# Data Structure

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References:

- http://r4ds.had.co.nz/
- MOOC: https://www.coursera.org/specializations/jhu-data-science

Report submission:

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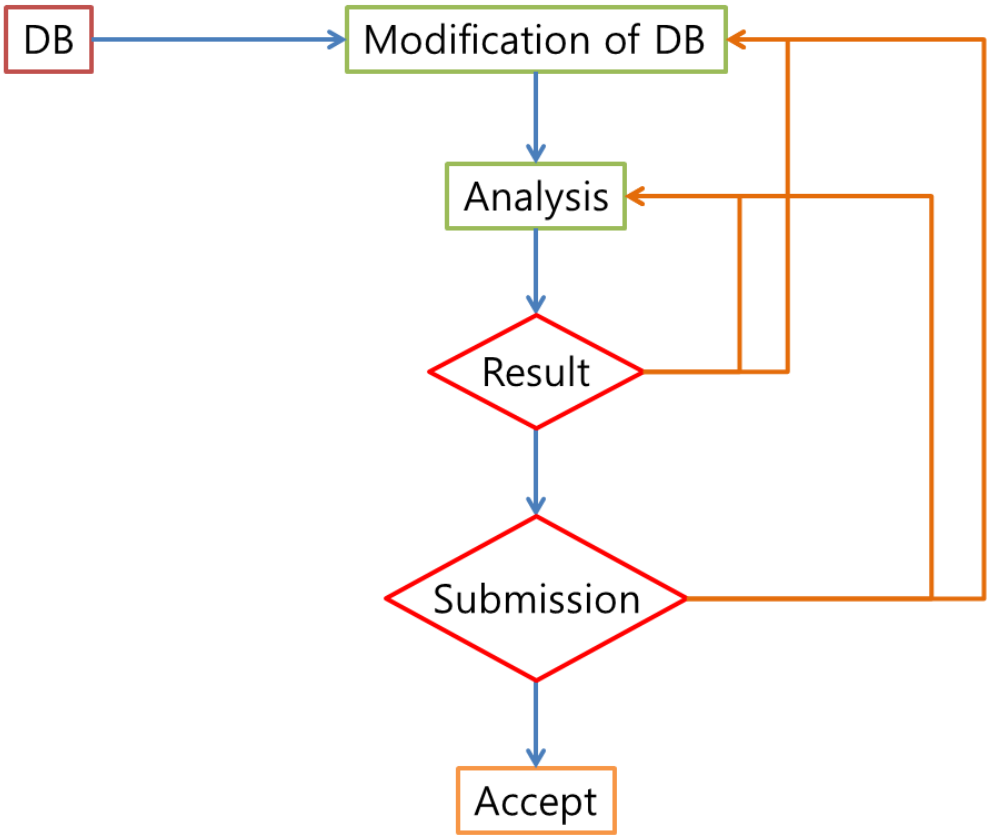
- Title: Student_ID, Name, Report_title

Lecture material: https://github.com/sbaram1/Presentation

No lecture: 4/5, 4/12

Supplementary lecture: 3/22, 3/29

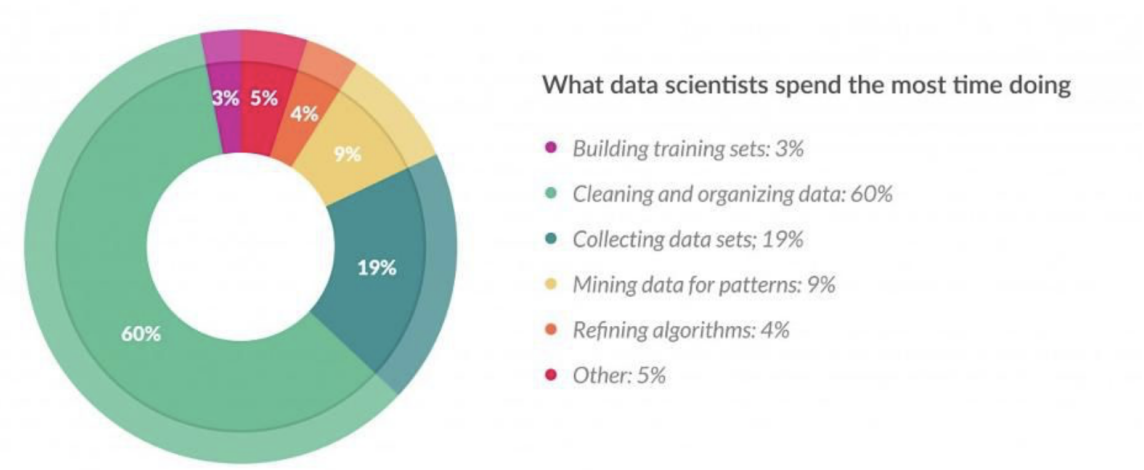
# Research Process



# Cleaning Big Data: Most Time-Consuming, Least Enjoyable Data Science Task, Survey Says

A new survey of data scientists found that they spend most of their time massaging rather than mining or modeling data. Still, most are happy with having the sexiest job of the 21st century. The survey of about 80 data scientists was conducted for the second year in a row by CrowdFlower, provider of a "data enrichment" platform for data scientists. Here are the highlights:

***Data preparation*** *accounts for about 80% of the work of data scientists*



```
# install.packages("dplyr")
# install.packages("magrittr")

library(dplyr)
```

# Data structure and importing DB

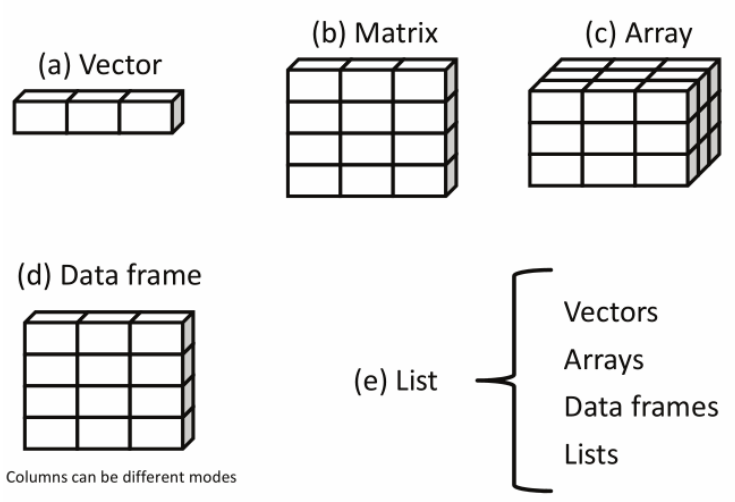
# Data Preparation for analysis

- Entering data from the keyboard

```
a <- c(1, 2, 3, 4, 5)
a
```

```
## [1] 1 2 3 4 5
```

# Data Structure




- Types
  - Logical
  - Integer
  - Numeric (Double)
  - Character

# Matrix

```
mat1 <- matrix(data=c(1:6), nr=3, nc=2)
mat1
```

```
##      [,1] [,2]
## [1,]    1    4
## [2,]    2    5
## [3,]    3    6
```

# Data frame

```
ID <- c(11:15)
Age <- c(32, 35, 45, 21, 58)
Sex <- c("M", "M", "F", "M", "F")
DB <- data.frame(ID, Age, Sex)
DB
```

```
##   ID Age Sex
## 1 11  32   M
## 2 12  35   M
## 3 13  45   F
## 4 14  21   M
## 5 15  58   F
```

# Data frame 2

```
DB[1,]
```

```
##   ID Age Sex
## 1 11  32   M
```

```
DB[,1]
```

```
## [1] 11 12 13 14 15
```

```
DB$ID
```

```
## [1] 11 12 13 14 15
```

```
str(DB)
```

```
## 'data.frame':    5 obs. of  3 variables:
##  $ ID : int  11 12 13 14 15
```

# Factor

```
a <- c(1, 2, 2, 1, 2, 1, 1, 1, 1, 2)
class(a)
```

```
## [1] "numeric"
```

```
b <- factor(a)
b
```

```
##  [1] 1 2 2 1 2 1 1 1 1 2
## Levels: 1 2
```

```
class(b)
```

```
## [1] "factor"
```

# Factor 2

```
?factor
```

```
b <- factor(a, levels=c(1, 2), labels=c("M", "F"))
b
```

```
##  [1] M F F M F M M M M F
## Levels: M F
```

```
# back_to_a <- as.numeric(as.character(b))
# droplevels()
```

# Exercise 1

- Make a numeric vector
  - What is the 3rd element?
- Make a 3x3 matrix
  - What is in the 3rd row and column?
- make vector b (1, 2, 3, 7, 8)
  - turn b into factor b
  - turn b into numeric vector b again
- Make a data frame
  - variable name: ID, age, sex
  - number of rows: 5
  - sex should be factor
  - Display the content of ID

# Managing data frame

# Read Data file

- Importing DB files
  - CSV file (comma separated values)
  - SPSS file (read.spss() in foreign package, spss.get() in Hmisc package, read_sav in heven package)
  - MS-EXCEL file

```
# Check Working directory
# getwd()
DB1 <- read.csv("db/VitDdb_example.csv", sep=",", header=TRUE)

#install.packages("Hmisc")
# library(Hmisc)
# DB2 <- spss.get("db/VitDdb_example.sav", use.value.labels=TRUE)
# library(haven)
# VitDdb_example <- read_sav("~/Dropbox/RBook/ERC_KSS_R_lecture/2nd_20180209/db/VitDdb_example.sav")
```

# Change the name of variable

```
names(DB1)
```

```
##  [1] "Age"                "Gender_F"           "TOAST.classification"
##  [4] "NIHSS.admission"    "mRS.admission"      "WBC"
##  [7] "Hemoglobin"         "hsCRP"              "FBS"
## [10] "T.Chol"             "HDL"                "LDL"
## [13] "TG"                 "VitD"
```

```
names(DB1)[4] <- c("NIHSS")
names(DB1)[which(names(DB1) == "mRS.admission")] <- c("Prev_mRS")
DB1 <- rename(DB1, TOAST = TOAST.classification)
# DB1 <- rename(DB1, NHISS = NIHSS.admission, Prev_mRS = mRS.admission,
#                    TOAST = TOAST.classification)
```

# Look at TOAST

- set "Undetermined" as reference

```
DB1$TOAST
```

```
##   [1] CE           Undetermined TIA          Undetermined
##   [5] LAA          CE           LAA          Undetermined
##   [9] TIA          Undetermined TIA          TIA
##  [13] LAA          SVO          LAA          LAA
##  [17] LAA          LAA          TIA          CE
##  [21] SVO          CE           LAA          LAA
##  [25] Undetermined TIA          LAA          CE
##  [29] LAA          LAA          TIA          LAA
##  [33] TIA          CE           CE           TIA
##  [37] CE           TIA          SVO          CE
##  [41] TIA          Undetermined LAA          Undetermined
##  [45] LAA          SVO          LAA          CE
##  [49] LAA          SVO          SVO          CE
##  [53] LAA          CE           LAA          LAA
##  [57] Undetermined LAA          TIA          LAA
##  [61] Undetermined TIA          LAA          LAA
```

# Change reference of a factor

```
levels(DB1$TOAST)
```

```
## [1] "CE"              "LAA"             "Other determined"
## [4] "SVO"             "TIA"             "Undetermined"
```

```
# library(magrittr)

DB1$TOAST <- factor(DB1$TOAST) %>% relevel(ref = "Undetermined")
# DB1$TOAST <- relevel(DB1$TOAST, ref = "Undetermined")

levels(DB1$TOAST)
```

```
## [1] "Undetermined"    "CE"              "LAA"
## [4] "Other determined" "SVO"             "TIA"
```

# Making new variable

- New variable: SVO vs. non-SVO

```
DB1$TOAST
```

```
##   [1] CE           Undetermined TIA          Undetermined
##   [5] LAA          CE           LAA          Undetermined
##   [9] TIA          Undetermined TIA          TIA
##  [13] LAA          SVO          LAA          LAA
##  [17] LAA          LAA          TIA          CE
##  [21] SVO          CE           LAA          LAA
##  [25] Undetermined TIA          LAA          CE
##  [29] LAA          LAA          TIA          LAA
##  [33] TIA          CE           CE           TIA
##  [37] CE           TIA          SVO          CE
##  [41] TIA          Undetermined LAA          Undetermined
##  [45] LAA          SVO          LAA          CE
##  [49] LAA          SVO          SVO          CE
##  [53] LAA          CE           LAA          LAA
##  [57] Undetermined LAA          TIA          LAA
##  [61] Undetermined TIA          LAA          LAA
```

```
DB1$SVO <- ifelse(DB1$TOAST == "SVO", 1, 0) %>%
              factor(levels=c(0, 1), labels=c("SVO(-)", "SVO(+)"))
DB1$SVO
```

```
##   [1] SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
##  [11] SVO(-) SVO(-) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
##  [21] SVO(+) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
##  [31] SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(+) SVO(-)
##  [41] SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(+)
##  [51] SVO(+) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
##  [61] SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(+)
##  [71] SVO(-) SVO(-) SVO(+) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(+) SVO(-)
##  [81] SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-)
##  [91] SVO(-) SVO(-) SVO(+) SVO(-) SVO(-) SVO(+) SVO(+) SVO(-) SVO(-) SVO(-)
## [101] SVO(+) SVO(-) SVO(-) SVO(+) SVO(+) SVO(+) SVO(-) SVO(-) SVO(-) SVO(-)
## [111] SVO(-) SVO(-) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(+) SVO(-) SVO(-)
## [121] SVO(-) SVO(-) SVO(-) SVO(+) SVO(+) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-)
## [131] SVO(+) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
## [141] SVO(-) SVO(-) SVO(+) SVO(-) SVO(-) SVO(+) SVO(-) SVO(+) SVO(-) SVO(+)
## [151] SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
## [161] SVO(-) SVO(-) SVO(-) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
## [171] SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
## [181] SVO(+) SVO(-) SVO(-) SVO(-) SVO(+) SVO(-) SVO(-) SVO(-) SVO(-) SVO(-)
```

```
table(DB1$TOAST, DB1$SVO)
```

```
##
##                   SVO(-) SVO(+)
##   Undetermined       121      0
##   CE                 202      0
##   LAA                186      0
##   Other determined    16      0
##   SVO                  0    148
##   TIA                 86      0
```

# Making Stroke subset

```
summary(DB1$TOAST)
```

```
##      Undetermined                CE               LAA Other determined
##               121               202               186                16
##               SVO               TIA
##               148                86
```

# Using subset function

```
subset(DB1, TOAST != "TIA") %>% nrow()
```

```
## [1] 673
```

```
subset(DB1, TOAST == "TIA") %>% nrow()
```

```
## [1] 86
```

```
nrow(DB1)
```

```
## [1] 759
```

# Exercise 2

- Use your own DB
  - Disply the summary of DB
  - Display the names of variables
  - Change variable name
  - Make a factor and change reference value
  - Make a new variable
  - Make a subset
- You can use data(mtcars)