

# Tidyverse tutorial 2 - More advanced operations

Ariane Ducellier

10/05/2023

Load R packages.

```
library(httr)
library(jsonlite)
library(mice)
```

```
##
## Attaching package: 'mice'

## The following object is masked from 'package:stats':
##
##   filter

## The following objects are masked from 'package:base':
##
##   cbind, rbind
```

```
library(rvest)
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.3      v readr      2.1.4
## v forcats    1.0.0      v stringr    1.5.0
## v ggplot2    3.4.3      v tibble     3.2.1
## v lubridate  1.9.3      v tidyr      1.3.0
## v purrr      1.0.2
```

```
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter()      masks mice::filter(), stats::filter()
## x purrr::flatten()     masks jsonlite::flatten()
## x readr::guess_encoding() masks rvest::guess_encoding()
## x dplyr::lag()          masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

## 1. Dealing with missing data

```
header <- c("age", "workclass", "fnlwgt", "education",
            "education_num", "marital_status", "occupation",
            "relationship", "race", "sex", "capital_gain",
            "capital_loss", "hours_per_week", "native_country", "target")
df <- read_csv("https://archive.ics.uci.edu/ml/machine-learning-databases/adult/adult.data",
              col_names=header, trim_ws=TRUE)
```

```
## Rows: 32561 Columns: 15
```

```
## -- Column specification -----
```

```
## Delimiter: ","
## chr (9): workclass, education, marital_status, occupation, relationship, rac...
## dbl (6): age, fnlwgt, education_num, capital_gain, capital_loss, hours_per_week
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.

df <- df %>%
  mutate(workclass = na_if(workclass, "?"),
         occupation = na_if(occupation, "?"),
         native_country = na_if(native_country, "?"))
```

### 1.1 Filling values with previous value

```
df_fill1 <- df %>%
  fill(workclass, occupation, native_country, .direction="down")
```

### 1.2 Filling values with most frequent value

For categorical variables.

```
m_freq_workcls <- names(table(df$workclass))[which.max(table(df$workclass))]
m_freq_occup <- names(table(df$occupation))[which.max(table(df$occupation))]
df_fill2 <- df %>%
  replace_na(list(workclass = m_freq_workcls,
                 occupation = m_freq_occup))
```

### 1.3 Dropping rows with missing values

Dropping rows with at least one missing value.

```
df_no_na <- df %>% na.omit()
```

Dropping rows with missing values for specific columns.

```
df_native <- df %>%
  drop_na(native_country)
```

### 1.4 Imputing with mice

```
data("txhousing")
txhousing$date <- date_decimal(txhousing$date, tz="GMT")
txhousing$city <- as.factor(txhousing$city)

idx <- which(rowSums(is.na(txhousing)) == 5)
txhousing <- txhousing[-idx,]
```

Impute median value for sales, volume and median.

```
txhousing$sales[is.na(txhousing$sales)] <- median(txhousing$sales, na.rm=TRUE)
txhousing$volume[is.na(txhousing$volume)] <- median(txhousing$volume, na.rm=TRUE)
txhousing$median[is.na(txhousing$median)] <- median(txhousing$median, na.rm=TRUE)
```

Use mice to impute listings and inventory.

```
impute <- mice(data.frame(txhousing[,7:8]), seed=123)
```

```
##
## iter imp variable
## 1 1 listings inventory
## 1 2 listings inventory
## 1 3 listings inventory
## 1 4 listings inventory
## 1 5 listings inventory
## 2 1 listings inventory
## 2 2 listings inventory
## 2 3 listings inventory
## 2 4 listings inventory
## 2 5 listings inventory
## 3 1 listings inventory
## 3 2 listings inventory
## 3 3 listings inventory
## 3 4 listings inventory
## 3 5 listings inventory
## 4 1 listings inventory
## 4 2 listings inventory
## 4 3 listings inventory
## 4 4 listings inventory
## 4 5 listings inventory
## 5 1 listings inventory
## 5 2 listings inventory
## 5 3 listings inventory
## 5 4 listings inventory
## 5 5 listings inventory
```

```
impute_data <- complete(impute, 1)
txhousing_clean <- txhousing %>%
  mutate(listings = impute_data[,1],
         inventory = impute_data[,2])
```

## 1.5 Implicit missing values

The price for the 1st quarter of 2021 is missing, but you won't see it just looking for the rows with NA.

```
stocks <- tibble(
  year = c(2020, 2020, 2020, 2020, 2021, 2021, 2021),
  qtr = c(1, 2, 3, 4, 2, 3, 4),
  price = c(1.88, 0.59, 0.35, NA, 0.92, 0.17, 2.66)
)
```

It becomes obvious when you pivot to a wider table, but then you no longer have tidy data.

```
stocks %>%
  pivot_wider(
    names_from = qtr,
    values_from = price
  )
```

```
## # A tibble: 2 x 5
##   year `1` `2` `3` `4`
##   <dbl> <dbl> <dbl> <dbl> <dbl>
## 1 2020 1.88 0.59 0.35 NA
## 2 2021 NA 0.92 0.17 2.66
```

the complete function will fill your tidy dataset with the missing rows and NA for the missing value:

```
stocks %>% complete(year, qtr)
```

```
## # A tibble: 8 x 3
##   year    qtr price
##   <dbl> <dbl> <dbl>
## 1 2020     1  1.88
## 2 2020     2  0.59
## 3 2020     3  0.35
## 4 2020     4  NA
## 5 2021     1  NA
## 6 2021     2  0.92
## 7 2021     3  0.17
## 8 2021     4  2.66
```

## 2. Getting data from the web

- Go to the Wiki page.
- Right-click and select Inspect.
- Find the piece of code that highlights the table.
- Right-click and select Copy > XPath.

```
page <- "https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)"
gdp <- rvest::read_html(page)
```

Get the first paragraph.

```
p1 <- gdp %>%
  html_elements("p") %>%
  html_text()
p1[3]
```

```
## [1] "Gross domestic product (GDP) is the market value of all final goods and services from a nation"
```

Get the table.

```
gdp_df <- gdp %>%
  html_elements(xpath = '//*[@id="mw-content-text"]/div[1]/table[2]') %>%
  html_table() %>%
  .[[1]]
```

## 3. Getting data from an API

The base URL is: [https://api.fiscaldata.treasury.gov/services/api/fiscal\\_service](https://api.fiscaldata.treasury.gov/services/api/fiscal_service)

The end point is: `/v1/accounting/mts/mts_table_1`

Gathering both gives you data in the JSON format.

```
url <- "https://api.fiscaldata.treasury.gov/services/api/fiscal_service/v1/accounting/mts/mts_table_1"
treasury_api <- GET(url)
```

```
result <- content(treasury_api, "text", encoding="UTF-8")
df_json <- fromJSON(result, flatten=TRUE)
df <- as.data.frame(df_json$data)
```

## 4. Miscellaneous functions

To apply the same function to all the columns in the data set:

```
mtcars %>%  
  select(hp, wt) %>% map(mean)
```

```
## $hp  
## [1] 146.6875  
##  
## $wt  
## [1] 3.21725
```

To combine data sets by rows:

```
A <- mtcars[1:3, ]  
B <- mtcars[4:6, ]  
AB <- A %>% bind_rows(B)
```

To combine data sets by columns:

```
A <- mtcars[1:5, 1:3]  
B <- mtcars[1:5, 4:6]  
AB <- A %>% bind_cols(B)
```

Another way of creating a new column with a condition. It allows handling multiple cases of logical tests.

```
mtcars %>%  
  mutate(transmission_type =  
    case_when(  
      am == 0 ~ "automatic",  
      am == 1 ~ "manual"))
```

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
## Mazda RX4	21.0	6	160.0	110	3.90	2.620	16.46	0	1	4	4
## Mazda RX4 Wag	21.0	6	160.0	110	3.90	2.875	17.02	0	1	4	4
## Datsun 710	22.8	4	108.0	93	3.85	2.320	18.61	1	1	4	1
## Hornet 4 Drive	21.4	6	258.0	110	3.08	3.215	19.44	1	0	3	1
## Hornet Sportabout	18.7	8	360.0	175	3.15	3.440	17.02	0	0	3	2
## Valiant	18.1	6	225.0	105	2.76	3.460	20.22	1	0	3	1
## Duster 360	14.3	8	360.0	245	3.21	3.570	15.84	0	0	3	4
## Merc 240D	24.4	4	146.7	62	3.69	3.190	20.00	1	0	4	2
## Merc 230	22.8	4	140.8	95	3.92	3.150	22.90	1	0	4	2
## Merc 280	19.2	6	167.6	123	3.92	3.440	18.30	1	0	4	4
## Merc 280C	17.8	6	167.6	123	3.92	3.440	18.90	1	0	4	4
## Merc 450SE	16.4	8	275.8	180	3.07	4.070	17.40	0	0	3	3
## Merc 450SL	17.3	8	275.8	180	3.07	3.730	17.60	0	0	3	3
## Merc 450SLC	15.2	8	275.8	180	3.07	3.780	18.00	0	0	3	3
## Cadillac Fleetwood	10.4	8	472.0	205	2.93	5.250	17.98	0	0	3	4
## Lincoln Continental	10.4	8	460.0	215	3.00	5.424	17.82	0	0	3	4
## Chrysler Imperial	14.7	8	440.0	230	3.23	5.345	17.42	0	0	3	4
## Fiat 128	32.4	4	78.7	66	4.08	2.200	19.47	1	1	4	1
## Honda Civic	30.4	4	75.7	52	4.93	1.615	18.52	1	1	4	2
## Toyota Corolla	33.9	4	71.1	65	4.22	1.835	19.90	1	1	4	1
## Toyota Corona	21.5	4	120.1	97	3.70	2.465	20.01	1	0	3	1
## Dodge Challenger	15.5	8	318.0	150	2.76	3.520	16.87	0	0	3	2
## AMC Javelin	15.2	8	304.0	150	3.15	3.435	17.30	0	0	3	2
## Camaro Z28	13.3	8	350.0	245	3.73	3.840	15.41	0	0	3	4

## Pontiac Firebird	19.2	8	400.0	175	3.08	3.845	17.05	0	0	3	2
## Fiat X1-9	27.3	4	79.0	66	4.08	1.935	18.90	1	1	4	1
## Porsche 914-2	26.0	4	120.3	91	4.43	2.140	16.70	0	1	5	2
## Lotus Europa	30.4	4	95.1	113	3.77	1.513	16.90	1	1	5	2
## Ford Pantera L	15.8	8	351.0	264	4.22	3.170	14.50	0	1	5	4
## Ferrari Dino	19.7	6	145.0	175	3.62	2.770	15.50	0	1	5	6
## Maserati Bora	15.0	8	301.0	335	3.54	3.570	14.60	0	1	5	8
## Volvo 142E	21.4	4	121.0	109	4.11	2.780	18.60	1	1	4	2
##	transmission_type										
## Mazda RX4										manual	
## Mazda RX4 Wag										manual	
## Datsun 710										manual	
## Hornet 4 Drive										automatic	
## Hornet Sportabout										automatic	
## Valiant										automatic	
## Duster 360										automatic	
## Merc 240D										automatic	
## Merc 230										automatic	
## Merc 280										automatic	
## Merc 280C										automatic	
## Merc 450SE										automatic	
## Merc 450SL										automatic	
## Merc 450SLC										automatic	
## Cadillac Fleetwood										automatic	
## Lincoln Continental										automatic	
## Chrysler Imperial										automatic	
## Fiat 128										manual	
## Honda Civic										manual	
## Toyota Corolla										manual	
## Toyota Corona										automatic	
## Dodge Challenger										automatic	
## AMC Javelin										automatic	
## Camaro Z28										automatic	
## Pontiac Firebird										automatic	
## Fiat X1-9										manual	
## Porsche 914-2										manual	
## Lotus Europa										manual	
## Ford Pantera L										manual	
## Ferrari Dino										manual	
## Maserati Bora										manual	
## Volvo 142E										manual	