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An Introduction to Web Scraping

Coffee and Coding

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To start…

- Who knows what web scraping is?
- Who has used it before?
- What is the main thing you want to learn today?
- This is an introduction to show what is possible and where to look for more guidance

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In this C&C talk

1. What is web scraping
2. When is web scraping useful
3. Legal implications
4. How web scraping works
5. Useful R packages
6. Example 1 – Simple HTML table
7. Example 2 – The Book Store

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What is web scraping?

"Web scraping, web harvesting, or web data extraction is data scraping used for extracting data from websites."

Boeing & Waddell 2016

Two types of online data

- Structured data files ("easy" web scraping)
  - Plain-text data (e.g. csv) stored at secure or non-secure URLs
  - Data stored in a database with a well structured API (Application Programming Interface)
  - URL is all you need, multiple datasets are saved with defined URLs → looped downloads possible
- Not as well structure information ("difficult" web scraping)
  - Html tables
  - Text on websites
  - Information requiring navigation of web forms
  - Information needs to be identified: Either by html "node" (best way) or by string pattern (if nodes are not an option)

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When web scraping can be useful

- A lot of useful data is stored on webpages in unstructured format. We all have used the simplest form of web scraping – copy-pasting – but for more complex tasks, automation saves time and is more efficient.
- Certain data can be collected from the web and processed without spending too much resources – both time-wise and financially.

- Principles of reproducibility apply:
  - Fully document your web scraping
  - Find (inevitable) mistakes
  - Easy to re-run or update if webpage content changes
  - Can apply scraping methods to other webpages

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Legal implications

- Web scraping can put strain on the servers of a website and can cause issues for the provider
- Check the terms of service of a website before scraping
- Think about the use of the data (exploratory vs business)
- Some webpages will block access after a certain amount of website requests within a short amount of time (e.g. Google)

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How it works

- Web pages are coded in order to correctly display in browser
- Most common coding language is the “Hypertext Markup Language” (HTML)
- Text is “marked up” in html via the use of “tags” (e.g. formatted in **bold**)
- Querying the html code for those tags lets us find and extract the needed information
- Easiest way to explorer the html code of a webpage is the “Inspect” element in browsers (“right click” → “View page source”, or “Ctrl+U” in Chrome)

Tags (pink)

Tag attributes (blue)

Marked up text (black)

```
43
44
45
46      </head>
47
48      <body id="default" class="default">
49
50
51
52
53          <header class="header container-fluid">
54              <div class="page_inner">
55                  <div class="row">
56                      <div class="col-sm-8 h1"><a href="index.html">Books to Scrape</a><small> We lov
57  </div>
58
59
60                  </div>
61              </div>
62          </header>
63
64
65
66  <div class="container-fluid page">
67      <div class="page_inner">
68
69          <ul class="breadcrumb">
70              <li>
71                  <a href="index.html">Home</a>
72              </li>
73              <li class="active">All products</li>
74          </ul>
75
76              <div class="row">
```

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Web scraping in R with rvest

- **rvest** is a package for easy scraping (or “harvesting”) of data from webpages

- Main **rvest** functions:
  - **read_html()**: converts a website into an xml object
  - **html_node()**: extracts relevant “nodes” from an xml object, with an argument either for
    - Tags (e.g. “body”); or
    - Classes (e.g. “.header container-fluid”, the “.” signifies that the argument is a class)
  - **html_text()**: extracts the data from the selected nodes
  - **html_attrs()**: extracts the data from attributes (in case one is after the attribute and not the text)

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Key steps

1. Look at the HTML for the webpage you want to scrape (e.g. use Inspect Element in Chrome).
2. Request a URL with **rvest::read_html()**.
3. Extract the specific content nodes from the request with **rvest::html_nodes()**.
4. Convert the nodes to your desired R object type.
5. Clean the data.

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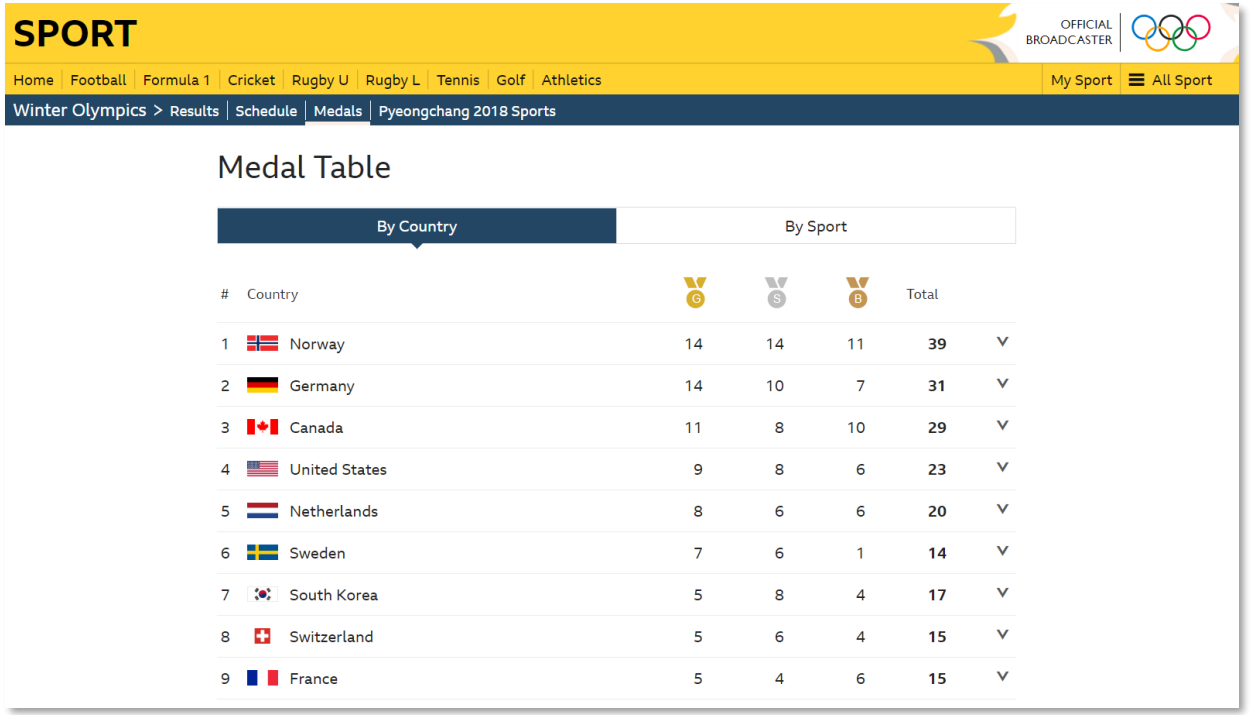
Example 1 – HTML table

https://www.bbc.co.uk/sport/winter-olympics/medals/countries

```
library(tidyverse)
library(rvest)

URL <- paste0("https://www.bbc.co.uk/sport/winter-olympics",
        "/medals/countries")

medals_table <- URL %>% read_html() %>%
                html_nodes('medals-table__table') %>%
                html_table() %>%
                as.data.frame
```


SPORT

OFFICIAL BROADCASTER

Home | Football | Formula 1 | Cricket | Rugby U | Rugby L | Tennis | Golf | Athletics | My Sport | All Sport

Winter Olympics > Results | Schedule | Medals | Pyeongchang 2018 Sports

Medal Table

By Country | By Sport

#	Country	G	S	B	Total
1	Norway	14	14	11	39
2	Germany	14	10	7	31
3	Canada	11	8	10	29
4	United States	9	8	6	23
5	Netherlands	8	6	6	20
6	Sweden	7	6	1	14
7	South Korea	5	8	4	17
8	Switzerland	5	6	4	15
9	France	5	4	6	15

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Example 2 – The Book Store

- Have a look at http://books.toscrape.com/ and investigate the page and the page source
- Open up the “R script - web scraping example 2” file on github if you want to run the code alongside

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Relevant coding areas

- Tidy data
  - Web scraped data might not come in a tidy format and might have to be converted
  - See **dplyr** package
- Character encoding
  - Some html text might be in latin1 and needs recoding to UTF-8 with the **iconv** function
- Stringr and regular expressions
  - For identifying and manipulating strings
  - See **stringr** package
- Functions
  - For structuring more complex web scraping and to keep the code modular and easy to test and improve

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References and further sources

- **Rstudio blogpost on rvest package (2014)**
  - Good introduction into main functionality (how to work with html code in R)
  - Link: https://blog.rstudio.com/2014/11/24/rvest-easy-web-scraping-with-r/
- **Free data camp tutorial on web scraping (2018)**
  - Useful overview over the process of identifying the location of information and how to loop the harvest process over a collection of pages
  - Detailed usage of functions → Crucial when building one's own custom built process
  - Link: https://www.datacamp.com/community/tutorials/r-web-scraping-rvest
- **Regular expressions training materials**
  - https://stackoverflow.com/questions/4736/learning-regular-expressions/2759417#2759417
  - https://regexone.com/
- **Digital Methods Initiative at Amsterdam University (2019)**
  - Internet studies research group
  - Useful collection of web scraping tools (many work as standalone tools)
  - Link: https://wiki.digitalmethods.net/Dmi/ToolDatabase

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Time for Memes

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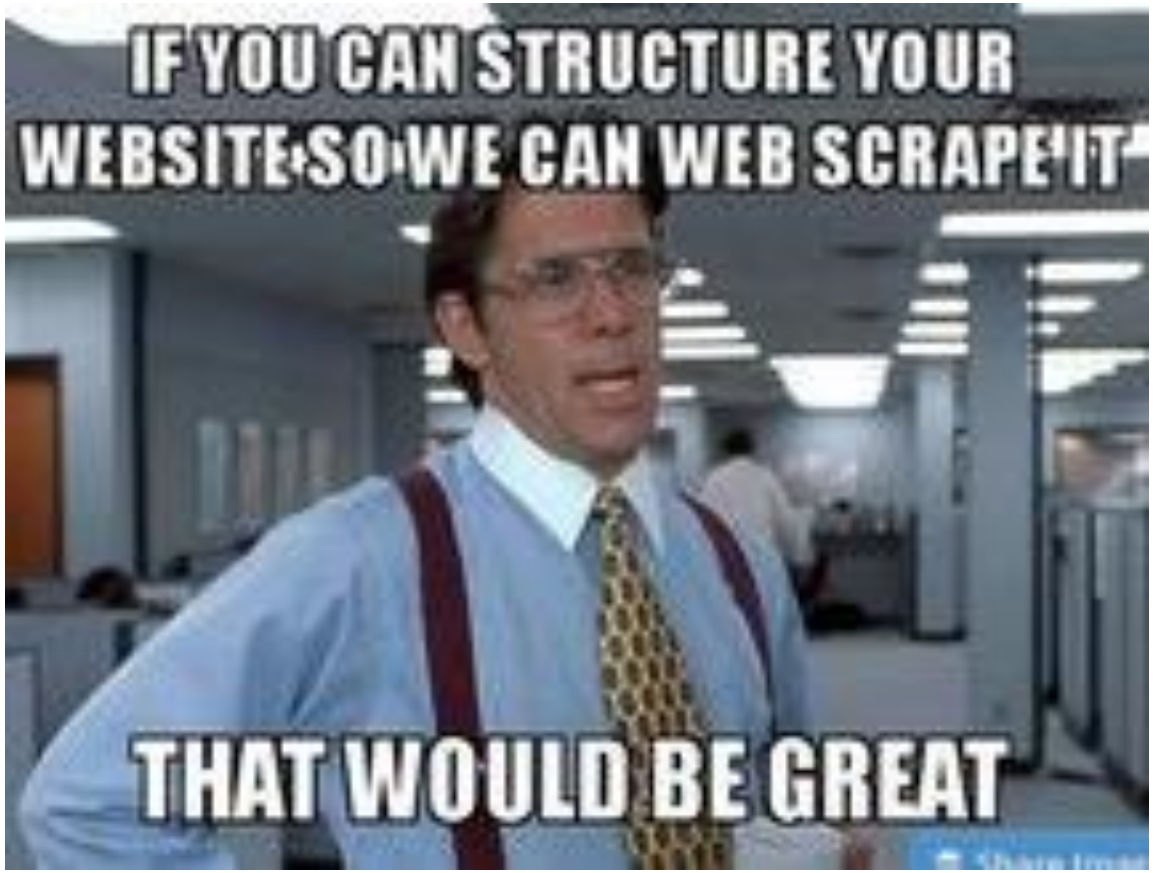

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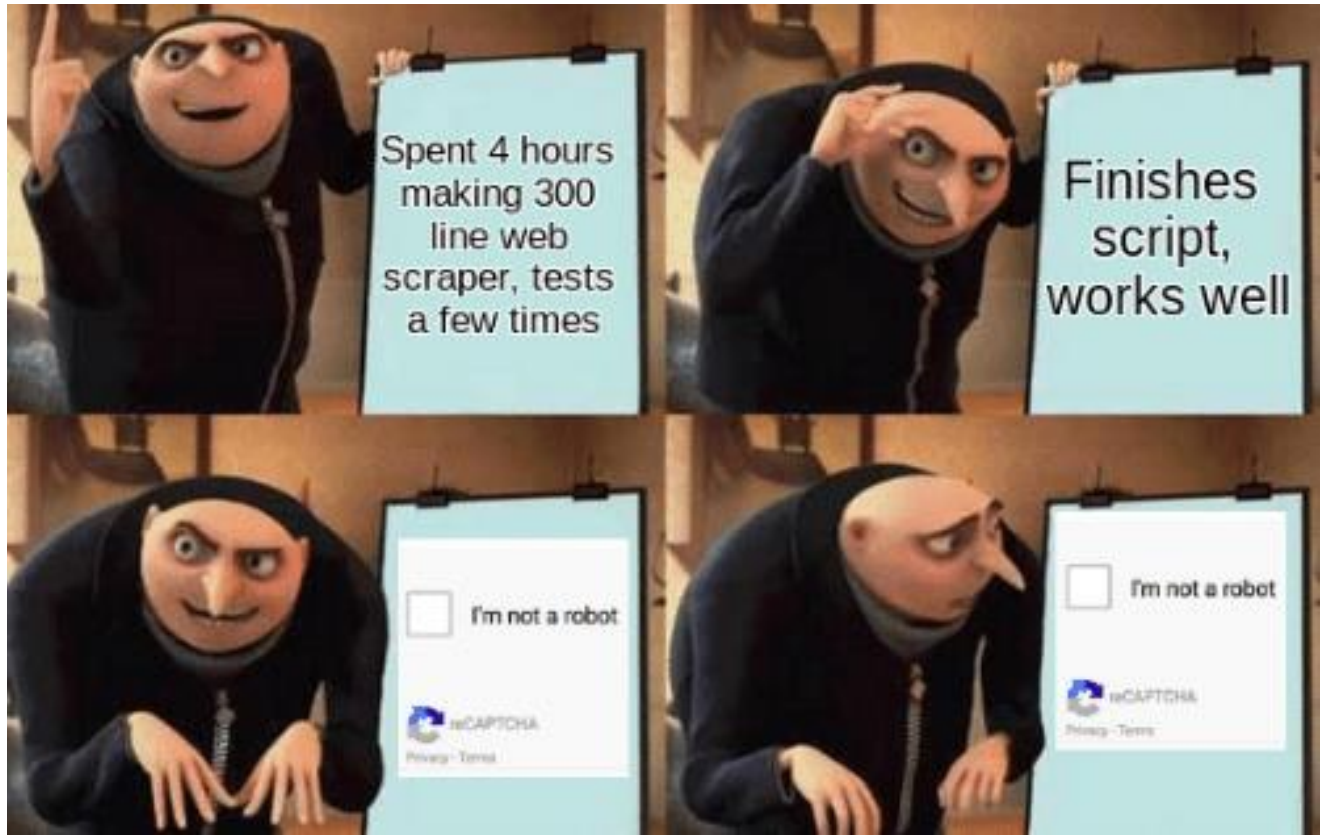

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Thank you