

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

Step 1: Collecting the comments

```
Comments <- get_all_comments(video_id="r8pJt4dK_s4") # takes a while
```

Step 2: Parse/process the comments

For this to work, the script `yt_parse.R` as well as the ones containing the helper functions (`CamelCase.R`, `ExtractEmoji.R`, and `ReplaceEmoji.R`) need to be in the working directory (you can find those files in the scripts folder in the workshop materials).

```
source("yt_parse.R")  
FormattedComments <- yt_parse(Comments) # this will take a while
```

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

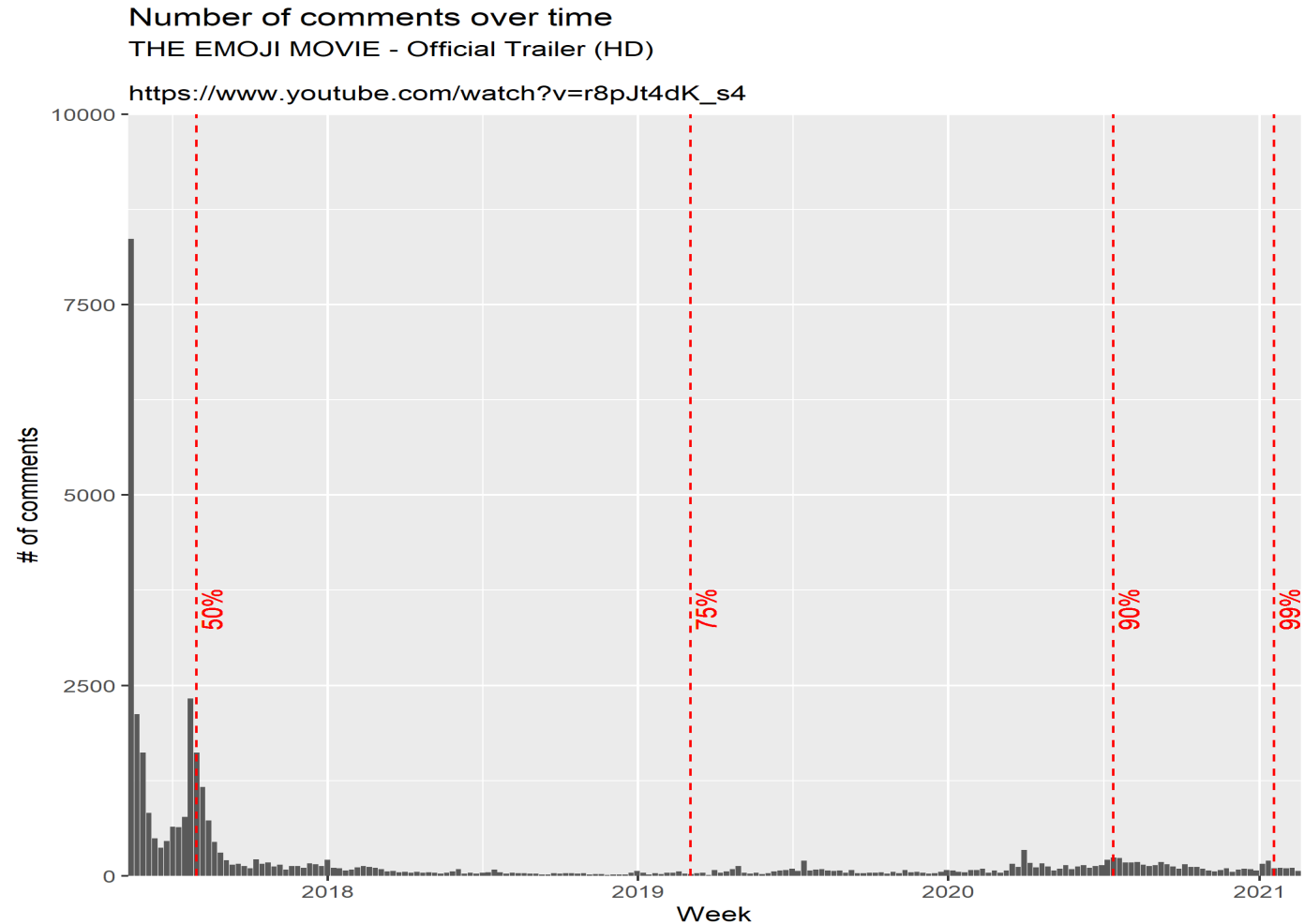
Comments Over Time: Plot

```

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 = "95",
               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.

[illegible]

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)
```

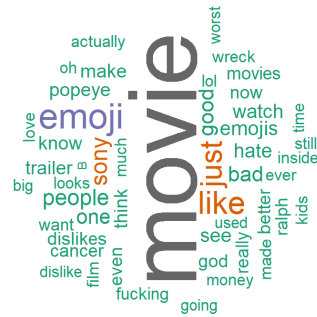
For more options for selecting or removing tokens, see the [quanteda documentation](#).

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



Don't Let Your Words Cloud Your Plots!

Plot Most Frequent Words

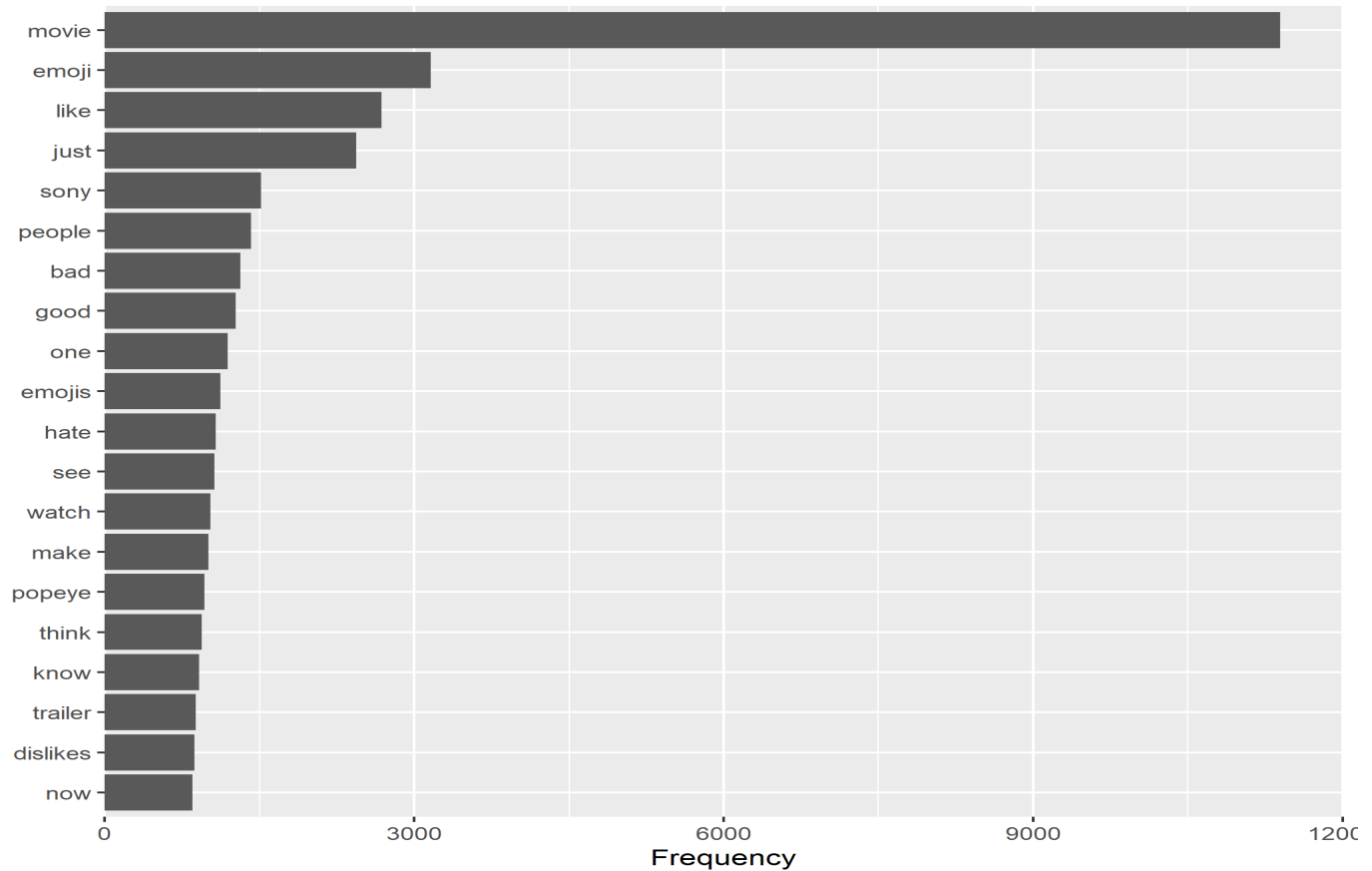
```
TermFreq %>%  
head(n = 20) %>%  
  ggplot(aes(x = reorder(feature, frequency), y = frequency)) +  
  geom_bar(stat="identity") +  
  labs(title = "Most frequent words in comments",  
        subtitle = "THE EMOJI MOVIE - Official Trailer (HD)  
        \nhttps://www.youtube.com/watch?v=r8pJt4dK_s4",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

Plot Most Frequent Words

Most frequent words in comments

THE EMOJI MOVIE - Official Trailer (HD)

https://www.youtube.com/watch?v=r8pJt4dK_s4



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.

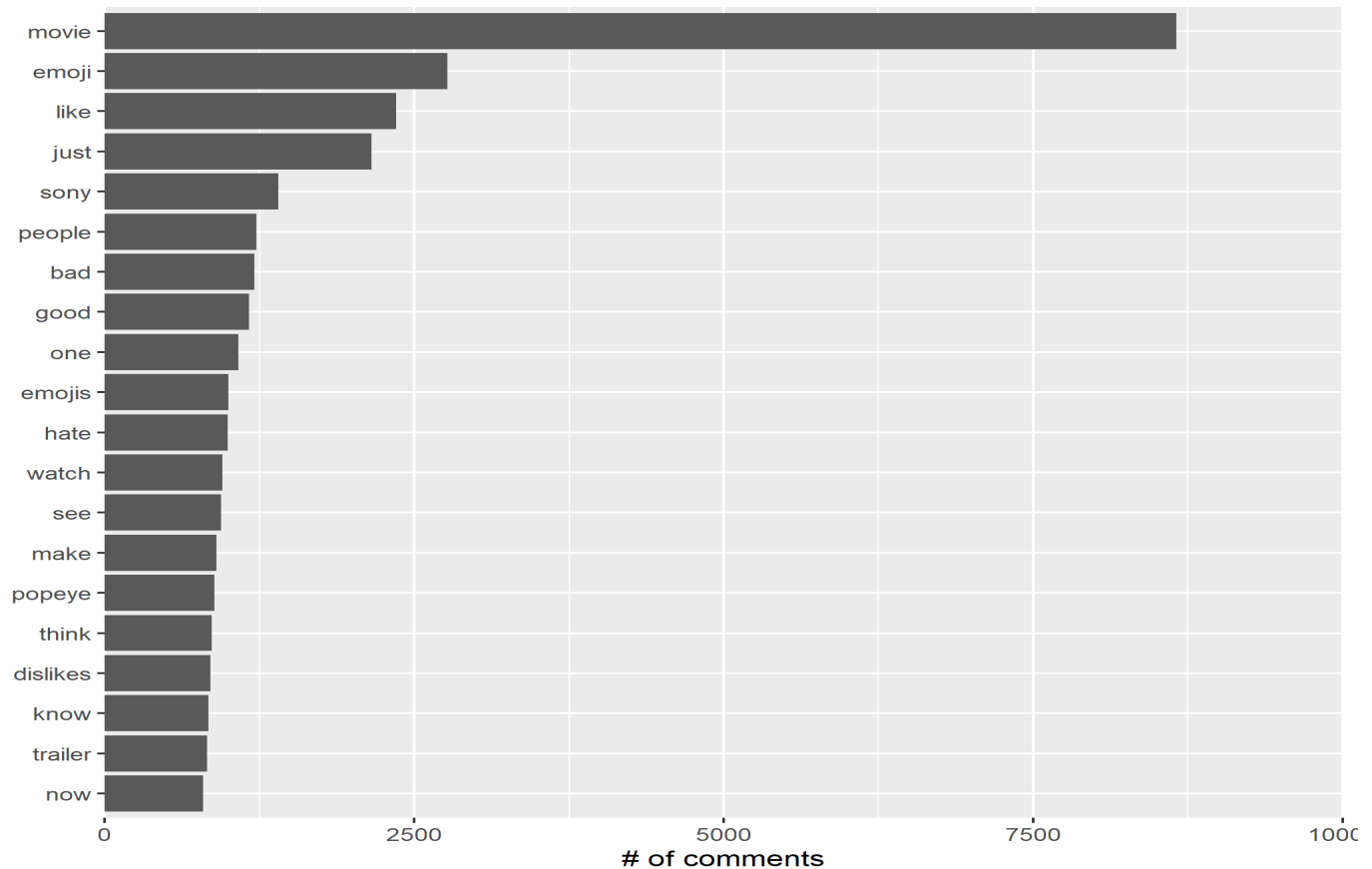
```
TermFreq %>%  
head(n = 20) %>%  
  ggplot(aes(x = reorder(feature, docfreq), y = docfreq)) +  
  geom_bar(stat="identity") +  
  labs(title = "Words that appear in the highest number of comments",  
        subtitle = "THE EMOJI MOVIE - Official Trailer (HD)  
        \nhttps://www.youtube.com/watch?v=r8pJt4dK\_s4",  
        x = "",  
        y = "# of comments") +  
  scale_y_continuous(expand = c(0,0),  
                     limits = c(0,10000)) +  
  coord_flip()
```

Plot Docfreq

Words that appear in the highest number of comments

THE EMOJI MOVIE - Official Trailer (HD)

https://www.youtube.com/watch?v=r8pJt4dK_s4



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)
```

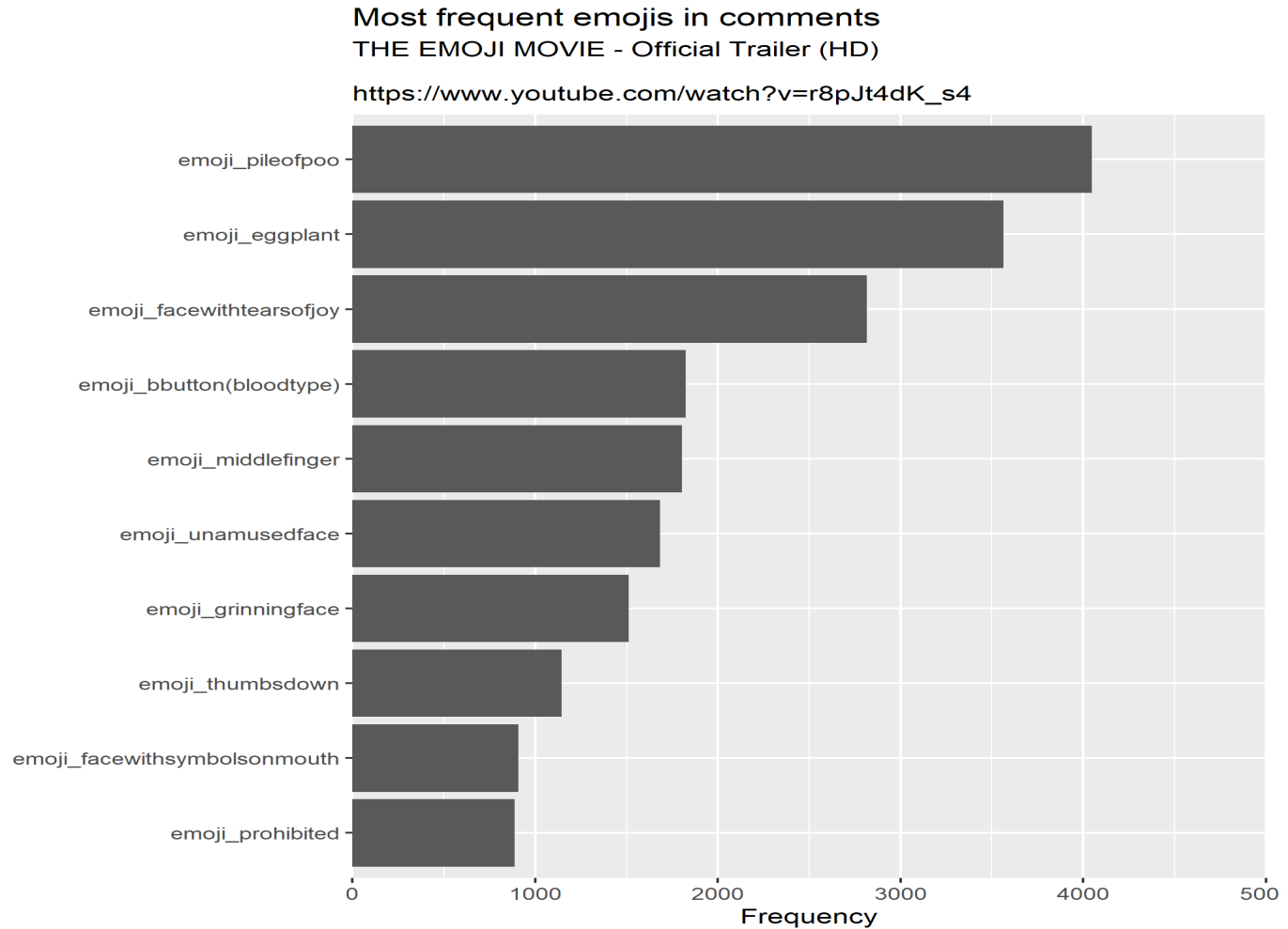
##	feature	frequency	rank	docfreq	group
## 1	emoji_pileofpoo	4047	1	519	all
## 2	emoji_eggplant	3563	2	272	all
## 3	emoji_facewithtearsofjoy	2814	3	801	all
## 4	emoji_bbutton(bloodtype)	1825	4	126	all
## 5	emoji_middlefinger	1804	5	295	all
## 6	emoji_unamusedface	1685	6	637	all
## 7	emoji_grinningface	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(ggeom_emoji, list(data = EmojiFreq[i,],
                             emoji = gsub("^0{2}", "", strsplit(tc
  })
}
```

[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 `j` 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
```

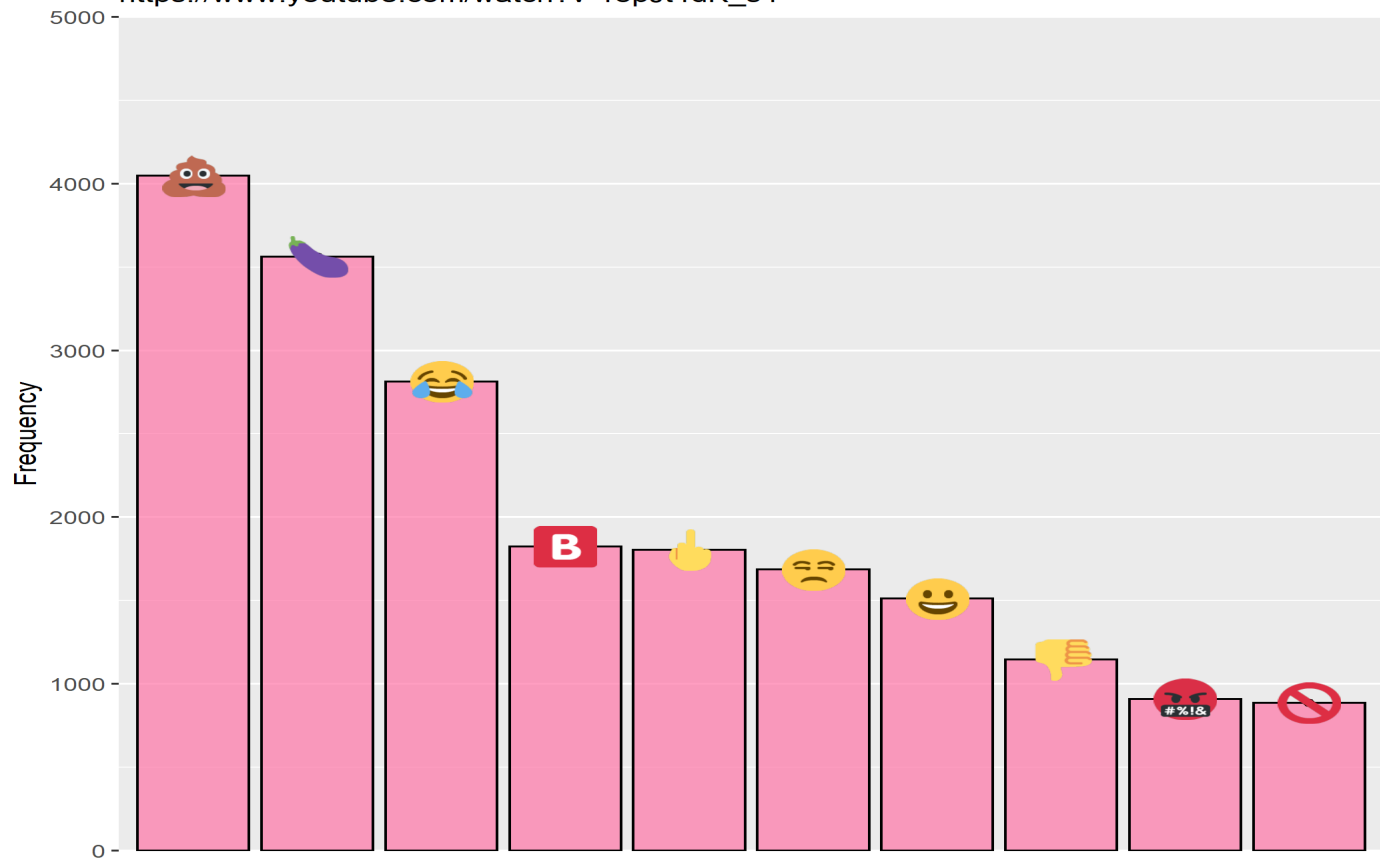






Emoji Frequency Plot

Most frequent emojis in comments

THE EMOJI MOVIE - Official Trailer (HD)

https://www.youtube.com/watch?v=r8pJt4dK_s4



Exercise time    

Solutions