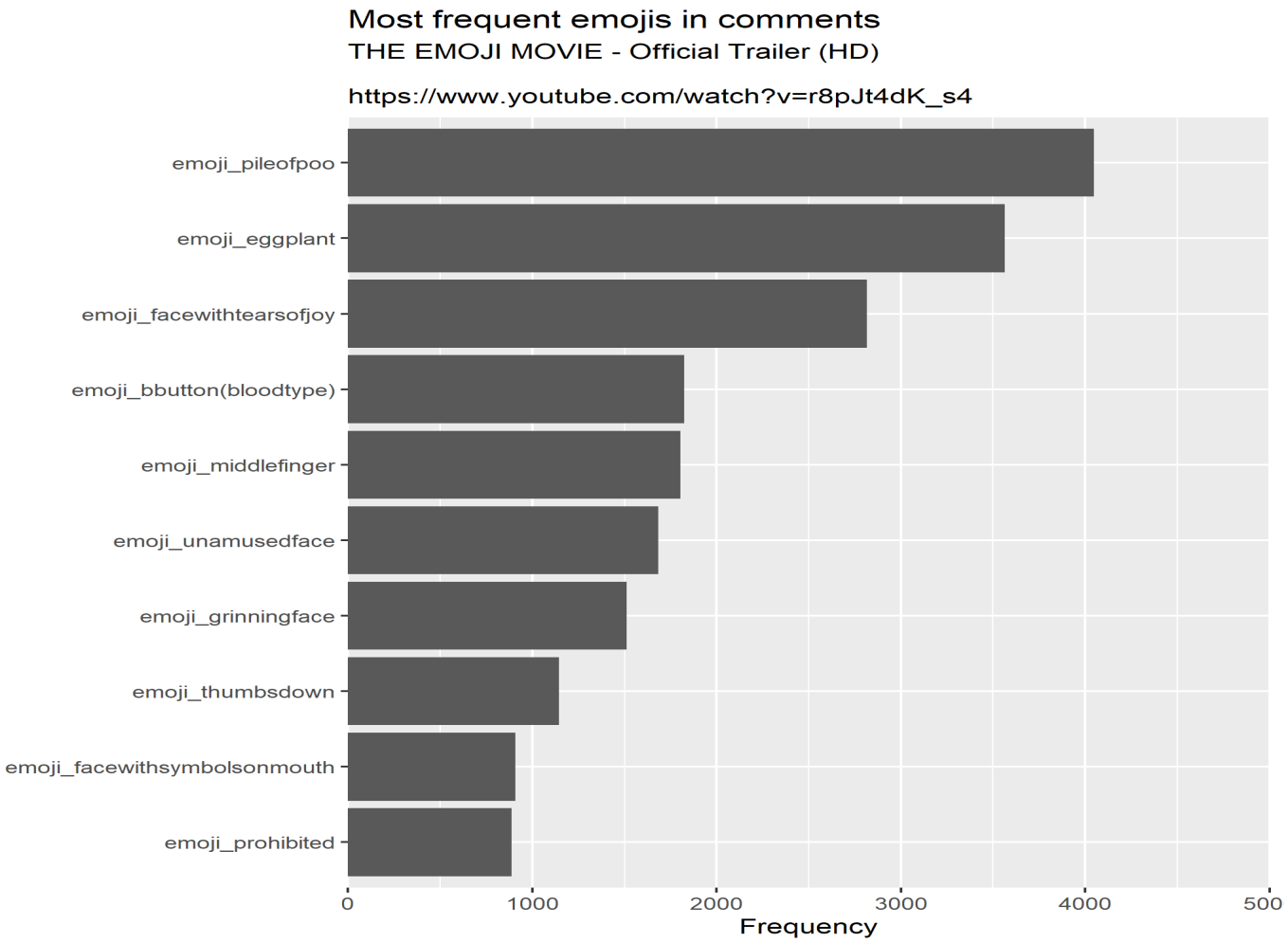
```
##                          feature frequency rank docfreq group
## 1                emoji_pileofpoo      4047    1     519   all
## 2                 emoji_eggplant      3563    2     272   all
## 3       emoji_facewithtearsofjoy      2814    3     801   all
## 4       emoji_bbutton(bloodtype)      1825    4     126   all
## 5             emoji_middlefinger      1804    5     295   all
## 6             emoji_unamusedface      1685    6     637   all
## 7             emoji_grinningface      1511    7     340   all
## 8               emoji_thumbsdown      1145    8     252   all
## 9  emoji_facewithsymbolsonmouth       909    9      62   all
## 10              emoji_prohibited       887   10      93   all
```

Plot Most Frequent Emojis

```
EmojiFreq %>%
head(n = 10) %>%
  ggplot(aes(x = reorder(feature, frequency), y = frequency)) +
  geom_bar(stat="identity") +
  labs(title = "Most frequent emojis in comments",
       subtitle = "THE EMOJI MOVIE - Official Trailer (HD)
       \nhttps://www.youtube.com/watch?v=r8pJt4dK_s4",
       x = "",
       y = "Frequency") +
  scale_y_continuous(expand = c(0,0),
                     limits = c(0,5000)) +
 coord_flip()
```

Note: Similar to what we did for the comment text before we could replace `frequency` with `docfreq` in the above code to create a plot with the emojis that appear in the highest number of comments.

Plot Most Frequent Emojis



😎 Emoji Frequency Plot: Preparation (1)

The previous emoji frequency plot was a bit 😢. To make things prettier, we can use the actual emojis instead of the text labels in our plot. Doing this takes a bit of preparation...[1]

As a first step, we need an emoji lookup table in which the values in the name column have the same format as the labels in the feature column of our `EmojiFreq` object.

```
emoji_lookup <- jis %>%
  select(runes, name) %>%
  mutate(runes = str_to_lower(runes),
         name = str_to_lower(name)) %>%
  mutate(name = str_replace_all(name, " ", "")) %>%
  mutate(name = paste0("emoji_", name))
```

[1] For an alternative approach to using emojis in `ggplot2` see this blog post by Emil Hvitfeldt.

😎 Emoji Frequency Plot: Preparation (2)

The second step of preparation for the nicer emoji frequency plot is creating mappings of emojis to data points so that we can use emojis instead of points in a scatter plot.[1]

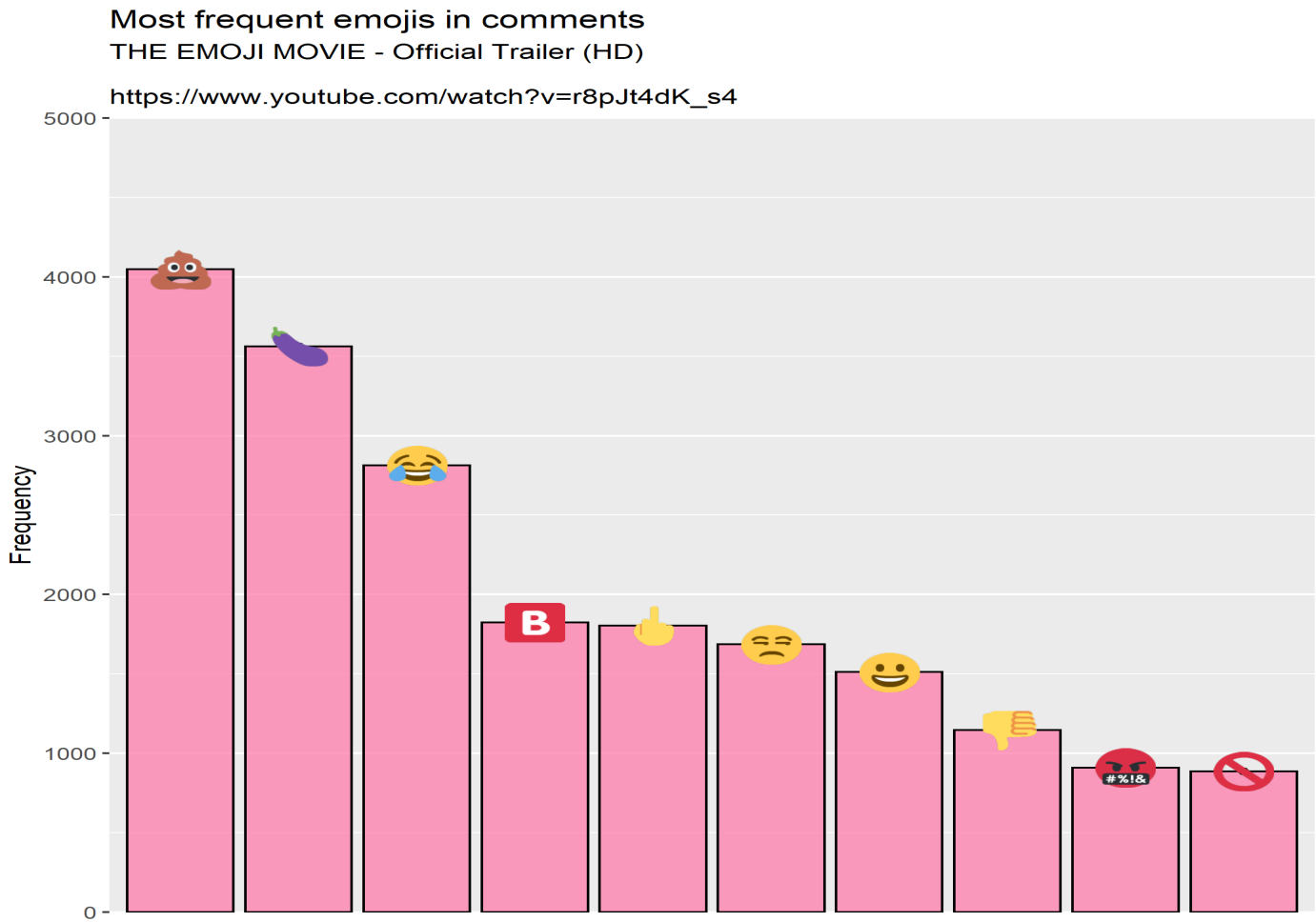
```
top_emojis <- 1:10

for(i in top_emojis){
  name <- paste0("mapping", i)
  assign(name,
         do.call(geom_emoji,list(data = EmojiFreq[i,],
                                 emoji = gsub("^0{2}","", strsplit(to
}
```

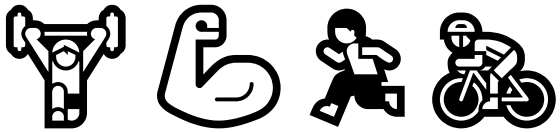
[1] Please note that this code has not been tested systematically. We only used it with a few videos. Depending on which emojis are the most frequent for the video you look at, this might not work because (a) one of the emojis is not included in the emoji lookup table (which uses the `jis` data frame from the `emo` package) or (b) the content in the `runes` column does not match the format/code that the `emoji` argument in the `geom_emoji` function from the `emoGG` package expects.

Emoji Frequency Plot

```
EmojiFreq %>%
head(n = 10) %>%
  ggplot(aes(x = reorder(feature, -frequency), y = frequency)) +
  geom_bar(stat="identity",
           color = "black",
           fill = "#FF74A6",
           alpha = 0.7) +
  geom_point() +
  labs(title = "Most frequent emojis in comments",
       subtitle = "THE EMOJI MOVIE - Official Trailer (HD)
       \nhttps://www.youtube.com/watch?v=r8pJt4dK_s4",
       x = "",
       y = "Frequency") +
  scale_y_continuous(expand = c(0,0),
                     limits = c(0,5000)) +
  theme(panel.grid.major.x = element_blank(),
        axis.text.x = element_blank(),
        axis.ticks.x = element_blank()) +
  mapping1 +
  mapping2 +
  mapping3 +
  mapping4 +
  mapping5 +
  mapping6 +
  mapping7 +
  mapping8 +
  mapping9 +
  mapping10
```

Emoji Frequency Plot



Exercise time 

Solutions