POIR 613: Measurement Models and Statistical Computing

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Scraping the web

Scraping the web: what?

An increasing amount of data is available on the web:

- Speeches, sentences, biographical information...
- Social media data, newspaper articles, press releases...
- Geographic information, conflict data...

These datasets are often provided in an unstructured format.

Web scraping is the process of extracting this information automatically and transforming it into a structured dataset.

Scraping the web: why?

- Copy & pasting is time-consuming, boring, prone to errors, and impractical for large datasets
- In contrast, automated web scraping:
 - 1. Scales well for large datasets
 - 2. Is reproducible
 - 3. Involved adaptable techniques
 - 4. Facilitates detecting and fixing errors
- When to scrape?
 - 1. Trade-off between your time today and your time in the future. Invest in your future self!
 - 2. Computer time is cheap; human time is expensive

Scraping the web: two approaches

Two different approaches:

- 1. Screen scraping: extract data from source code of website, with html parser and/or regular expressions
 - rvest package in R
- 2. Web APIs (application programming interfaces): a set of structured http requests that return JSON or XML data
 - httr package to construct API requests
 - Packages specific to each API: weatherData, WDI, Rfacebook... Check CRAN Task View on Web Technologies and Services for examples
 - More on APIs later this semester

The rules of the game

- 1. Respect the hosting site's wishes:
 - Check if an API exists or if data are available for download
 - Keep in mind where data comes from and give credit (and respect copyright if you want to republish the data!)
 - Some websites disallow scrapers on robots.txt file
- 2. Limit your bandwidth use:
 - Wait one or two seconds after each hit
 - Scrape only what you need, and just once (e.g. store the html file in disk, and then parse it)
- 3. When using APIs, read documentation
 - Is there a batch download option?
 - Are there any rate limits?
 - Can you share the data?

The art of web scraping

Workflow:

- 1. Learn about structure of website
- 2. Choose your strategy
- 3. Build prototype code: extract, prepare, validate
- 4. Generalize: functions, loops, debugging
- 5. Data cleaning

1. Data in table format



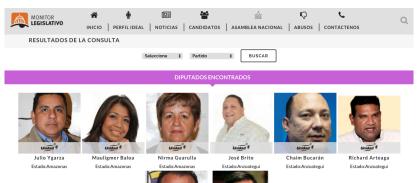
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|---|-----------|-----------------|-----------------------------------|
| International Court of Justice | Global | 1945-present | General disputes |
| International Criminal Court | Global | 2002-present | Criminal prosecutions |
| Permanent Court of International Justice | Global | 1922-1946 | General disputes |
| Appellate Body | Global | 1995-present | Trade disputes within the WTO |
| International Tribunal for the Law of the Sea | Global | 1994-present | Maritime disputes |
| African Court of Justice | Africa | 2009-present | Interpretation of AU treaties |
| African Court on Human and Peoples' Rights | Africa | 2006-present | Human rights |
| COMESA Court of Justice | Africa | 1998-present | Trade disputes within COMESA |
| ECOWAS Community Court of Justice | Africa | 1996-present | Interpretation of ECOWAS treaties |
| East African Court of Justice | Africa | 2001-present | Interpretation of EAC treaties |
| SADC Tribunal | Africa | 2005-2012 | Interpretation of SADC treaties |
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2. Data in unstructured format

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| Corruption due | to vague rules | | | | INSPIRE | OTHERS | | |
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| Reported on January 16 | | | | | Manik Taneja | a, a sports er | thusiast, | |
| At Chembur near Eastern Expressway traffic cop stopped me and started checking docsall was fine buy puc expiredthen he pointed out film He tookRead more | | | | | st a custom o com, for cou s official at E | gh up a hefty bribe | | |
| Things to Know on Traffic Offences and Respective Penalties | | | SEE HIS | | | | | |
| 🛞 I PAID A BRIBE 🕘 | | | | | Contraction of the local division of the loc | | and the second second | |
| Bribe collected | by Staff of Enro | llment agen | cy | | FT Ever Pair | d A Bribe? | | |
| Municipal Services 1 Aadhaar or UID Related 1 Paid INR 120 | | | Report your Bribe Story! | | | | | |
| Reported on January 16, 2016 from Mysore , Karnataka I Report #89467 | | | | | | | | |
| UIDAI has to take a stand on fees to be paid to enrolment agencies for processing Adhaar | | | | See action taken. | | | | |

www.ipaidabribe.com/reports/paid

3. Data hidden behind web forms



Candidates on 2015 Venezuelan parliamentary election

- 1. Data in table format
 - Automatic extraction with rvest
- 2. Data in unstructured format
 - Element identification with selectorGadget
 - Automatic extraction with rvest
- 3. Data hidden behind web forms
 - Automation of web browser behavior with selenium

HTML: a primer

Hypertext Markup Language (HTML): hidden standard behind every website.

- HTML is text with marked-up structure, defined by tags:

```
<h1>My First Heading</h1>
```

```
My first paragraph.
```

```
</body>
</html>
```

 What you see in your browser is an interpretation of the HTML document

HTML: a primer

- Some common tags:
 - Document elements: <head>, <body>, <footer>...
 - Document components: <title>,<h1>, <div>...
 - Text style: , <i>, ...
 - Hyperlinks: <a>
- An example: www.pablobarbera.com

Beyond HTML

Cascading Style Sheets (CSS): describes formatting of HTML components (e.g. <h1>, <div>...), useful for us!



 Javascript: adds functionalities to the website (e.g. change content/structure after website has been loaded)

Parsing HTML code

First step in webscraping: read HTML code in R and parse it

- Parsing = understanding structure
- How? rvest package in R:
 - read_html: parse HTML code into R
 - html_text: extract text from HTML code
 - html_table: extract tables in HTML code
 - html_nodes: extract components with CSS selector
 - html_attrs: extract attributes of nodes
- How to identify relevant CSS selectors? selectorGadget extension for Chrome and Firefox.