

A Primer to Web Scraping with R

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Introduction and Organizational Matters



First: ask questions! No matter what...



"Excuse me, but is this The
Society for Asking Stupid
Questions?"

Workshop outline

Time	Topic
08:30 a.m. - 10:15 a.m.	Introduction, setup, and overview
10.30 a.m. - 12.30 a.m.	Scraping static webpages with <code>rvest</code>
02.00 p.m. - 03.15 p.m.	Scraping with <code>RSelenium</code> ; good practice
03.30 p.m. - 05.00 p.m.	Tapping APIs

Goals

After attending this course, ...

- you have a fundamental overview of what's possible with R in terms of collecting data from the Web
- you are able to scrape information from static and dynamic websites using R
- you are able to access web services (APIs) with R

Goals

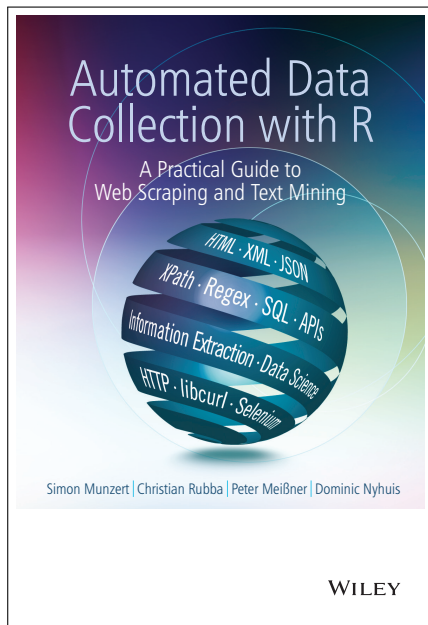
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→ the focus here is on **practical issues of web scraping**; see the **handout** to get an overview of the **technical background** of web architecture!

The accompanying book

- contains most of which I tell you during the workshop (but much more, and presumably more accurate)
- written between 2012 and 2014 → not entirely up-to-date anymore, more on that later
- homepage with materials: www.r-datacollection.com
- manuscript you have is a modified excerpt



Web scraping. What? Why?

Web scraping

A.k.a. screen scraping, crawling, web harvesting; computer-aided collection of predominantly unstructured data (e.g., from HTML code)

The World Wide Web is full of various kinds of new data, e.g.:

- open government data
- search engine data
- services that track social behavior

Practical arguments

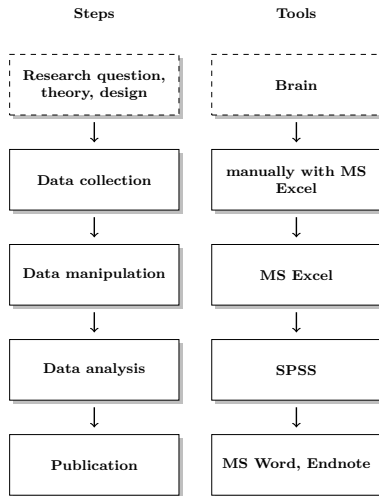
- financial resources are sparse
- ... and so is our time
- reproducibility

Why R?

- free
- open source
- large community
- powerful tools for statistical analysis
- powerful tools for visualization
- flexible in processing all kinds of data/languages
- useful in every step of the workflow

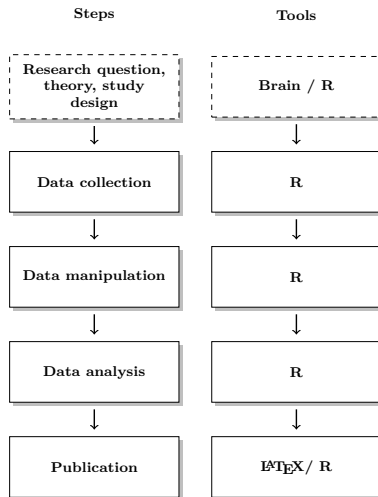
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R tools



Technical Setup

Please go to the following page now:

<https://github.com/simonmunzert/rscraping-jsm-2016>

AJAX and Selenium



What's AJAX?

- HTML/HTTP are used for static display of content
- in order to display dynamic content, they lack
 1. mechanisms to detect user behavior in the browser (and not only on the server)
 2. a scripting engine that reacts on this behavior
 3. a mechanism for asynchronous queries
- **A**synchronous **J**avaScript **a**nd **X**ML' is a set of technologies that serve these purposes
- massively used in modern webpage design and architecture
- makes classical screen scraping more difficult

Example: <https://twitter.com/POTUS>

JavaScript

What's JavaScript?

- Programming language that connects well to web technologies
- W3C web standard
- native browser support
- extensible by many libraries
- *jQuery* library for DOM manipulation

JavaScript on the Web

How's JavaScript code embedded in HTML?

- between `<script>` tags
- as an external reference in the `src` attribute of a `<script>` element
- directly in certain HTML attributes ('event handler')

JavaScript on the Web

DOM manipulation with JavaScript

- adding/removing HTML elements
- changing attributes
- modification of CSS styles
- ...

Example:

```
1 <script type="text/javascript" src="jquery-1.8.0.min.js"></script>  
2 <script type="text/javascript" src="script1.js"></script>
```

Example

<http://www.r-datacollection.com/materials/ajax/>

Selenium

The problem reconsidered

- dynamic data requests are not stored in the static HTML page
- therefore, we cannot access them with classical methods and packages (`rvest`, `download.file()`, etc.)

The solution

- initiate and control a web browser session with R
- let the browser do the JavaScript interpretation work and the manipulations in the live DOM tree
- access information from the web browser session

Selenium

What's Selenium?

- <http://www.seleniumhq.org>
- free software environment for automated web application testing
- several modules for different tasks; most important for our purposes: Selenium WebDriver
- Selenium WebDriver starts a server instance (as proxy) and passes commands (posed in R in our case) to the browser
- automated browsing via scripts

Good Practice



Is web scraping legal?

- no unambiguous **yes** or **no** in any country according to current jurisdiction
- so far, court cases (especially in the US) often (but not always) dealt with commercial interest and often (but not always) huge masses of data
 - eBay vs. Bidder's Edge
 - AP vs. Meltwater
 - Facebook vs. Pete Warden
 - United States vs. Aaron Swartz

A (not very useful) recommendation for your work

1. you take all the responsibility for your web scraping work
2. take all copyrights of a country's jurisdiction into account
3. if you publish data, do not commit copyright fraud
4. if in doubt, ask the author/creator/provider of data for permission—if your interest is entirely scientific, chances aren't bad that you get data
5. consult current jurisdiction, e.g. on <http://blawgsearch.justia.com> or from a lawyer specialized on internet law

robots.txt

What's robots.txt?

- 'Robots Exclusion Protocol', informal protocol to prohibit web robots from crawling content
- located in the root directory of a website, e.g., <http://www.google.com/robots.txt>)
- documents which bot is allowed to crawl which resources (and which not)
- not a technical barrier, but a sign that asks for compliance

Examples:

- [Google](#)
- [NYTimes](#)

Syntax in robots.txt

Syntax

- not an official W3C standard, partly inconsistent syntax
- rules listed bot by bot
- general, bot-independent rules under '*' (most interesting entry for R-based crawlers)
- directories/folders listed separately

```
1 User-agent: Googlebot
2 Disallow: /images/
3 Disallow: /private/
```

```
1 User-agent: *
2 Disallow: /private/
```

Syntax in robots.txt

Universal ban

```
1 User-agent: *  
2 Disallow: /
```

Separation of bots by empty line

```
1 User-agent: Googlebot  
2 Disallow: /images/  
  
4 User-agent: Slurp  
5 Disallow: /images/
```

Allow declaration

```
1 User-agent: *  
2 Disallow: /images/  
3 Allow: /images/public/
```

Syntax in robots.txt

Crawl-delay (in seconds)

```
1 User-agent: *  
2 Crawl-delay: 2  
3 User-Agent: Googlebot  
4 Disallow: /search/
```

Robots <meta> tag

```
1 <meta name="robots" content="noindex,nofollow" />
```

How to deal with `robots.txt`?

- not clear if `robots.txt` is legally binding or not, and if yes for which activities
- originally not thought of as protection against small-scale web scraping applications, but against large-scale indexing bots
- guide to a webmaster's preferences with regards to visibility of content
- my advice: take `robots.txt` into account! If the data you are interested in are excluded from crawling: contact webmaster
- for crawling purposes: have a look at the new CRAN package `robotstxt`

Scraping etiquette

