# M31 - Text Mining

LearningSpoonsR

2018-07-08

# Contents

- Part 2. 분석 & 시각화 - `ggplot2`
- Part 1. Text 전처리 - `tm`, `KONLP`
- Part 3. 일반화 - Writing a function
- (NEXT - Part. 일반화) - `M32-flexdashboard`

- `ggplot2`의 원리와 다른 용법에 대해서 알아봅니다.
- Text 문서를 입력으로 하여 분석하는 `text-mining` 도구들을 알아봅니다.
- 함수를 작성하면서, 1) 공통 기능을 일반화 하고, 2) 다른 기능은 분기하여 범용적인 도구로 진화시킵니다.
- (Next - 다양한 input형태를 모두 처리할 수 있는 도구로 완성시킵니다. (`shiny`))

# Part 2. - 분석 & 시각화 - ggplot2

# GG - Grammar of Graphics

- Motivation

1. 그래픽스에 대한 원리가 없다면, 그래픽 관련 패키지와 함수는 단지 특수 경우의 모음일 뿐
2. 요리 백과사전을 다 읽는 것 vs. 물과 기름과 불의 작용에 대해서 익히고 백과사전을 **찾아가면서** 요리하는 것

- Advantage

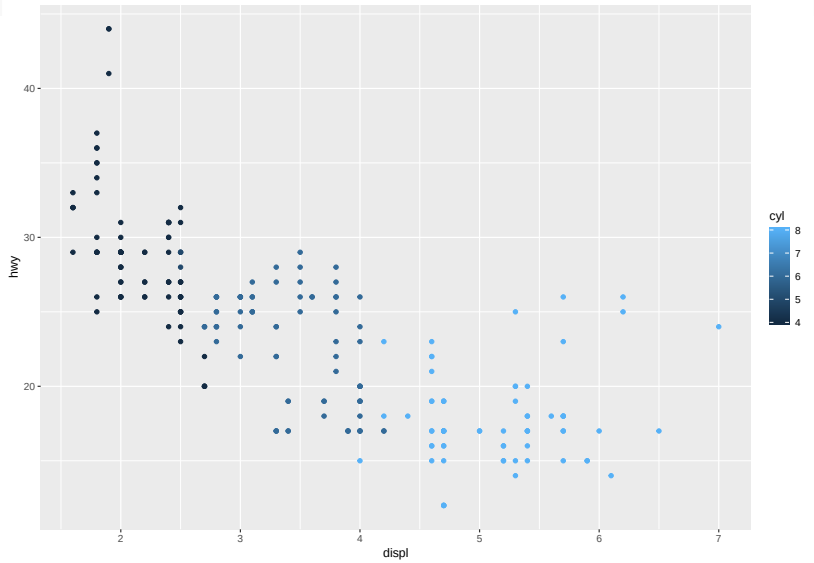
1. 새로운 package나 함수의 등장을 빠르게 흡수
2. 새로운 graphics를 만들어 내는 아이디어가 체계적이 됨

- Features

1. 독립적이고 더할 수 있는 구성 요소들로 그래픽을 표현
2. 개발과정에서 그래프의 특징을 한 가지 씩, 반복적으로 바꾸면서 그래프를 만들어 감
3. 생각의 흐름, 스토리텔링의 흐름과 연계시킬 수 있기에 interactive graphics와 잘 조화됨

# 구성 요소

```
library(ggplot2)
ggplot(mpg) +
  aes(x = displ, y = hwy, color = cyl) +
  geom_point()
```




- Aesthetics

1. position
2. size
3. color
4. shape

- Geometric Object (**geom_**)

1. Scatterplot - **point**
2. Bubblechart - **point**
3. Barchart - **bar**
4. Box-and-whisker plot - **boxplot**
5. Line chart - **line**

# Behind the scene

## data

```
head(mpg[,c("displ", "hwy", "cyl")],10)

## # A tibble: 10 x 3
##    displ   hwy   cyl
##    <dbl> <int> <int>
##  1  1.80    29     4
##  2  1.80    29     4
##  3  2.00    31     4
##  4  2.00    30     4
##  5  2.80    26     6
##  6  2.80    26     6
##  7  3.10    27     6
##  8  1.80    26     4
##  9  1.80    25     4
## 10  2.00    28     4
```

## aes

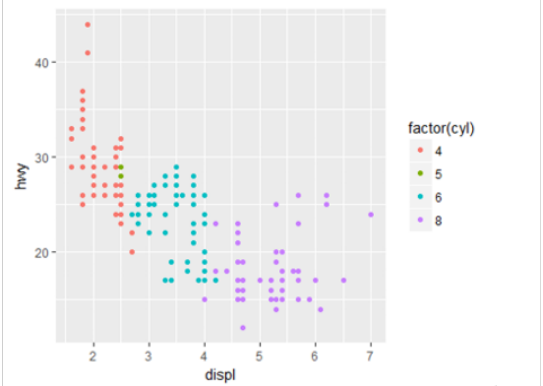
| x | y | colour |
|---|---|---|
| 1.8 | 29 | 4 |
| 1.8 | 29 | 4 |
| 2.0 | 31 | 4 |
| 2.0 | 30 | 4 |
| 2.8 | 26 | 6 |
| 2.8 | 26 | 6 |
| 3.1 | 27 | 6 |
| 1.8 | 26 | 4 |

## geom

| x | y | colour | size | shape |
|---|---|---|---|---|
| 0.037 | 0.531 | #F8766D | 1 | 19 |
| 0.037 | 0.531 | #F8766D | 1 | 19 |
| 0.074 | 0.594 | #F8766D | 1 | 19 |
| 0.074 | 0.562 | #F8766D | 1 | 19 |
| 0.222 | 0.438 | #00BFC4 | 1 | 19 |
| 0.222 | 0.438 | #00BFC4 | 1 | 19 |
| 0.278 | 0.469 | #00BFC4 | 1 | 19 |
| 0.037 | 0.438 | #F8766D | 1 | 19 |

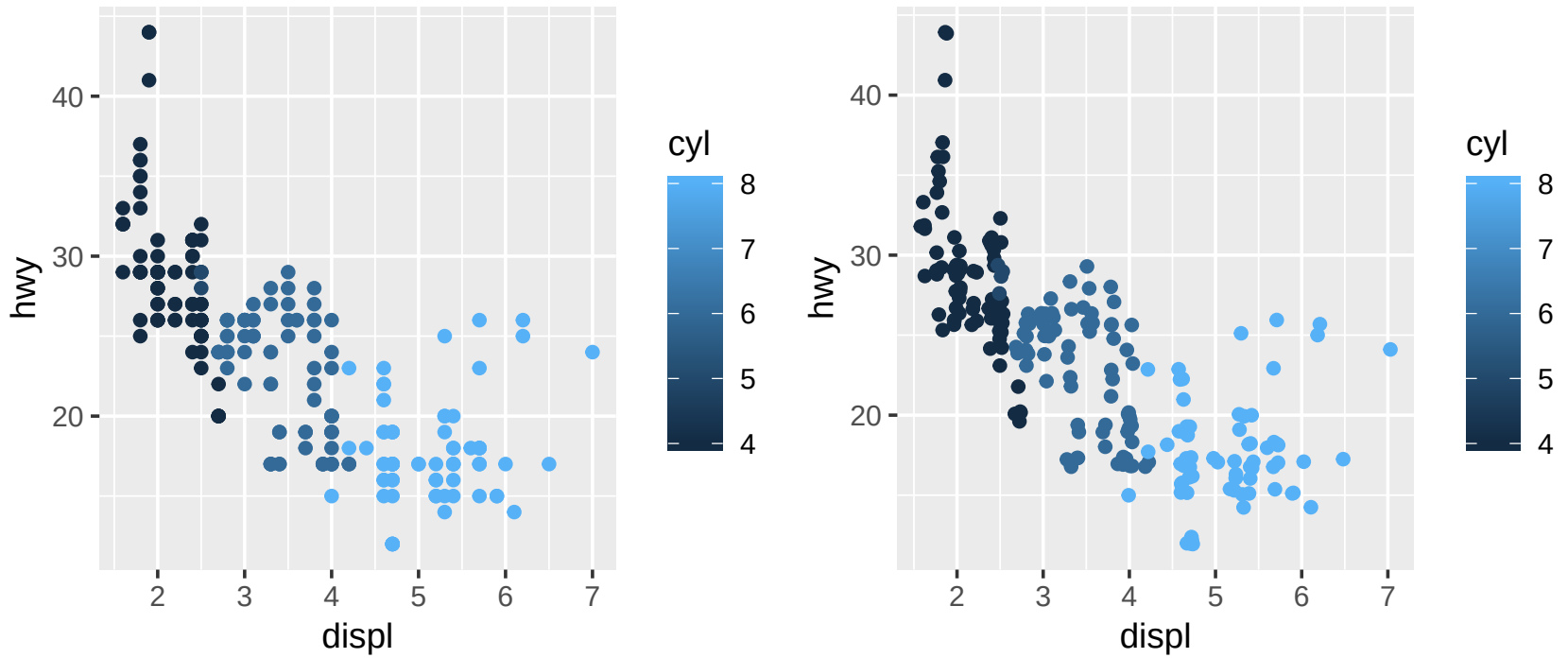
## plot

```
library(ggplot2)
ggplot(data = mpg, aes(x = displ, y = hwy, color = factor(cyl))) +
  geom_point()
```



# 중첩된 관찰값에 노이즈를: position = "jitter"

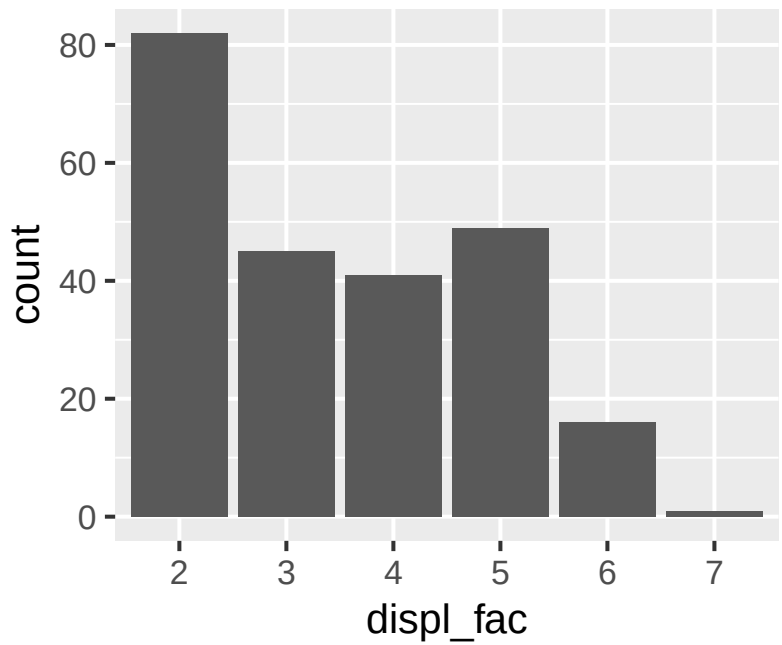
```
library(gridExtra)
a <- ggplot(mpg) + geom_point(aes(displ, hwy, color = cyl))
b <- ggplot(mpg) + geom_point(aes(displ, hwy, color = cyl), position = "jitter")
grid.arrange(a, b, nrow = 1, ncol = 2)
```



# Barchart

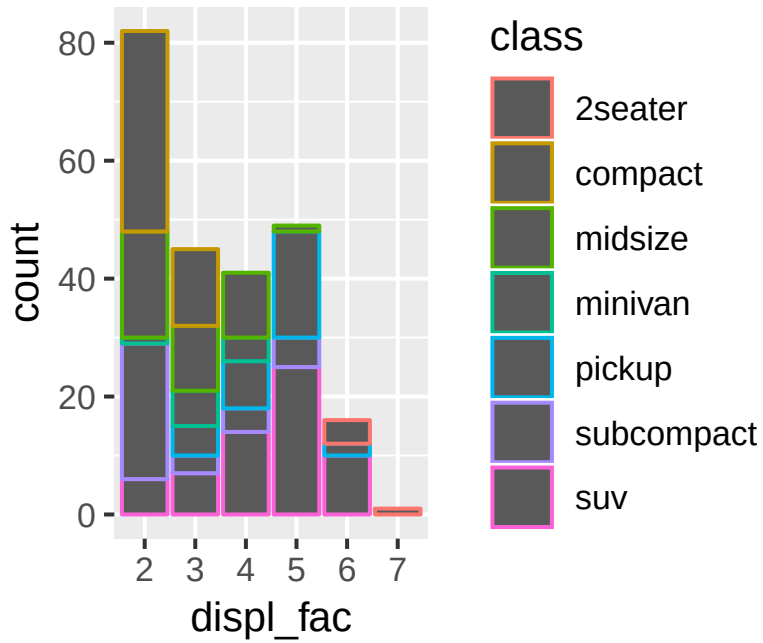
- x축에 이산변수 (discrete value)를 넣고 변수 x의 각각의 값에 대해서 몇 개의 관찰값이 있는지를 보여줌.
- #count #density #distribution

```
mpg$displ_fac <-
  as.factor(round(mpg$displ,0))
ggplot(mpg) +
  geom_bar(aes(x = displ_fac))
```




- x변수 외에도 이산 변수를 추가할 수 있음.

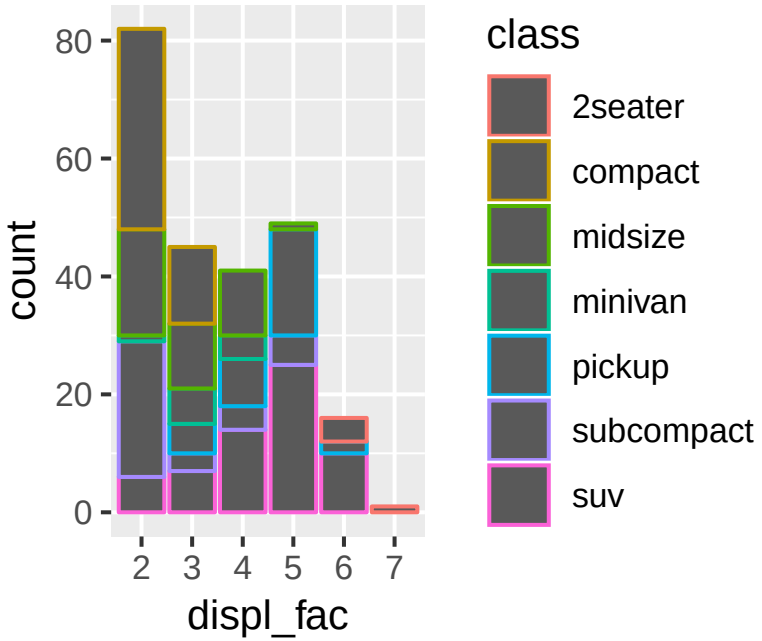
```
ggplot(mpg) +
  geom_bar(aes(x = displ_fac, color = class))
```



# Barchart (Color and Fill)

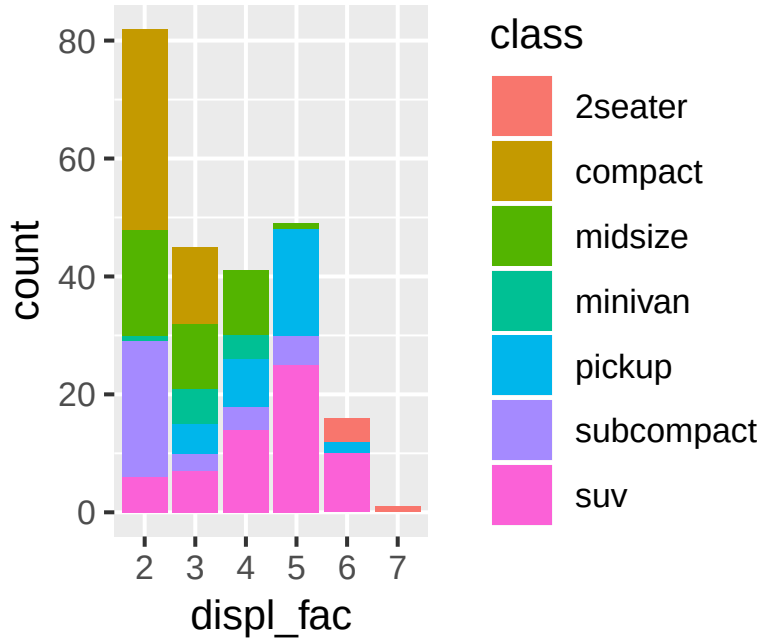
- `color` - 테두리만 됨

```
ggplot(mpg) +
  geom_bar(aes(x = displ_fac, color = class))
```



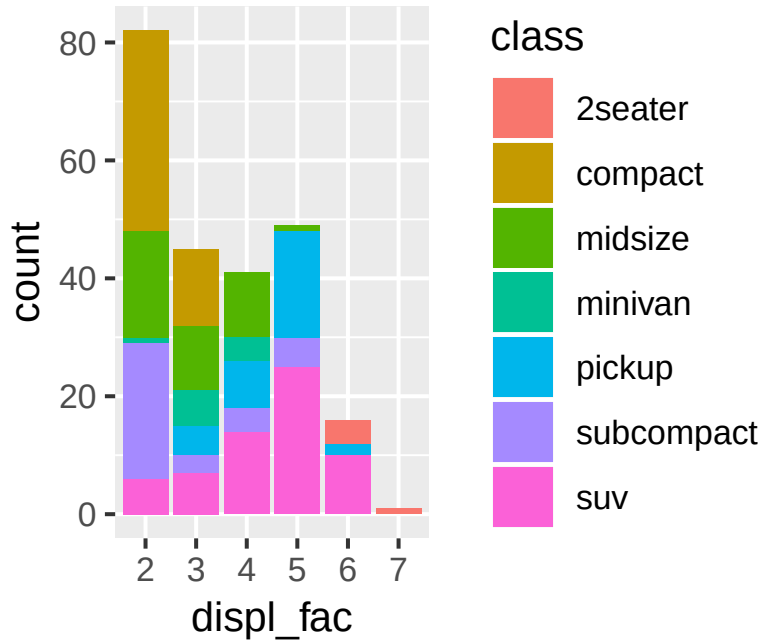

- `fill` - 채워짐

```
ggplot(mpg) +
  geom_bar(aes(x = displ_fac, fill = class))
```

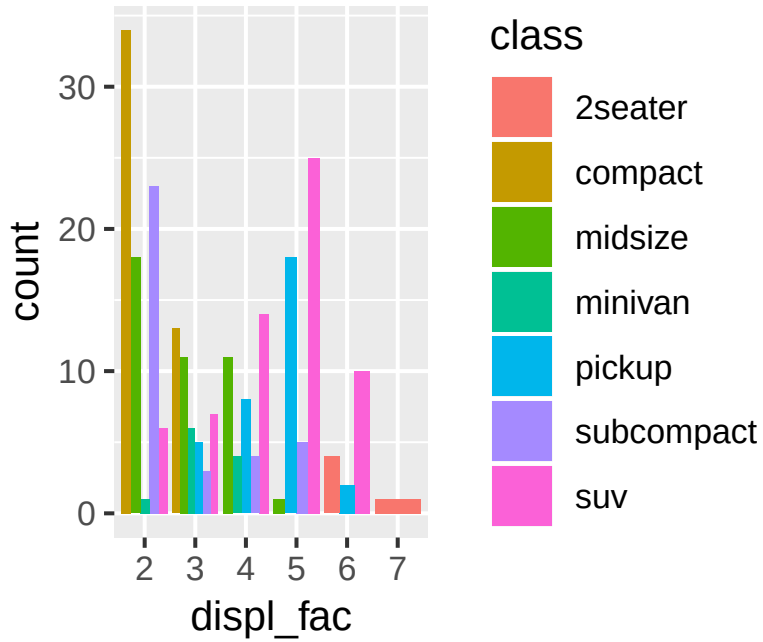


# Barchart (position = "dodge")

```
ggplot(mpg) +
  geom_bar(aes(x = displ_fac, fill = class))
```



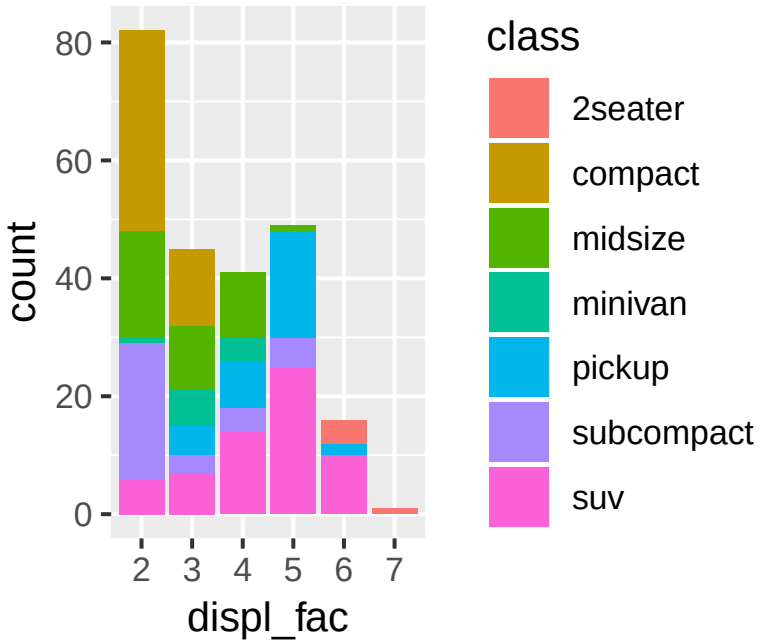

```
ggplot(mpg) +
  geom_bar(aes(x = displ_fac, fill = class),
           position = "dodge")
```



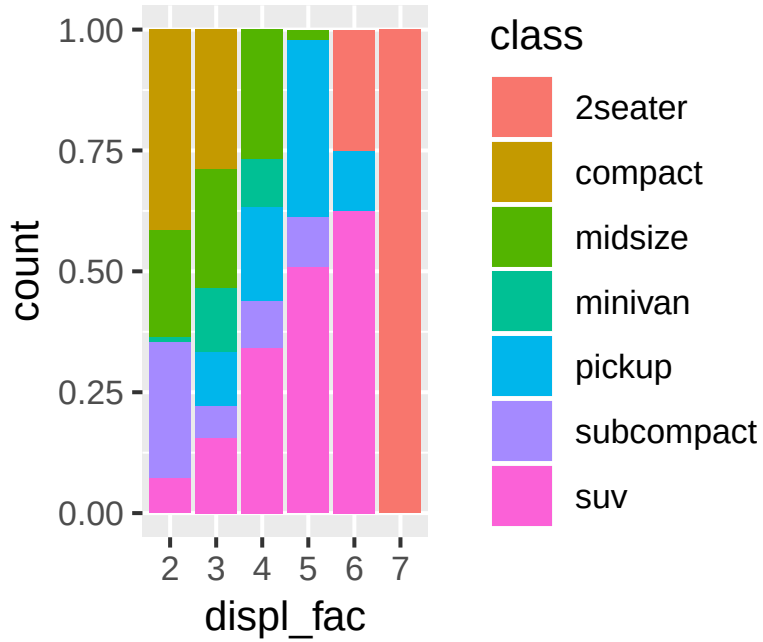

- 2개의 discrete 변수를 잘 처리하는 법?

# Barchart (position = "fill")

```
ggplot(mpg) +
  geom_bar(aes(x = displ_fac, fill = class))
```




```
ggplot(mpg) +
  geom_bar(aes(x = displ_fac, fill = class),
           position = "fill")
```

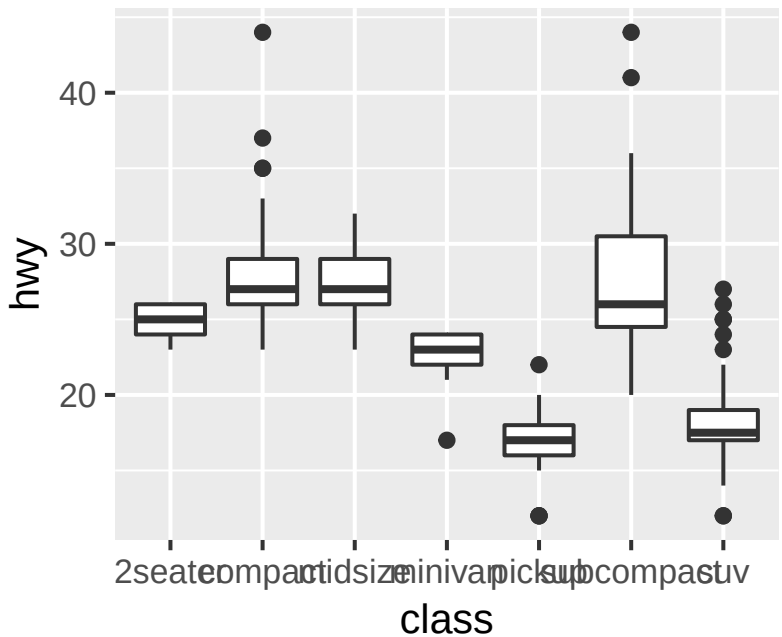



- `class`의 각각의 `displ_fac` 값에서의 분포?

# Boxplot

- x 변수는 이산 변수이고 x 변수의 각각의 값에 대해서 연속 변수인 y의 분포를 보기 위함.

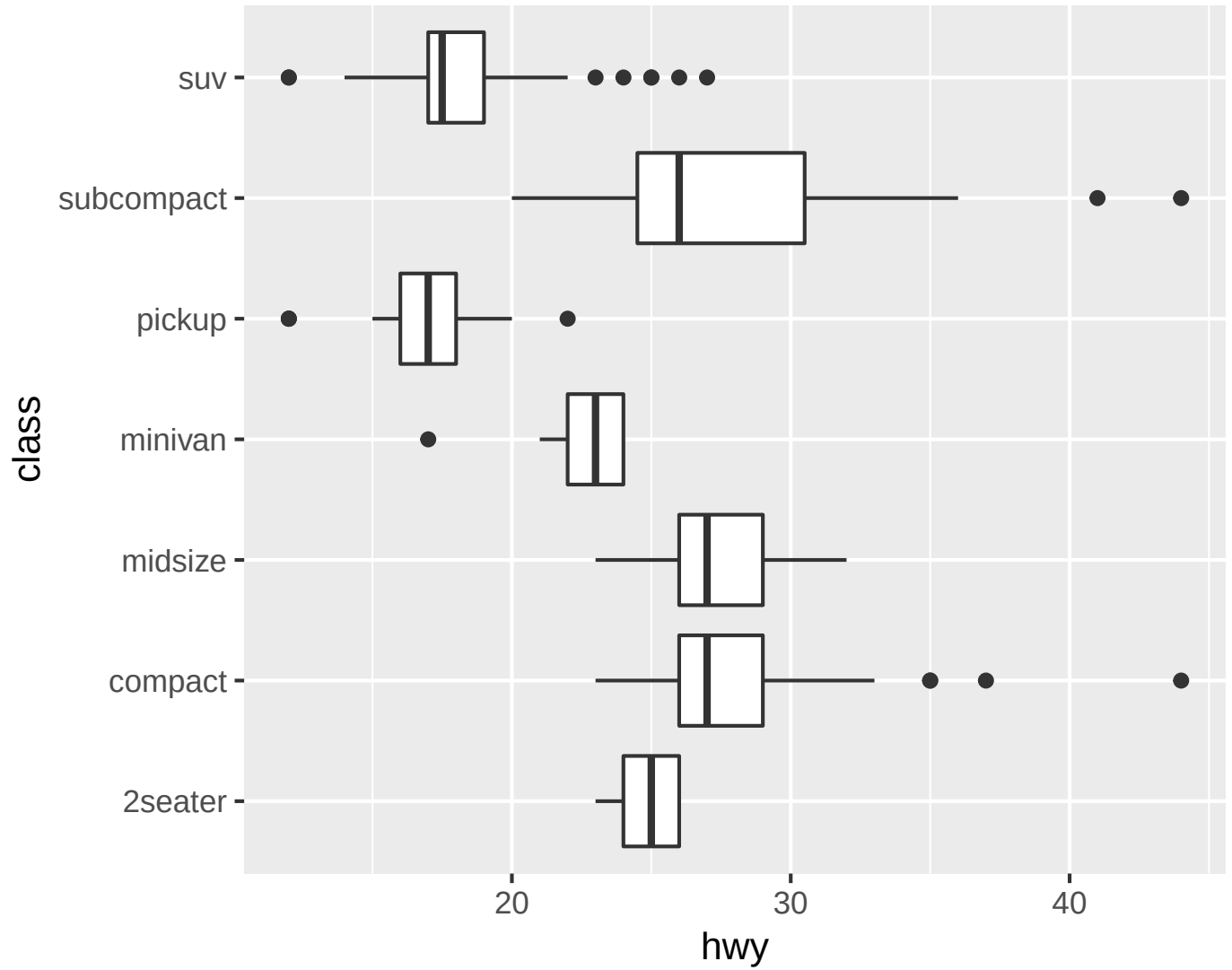
```
ggplot(mpg) +
  geom_boxplot(aes(x = class, y = hwy))
```




- 점으로 표현된 것은 이상치(outlier)로서 이상하게 높거나 낮은 값
- 꼬리의 각 끝은 상위/하위 10%의 값
- 박스의 상단은 상위 25%, 하단은 하위 25%
- 박스의 가운데 직선은 중간값
- x변수가 이산 변수이면서 `factor`라면, 변수의 값이 `character`라서 display가 복잡할 가능성이 높음
- 이럴때는?

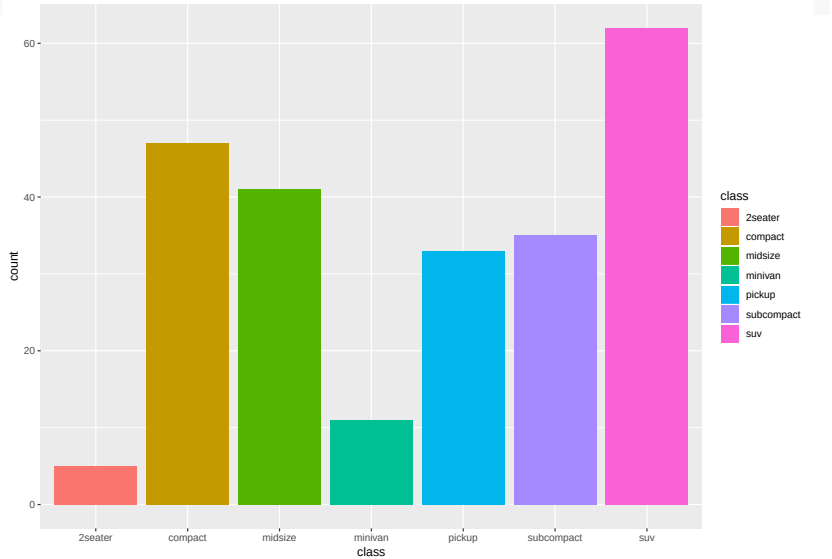
# Boxplot (coord_flip())

```
ggplot(mpg) +
  geom_boxplot(aes(x = class, y = hwy)) +
  coord_flip()
```

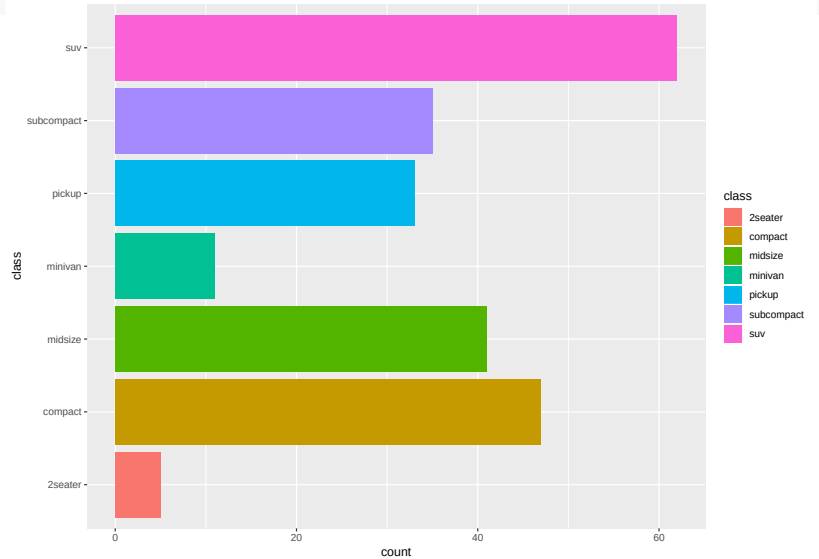


# Barplot (coord_flip())

```
ggplot(mpg, aes(x = class, fill = class)) +
  geom_bar()
```

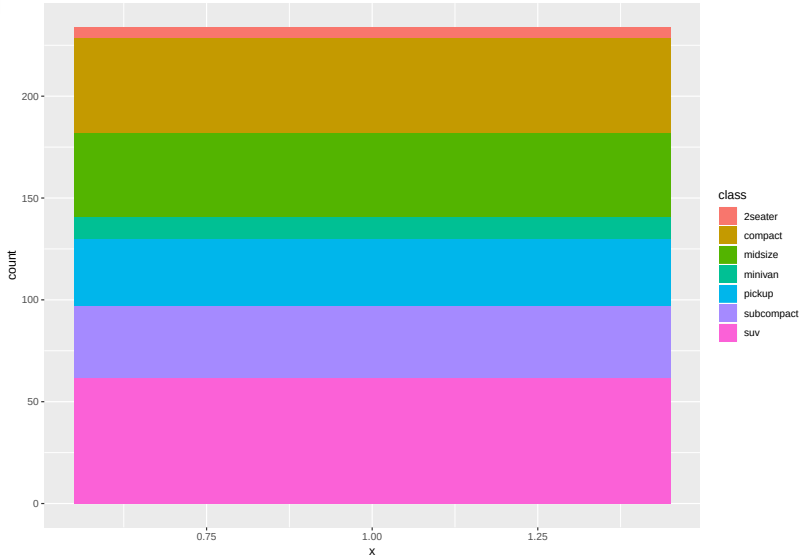



```
ggplot(mpg, aes(x = class, fill = class)) +
  geom_bar() + coord_flip()
```

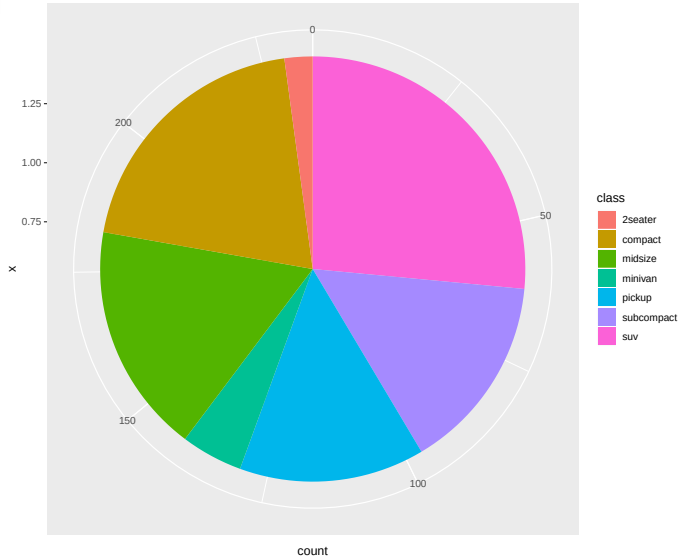


# Pie-chart (coord_polar())

```
ggplot(mpg, aes(x = 1, fill = class)) +
  geom_bar()
```

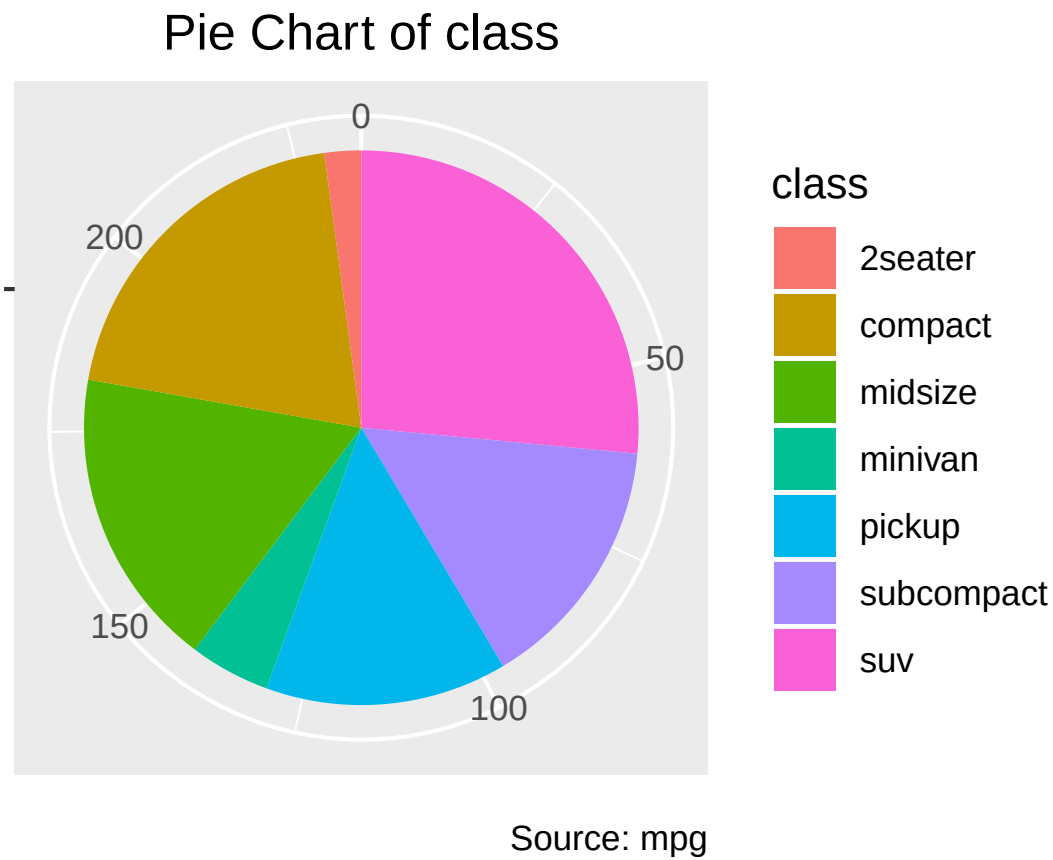



```
ggplot(mpg, aes(x = 1, fill = class)) +
  geom_bar() + coord_polar(theta = "y")
```



# Pie Chart (from M91-ggplot2-50examples.pdf)

```
ggplot(mpg, aes(x = "", fill = factor(class))) +
  geom_bar(width = 1) +
  theme(axis.line = element_blank(), plot.title = element_text(hjust=0.5)) +
  labs(fill = "class", x = NULL, y = NULL,
       title = "Pie Chart of class", caption = "Source: mpg") +
  coord_polar(theta = "y", start=0)
```



# ggplot 기타 기능 (저장 & plotly)

- ggplot객체를 png 파일로 저장

```
png("out_file.png")
ggplot(mpg) + geom_bar(aes(x=class)) +
  coord_flip()
dev.off()
```

- plotly - html에서 각종 추가 기능 제공

```
library(plotly)
a <- ggplot(mpg) + geom_bar(aes(x=class))
ggplotly(a)
```

# Part 1. Text 전처리 - tm, KONLP

# “I have a dream” - Martin Luther King, Jr.

## Nulla. Source packages

```
library(tm) # for text mining
library(SnowballC) # for text stemming
library(wordcloud) # word-cloud generator
library(wordcloud2) # word-cloud generator
library(RColorBrewer) # color palettes
library(ggplot2)
library(dplyr)
```

## I. Infile

```
# txt in web? no problem!
filePath <- paste0(
  "http://www.sthda.com/sthda/RDoc/",
  "example-files/martin-luther-king",
  "-i-have-a-dream-speech.txt")
text <- readLines(filePath)
docs <- Corpus(VectorSource(text))
inspect(docs)
```

```
## <<SimpleCorpus>>
## Metadata:  corpus specific: 1, document lev
## Content:  documents: 46
##
##  [1]
##  [2] And so even though we face the difficu
##  [3]
##  [4] I have a dream that one day this natio
##  [5]
##  [6] We hold these truths to be self-eviden
##  [7]
##  [8] I have a dream that one day on the red
##  [9]
## [10] I have a dream that one day even the s
## [11]
## [12] I have a dream that my four little chi
## [13]
```

## II. Cleanup text

```
toSpace <- content_transformer(
  function(x, pattern) gsub(pattern, " ", x))
docs <- docs %>%
  tm_map(toSpace, "/") %>%
  tm_map(toSpace, "@") %>%
  tm_map(toSpace, "\\|")
```

```
docs <- docs %>%
  tm_map(content_transformer(tolower)) %>%          # Convert it to lower case
  tm_map(removeNumbers) %>%                         # Remove numbers
  tm_map(removeWords, stopwords("english")) %>%     # Remove english common stopwords
  tm_map(removeWords, c("blabla1", "blabla2")) %>% # Remove your own stop word
  tm_map(removePunctuation) %>%                     # Remove punctuations
  tm_map(stripWhitespace)                           # Eliminate extra white spaces
```

```
inspect(docs)
```

```
## <<SimpleCorpus>>
## Metadata:  corpus specific: 1, document level (indexed): 0
## Content:  documents: 46
##
##  [1]
##  [2]  even though face difficulties today tomorrow still dream dream deeply rooted ameri
##  [3]
##  [4]  dream one day nation will rise live true meaning creed
##  [5]
##  [6]  hold truths selfevident men created equal
##  [7]
##  [8]  dream one day red hills georgia sons former slaves sons former slave owners will a
##  [9]
## [10]  dream one day even state mississippi state sweltering heat injustice sweltering he
```

## III. Generate FreqTable

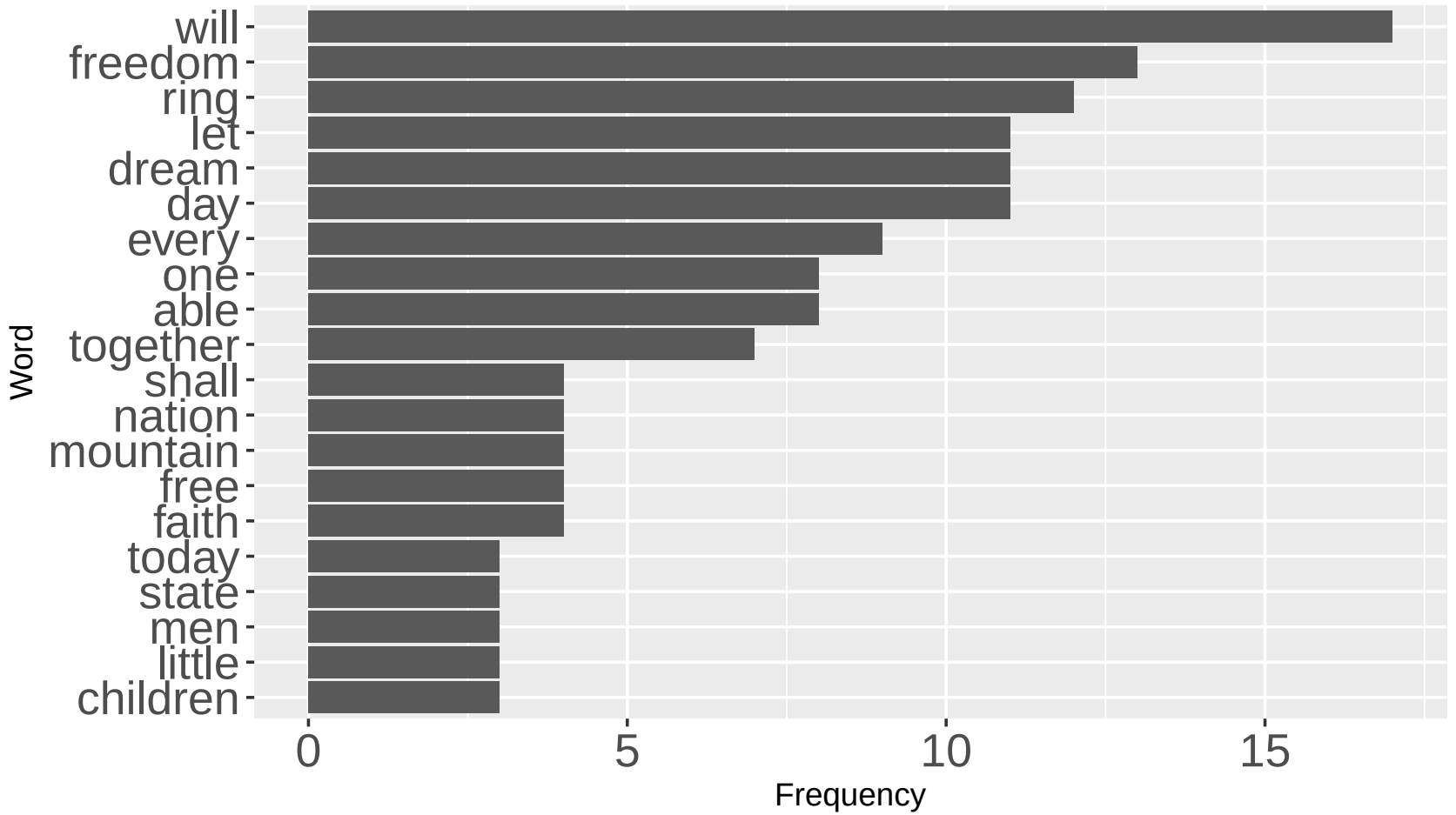
```
termMat   <- TermDocumentMatrix(docs)
termTable <- as.matrix(termMat)
freqTable <- data.frame(word = rownames(termTable),
                        freq = rowSums(termTable),
                        row.names = NULL)
freqTable <- freqTable %>% arrange(desc(freq))
```

```
freqTable %>% head()
```

```
##      word freq
## 1    will   17
## 2 freedom   13
## 3    ring   12
## 4   dream   11
## 5     day   11
## 6     let   11
```

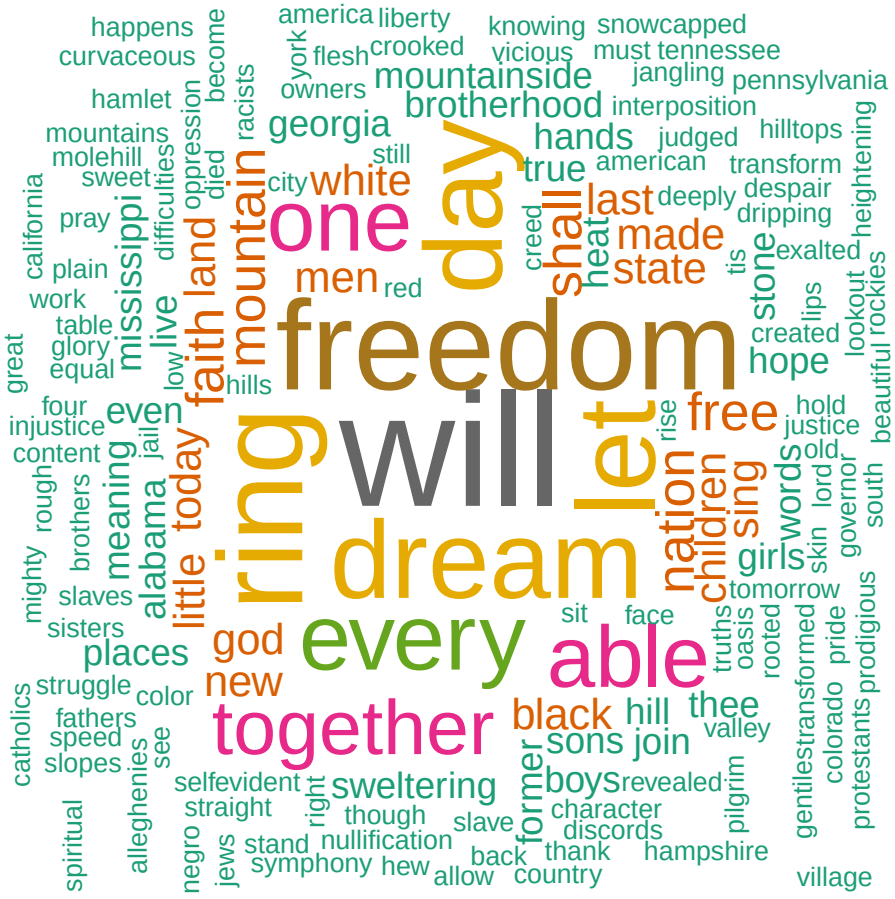
## IV. Render barplot

```
ggplot(data = head(freqTable, 20)) +
  geom_bar(aes(x = reorder(word, freq), y = freq), stat="identity") +
  coord_flip() +
  theme(axis.text = element_text(size = 16)) +
  labs(x = "Word", y = "Frequency")
```



## V. Render wordcloud

```
wordcloud(words = freqTable$word, freq = freqTable$freq,
          min.freq = 1, max.words=200, random.order=FALSE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"))
```




```
# for html, newer version is available!
# wordcloud2(freqTable, color = "random-light", backgroundColor = "grey")
```

# Summary

0. Source packages
1. Infile
2. Cleanup text
3. Generate **`FreqTable`**
4. Render barplot
5. Render wordcloud

- **Next step: `sonaki.pdf`**

## Nulla. Source packages

### i-have-a-dream.txt

```
library(tm) # for text mining
library(SnowballC) # for text stemming
library(wordcloud) # word-cloud generator
library(wordcloud2) # word-cloud generator
library(RColorBrewer) # color palettes
library(ggplot2)
library(dplyr)
```

### sonaki.pdf

```
library(tm) # for text mining
library(SnowballC) # for text stemming
library(wordcloud) # word-cloud generator
library(wordcloud2) # word-cloud generator
library(RColorBrewer) # color palettes
library(ggplot2)
library(dplyr)
```

```
library(KoNLP)
# Korean Natural Language Processing
library(pdftools)
# Extract text from pdf
```

## i-have-a-dream.txt

```
# txt in web? no problem!
filePath <- paste0(
  "http://www.sthda.com/sthda/RDoc/",
  "example-files/", "martin-luther-",
  "king-i-have-a-dream-speech.txt")
text <- readLines(filePath)
docs <- Corpus(VectorSource(text))
inspect(docs)
```

## sonaki.pdf

```
# local pdf
text <- pdf_text("../script/sonaki.pdf")
# Apply extract Noun
docs <- sapply(
  text, extractNoun, USE.NAMES = F)
docs <- unlist(docs)
# Character length >= 2
docs <- Filter(
  function(x) {nchar(x) >= 2}, docs)
```

head(docs): 소나기, 황순원, 소년, 개울가, 소녀, 증손녀(曾孫女)딸이라는

# II. Cleanup text

## i-have-a-dream.txt

```
toSpace <- content_transformer(
  function(x, pattern) gsub(pattern, " ", x))
docs <- docs %>%
  tm_map(toSpace, "/") %>%
  tm_map(toSpace, "@") %>%
  tm_map(toSpace, "\\|")
```

```
docs <- docs %>%
  # Convert it to lower case
  tm_map(content_transformer(tolower)) %>%
  # Remove numbers
  tm_map(removeNumbers) %>%
  # Remove english common stopwords
  tm_map(removeWords, stopwords("english")) %>%
  # Remove your own stop word
  tm_map(removeWords, c("blabla1", "blabla2")) %>%
  # Remove punctuations
  tm_map(removePunctuation) %>%
  # Eliminate extra white spaces
  tm_map(stripWhitespace)
```

## sonaki.pdf

```
# `extractNoun` already
# took care of...
```

## III. Generate 'FreqTable'

### i-have-a-dream.txt

```
termMat   <- TermDocumentMatrix(docs)
termTable <- as.matrix(termMat)
freqTable <-
  data.frame(word = rownames(termTable),
             freq = rowSums(termTable),
             row.names = NULL)
freqTable <- freqTable %>%
  arrange(desc(freq))
# head(freqTable)
```

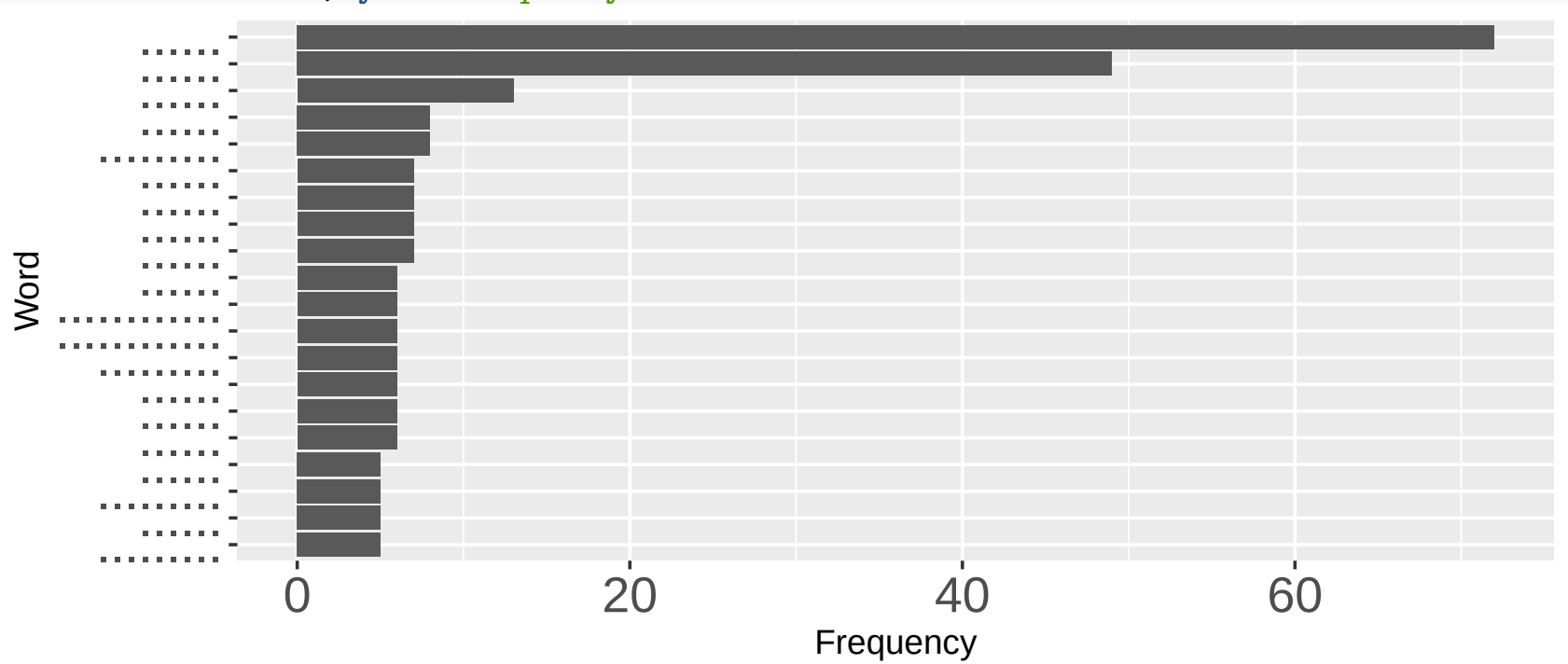
### sonaki.pdf

```
freqTable <- data.frame(table(docs))
names(freqTable) <- c("word", "freq")
freqTable <- freqTable %>%
  arrange(desc(freq))
# head(freqTable)
```

# IV. Render barplot

i-have-a-dream.txt
sonaki.pdf

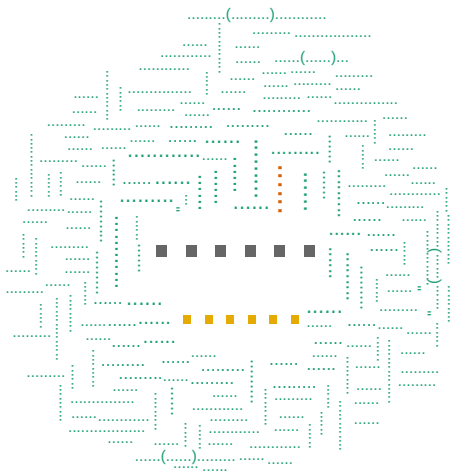
```
ggplot(data = head(freqTable, 20)) +
  geom_bar(aes(x = reorder(word, freq), y = freq), stat="identity") +
  coord_flip() +
  theme(axis.text = element_text(size = 16)) +
  labs(x = "Word", y = "Frequency")
```



# V. Render wordcloud

i-have-a-dream.txt
sonaki.pdf

```
wordcloud(words = freqTable$word, freq = freqTable$freq,
          min.freq = 1, max.words=200, random.order=FALSE, rot.per=0.35,
          colors=brewer.pal(8, "Dark2"))
```



# Summary

- txt vs pdf
- English vs Korean

# Part 3. 일반화 - Writing a function.

# function getDocs2

## 0. Source packages & 1. Infile

```
getDocs2 <- function(fileName) {
  # 0. Source packages
  activate("tm", "SnowballC", "wordcloud", "KoNLP", "pdftools")
  activate("ggplot2", "dplyr", "RColorBrewer", "cld3")
  # 1. Infile
  fileType <- unlist(strsplit(fileName, split = "\\.")) %>% tail(1)
  if (fileType == "pdf") {
    text <- pdf_text(fileName)
  } else if (fileType == "txt") {
    text <- readLines(fileName)
  } else {
    stop("We only support pdf and txt!") # defensive programming
  }
  isKO <- "ko" %in% detect_language(text)
  if (isKO) { # if Korean
    docs <- sapply(text, extractNoun, USE.NAMES = F) %>% unlist()
    docs <- Filter(function(x) {nchar(x) >= 2}, docs)
    attr(docs, "lang") <- "kr"
  } else { # if English
    docs <- Corpus(VectorSource(text))
    attr(docs, "lang") <- "en"
  }
  return(docs)
}
```

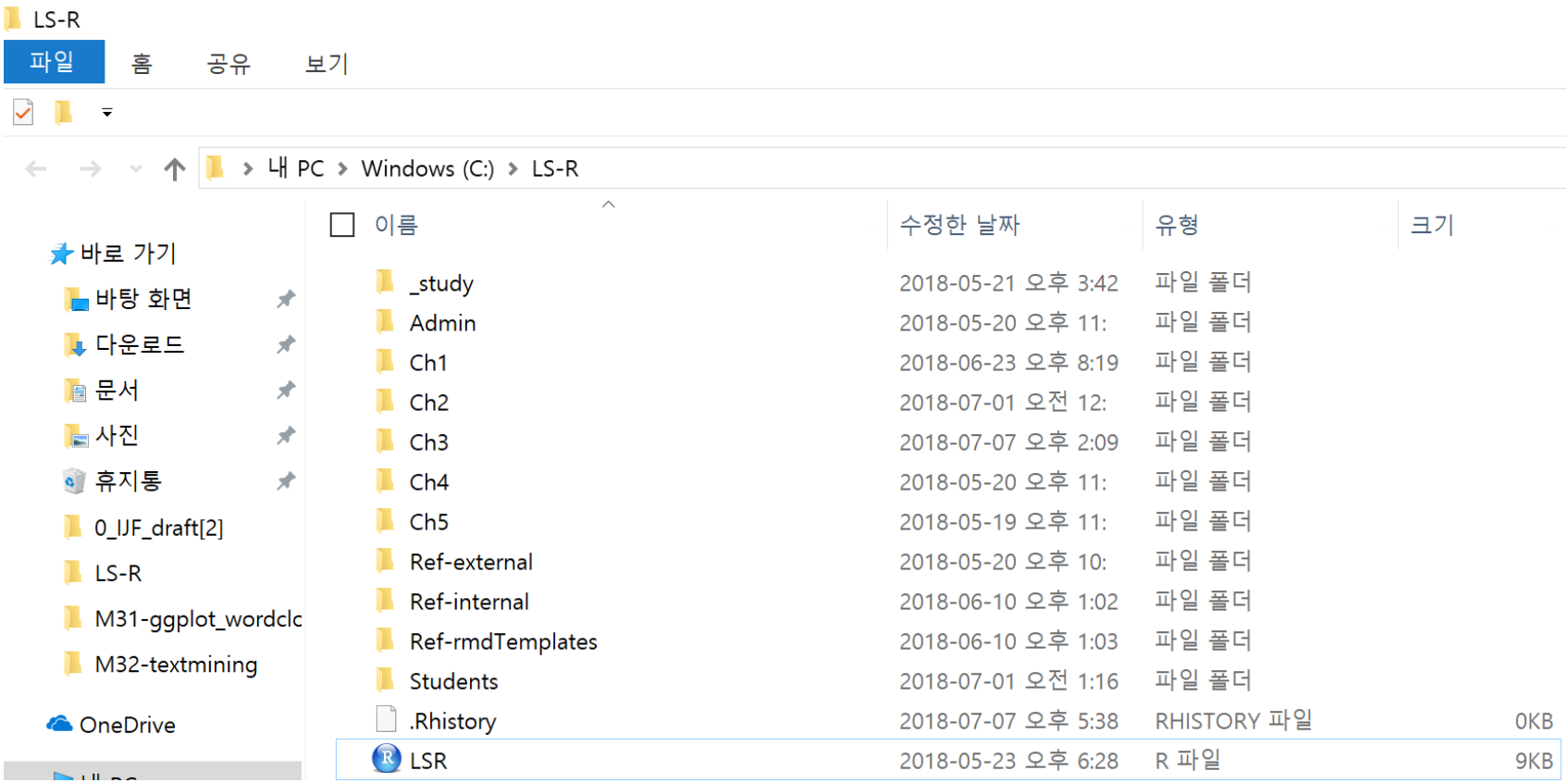
# function cleanDocsGenerateFreqTable

## 2. Cleanup text & 3. Generate FreqTable

```r
cleanDocsGenerateFreqTable <- function(docs, lang) {
  if (lang == "kr") {
    docs <- unlist(docs)
    docs <- Filter(function(x) {nchar(x) >= 2}, docs) # Character length >= 2
    freqTable <- data.frame(table(docs))
    names(freqTable) <- c("word", "freq")
    freqTable <- freqTable %>% arrange(desc(freq))
  } else { # lang == "en"
    toSpace <- content_transformer(function (x , pattern) gsub(pattern, " ", x))
    docs <- docs %>% tm_map(toSpace, "/") %>%
      tm_map(toSpace, "@") %>% tm_map(toSpace, "\\|")
    docs <- docs %>%
      tm_map(content_transformer(tolower)) %>%          # Convert it to lower case
      tm_map(removeNumbers) %>%                         # Remove numbers
      tm_map(removeWords, stopwords("english")) %>%     # Remove english common stopwords
      tm_map(removeWords, c("blabla1", "blabla2")) %>% # Remove your own stop word
      tm_map(removePunctuation) %>%                     # Remove punctuations
      tm_map(stripWhitespace)                           # Eliminate extra white spaces
    termMat   <- TermDocumentMatrix(docs)
    termTable <- as.matrix(termMat)
    freqTable <- data.frame(word = rownames(termTable), freq = rowSums(termTable))
    freqTable$word <- rownames(freqTable)
    freqTable <- freqTable %>% arrange(desc(freq))
  }
  return(freqTable)
}
```

# Source File 관리

- 위의 두 함수 `getDocs2`와 `cleanDocsGenerateFreqTable`를 `LSR.R`파일에 저장
- 다른 곳에서 `source("LSR.R")`을 한번 실행하면 함수가 메모리에 정의되어 있으므로 두 함수를 사용이 가능함
- 수업 중 프로그램 단위인 `MXX`의 폴더에서는 상위 폴더로 두 번 올라가면 `LSR.R`이 있으므로 `source("../../LSR.R")`은 경로로 실행



# activate - LSR.R내의 다른 function(1)

- 패키지가 인스톨 되어있지 않으면 인스톨 한후에,
- 패키지가 로드되어 있지 않다면 로드함.
- 주의. **shiny**에서는 실행하지 말 것

```
activate <- function(...) {
  # activate("dplyr")
  # activate("xts", "dygraphs")
  # activate(c("ggplot2", "ISLR"))
  packages <- unlist(list(...))
  for (i in 1:length(packages)) {
    package_i <- packages[i]
    if (!package_i %in% installed.packages()[,"Package"]) {
      print(paste("Installing", package_i))
      suppressMessages(install.packages(package_i))
    }
    suppressMessages(require(package_i, character.only = TRUE))
  }
}
```

# rndQuote - LSR.R내의 다른 function(2)

- **ranjith19**라는 github 사용자가 올려놓은 명언들 중에서
- 무작위로 몇개를 선택하여 돌려주는 함수
- 매일 자동 실행되는 프로그램에서 사용하기에 유용함

```
rndQuote <- function(n = 1) {
  # rndQuote() # 2018-05-09
  fileName <- paste0(
    "https://raw.githubusercontent.com/ranjith19/",
    "random-quotes-generator/master/quotes.txt")
  activate("readr")
  quotes <- read_file(fileName)
  quotes <- gsub("\n.\n", "zzzzzz", quotes)
  quotes <- unlist(strsplit(quotes, split="zzzzzz"))
  return(quotes[sample(length(quotes), n)])
}
```

```
cat(rndQuote(1))
```

```
## "All our knowledge merely helps us to die a more painful death
##  than animals that know nothing." -- Maurice Maeterlinck.
```

```
cat(rndQuote(1))
```

```
## "Hofstadter's Law: It always takes longer than you expect, even
##  when you take into account Hofstadter's Law."
```