Introduction to Computational Tools and Techniques in Social Science

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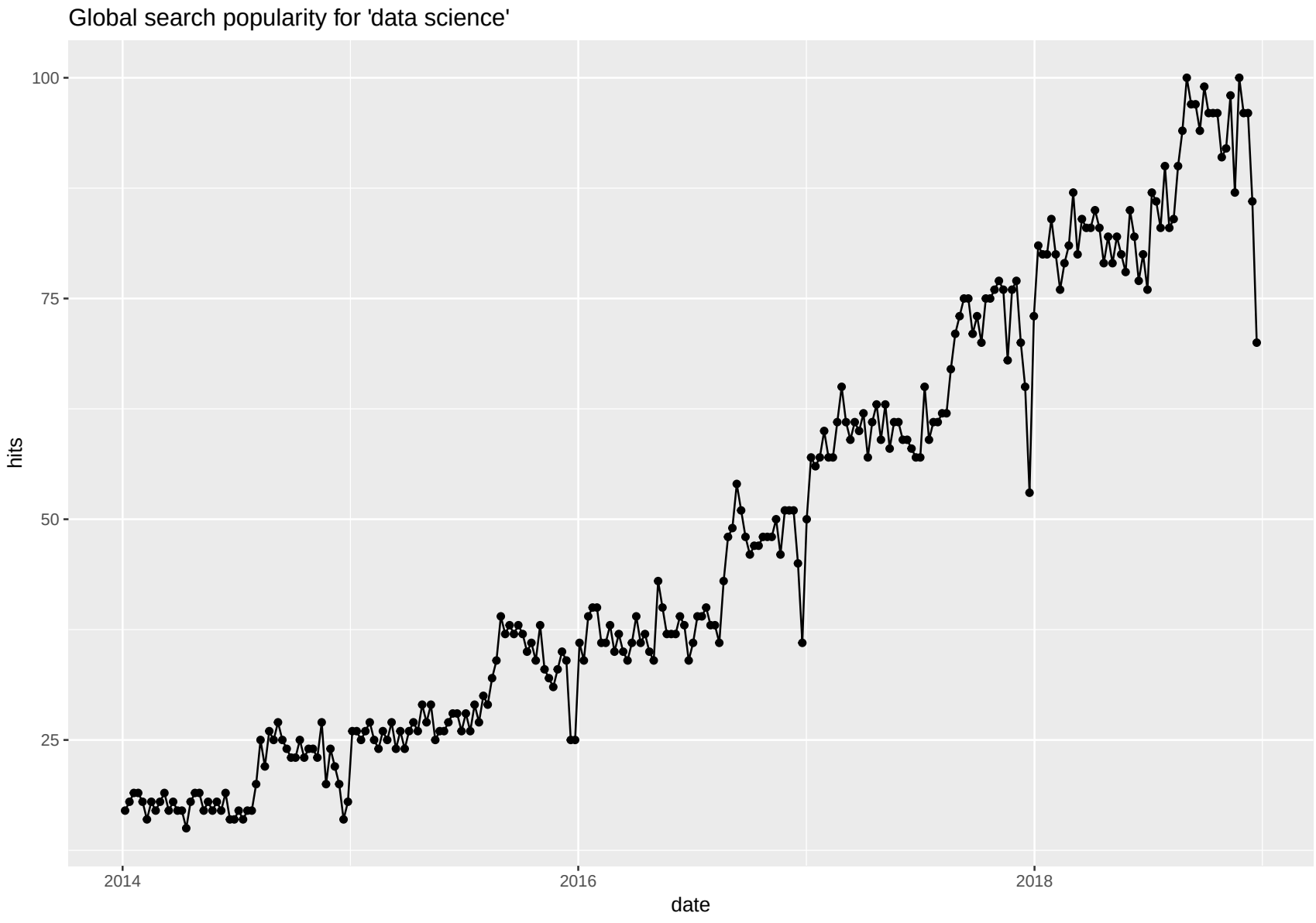
Motivation


Global search popularity for 'data science'
100
75
50
25
hits
2014
2016
2018
date

- Why should we care?
- Yes, big data (or data science, or machine learning) is a trend.
- But computational tools and techniques are much broader and fundamental to how we work:
  - Data collection (e.g., APIs, webscraping)
  - Analysis (e.g., text analysis, machine learning)
  - Visualization (e.g., maps, social networks)

- For things you've done, computational tools and techniques can help you do these tasks better with much less time and efforts. For a researcher, learning computational tools is very much like eating more nutritious foods or doing regular workouts.
- For things you've never done, computational tools and techniques can open a new window of opportunities. For example, think about web scraping, or machine learning.

- Using Excel:
  - 3 mins for copying, pasting, and reorganizing one article
  - 80,000 newspaper articles
  - Taking **4,000** hours or **166 days**

- Using python:
  - A few hours for coding
  - Less than 5 mins for creating the dataset
  - Also, the code is reusable.

In [1]:

```
def parsing_proquest(x):

    # load libs

    from bs4 import BeautifulSoup

    import re

    # load file
    soup = BeautifulSoup(open(x,"r"), 'html.parser')

    # filter by strong tag
    doc = soup('strong')

    # save filtered results to new objects

    doc.text = soup.findAll(text=re.compile('Full text:'))
    doc.date = soup.findAll(text=re.compile('Publication year:'))
    doc.source = soup.findAll(text=re.compile('Publication date:'))
    doc.author = soup.findAll(text=re.compile('Publication info:'))
```

- Yet it takes some **efforts** to take advantages of these new tools.
  - You need to learn how to code **a little bit**.
  - However, learning on your own is inefficient.
  - More important, you can get **bad** habits.

- The following examples are adapted from https://style.tidyverse.org

```
# Good
fit_models.R

if (y < 0 && debug) {
  message("y is negative")
}

# Bad
fit models.R

if (y < 0 && debug)
message("Y is negative")
```

```
# Good
do_something_very_complicated(
  something = "that",
  requires = many,
  arguments = "some of which may be long"
)

# Bad
do_something_very_complicated("that", requires, many, argu
                              "some of which may be long"
                              )
```

- Three commandments
  - Thou shall comment.
  - Thou shall reuse functions (no copy and paste).
  - Thou shall practice version control (no final_final_final.Rmd).

- Programming is similar to **cooking**.
  - So many different cuisines (programming languages).
  - But there are fundamentals.
    - Ingredients (data)
    - Techniques (logic)
    - Recipes (workflow)
  - Though programming is different from cooking, because it requires much more precision.
  - Basically, you learn how to talk to a computer and make the computer do what you want.

Objectives

- Tasting a wide range of computational tools
- Getting programming fundamentals right
  - Concepts
  - Techniques
- Learning by doing
  - Learning from your own MANY trials and errors
  - Learning from others (please, do Google search before asking me)

- **Don't expect**
  - Becoming a data scientist within one semester
  - I can answer all of your questions.
- We focus on learning **how to learn**.
  - Programming is one endless Google Search (aka "Rochelle's Law")

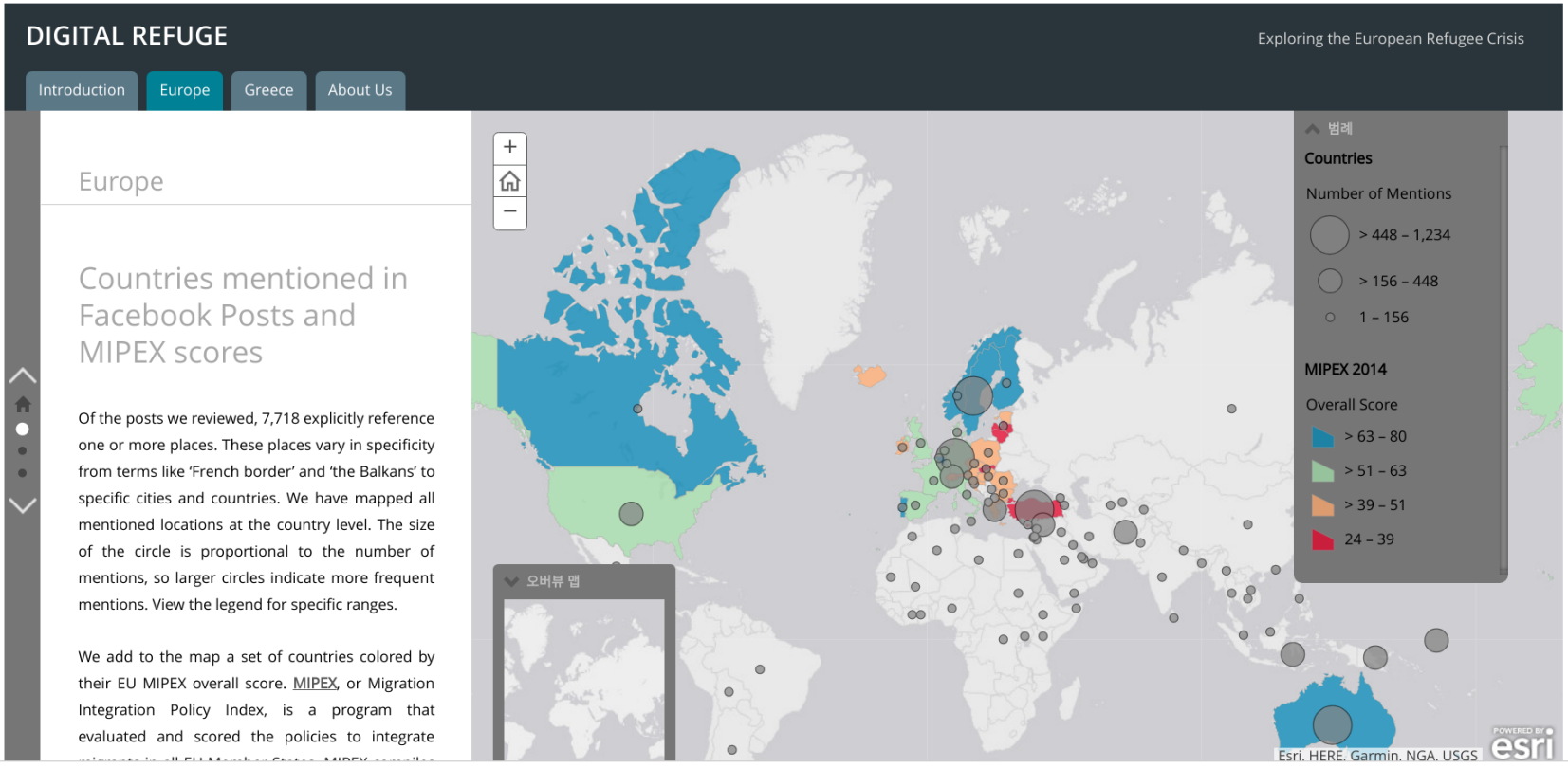
Syllabus

- Introduction
  - Jan. 16: Introduction and Setup ("Installfest")
- Version control
  - Jan. 21/23: Unix, Bash, and Git
- R and Python fundamentals
  - Jan. 28/30: Data Structure in R
  - Feb. 4/6: Data Analysis in R
  - Feb. 11/13: Data Visualization in R
  - Feb. 18/20: Intro to Python

- Online data collection
  - Feb. 25/27: Webscraping (project proposal draft due)
  - Mar. 4/6: APIs
  - Mar. 11/13: HTML/CSS/Javascript
  - Mar. 18/20: Online Sampling, Survey, and Field Experiments
- Mar. 25/27: SPRING BREAK (final project proposal due)

- Text analysis and machine learning
  - Apr. 1/3: Text Analysis in R (guest lecture by Marla Stuart, Social Work & BIDS Data Science Fellow)
  - Apr. 8/10: Unsueprvised Machine Learning in R
  - Apr. 15/17: Supervised Machine Learning in R (guest lecture by Chris Kennedy, Biostats & BIDS Data Science Fellow)
- Review
  - Apr. 22/24: Wrap-up: Frontiers in Computational Methods (project demo)

Previous final projects by students



Class

- Participation (25%)
  - Be nice to each other. We're all learning (especially me).
- Homework (50%)
  - Every week.
  - Practice, practice, and practice.
- Final project (25%)
  - Feasibility is your friend. Late Feb proposal, April presentations.

Logistics

- Learning by doing
  - Pair-programming on in-class challenges
- Section is required
- Julia Christensen is a technical assistant to the course.

Special thanks

- Laura Stoker (UC Berkeley)
- Rochelle Terman (Chicago)
- Rachel Bernhard (Oxford, UC Davis)