INST 728Q – Visual Analytics | Modified for Bureau of Economic Analysis

Visual Data Science

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MOTIVATING QUESTIONS:

What is data science, really?

~~How do I get answers from data?~~

How does visual analytics fit in?

OUTLINE

- Defining data science
  - Extract, transform, load (ETL)
- Exploratory analysis and modeling
  - NLP – Natural Language Processing
- Streaming visualization

What is a "data scientist?"

"Data Scientist (n.): Person who is better at statistics than any software engineer and better at software engineering than any statistician." - Josh Wills

- Something of a marketing term, but careers and formal data science programs have sprung up around the concept

Data science competencies

Anderson et al. (2014):

- **Information retrieval**
- **Large or streaming data sets**
- **Databases**
- AI and statistical techniques
- Software development and algorithms
- Mathematics
- Communication
- Social, ethical, and legal awareness

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Data science workflow

1. **Scope out the problem or question**
2. **Knowledge search: Research and sensemaking**
3. Data retrieval; extract, transform, load (ETL)
4. Exploratory analysis
5. Modeling

- System-building [sometimes]
- Versioning/archival
- Communication

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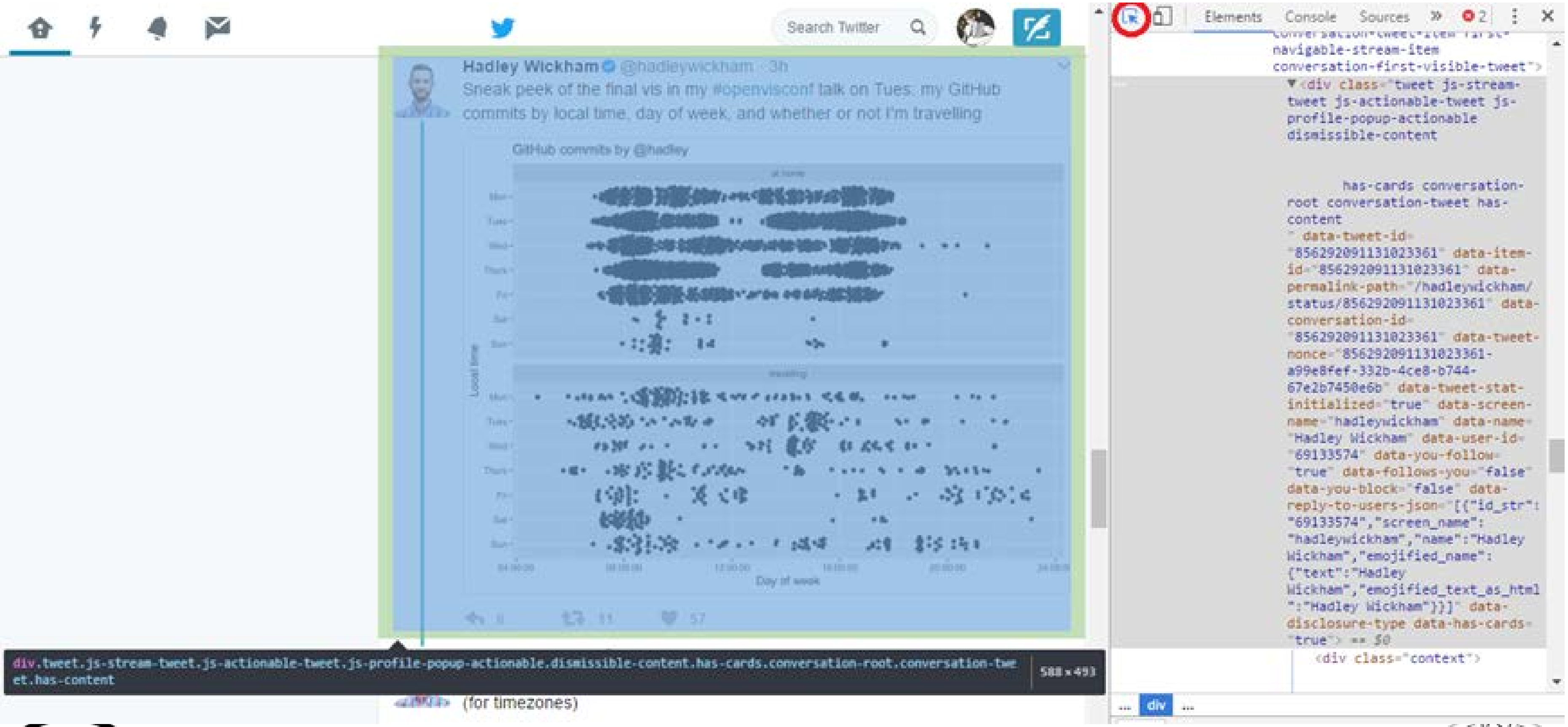
Extract: Information retrieval

- Information systems: Get data from a database

- Information studies: "Everything is data"
    - Tables
    - Text
    - Images
    - Media files (video, audio)
    - Interviews?
    - Artifacts??
- Other examples?

Extract: "Webscraping"



Hadley Wickham @hadleywickham · 3h
Sneak peek of the final vis in my #openvisconf talk on Tues: my GitHub commits by local time, day of week, and whether or not I'm travelling

(for timezones)

```
conversation-tweet-item first-
navigable-stream-item
conversation-first-visible-tweet">
 ▼<div class="tweet js-stream-
 tweet js-actionable-tweet js-
 profile-popup-actionable
 dismissible-content


           has-cards conversation-
 root conversation-tweet has-
 content
 " data-tweet-id=
 "856292091131023361" data-item-
 id="856292091131023361" data-
 permalink-path="/hadleywickham/
 status/856292091131023361" data-
 conversation-id=
 "856292091131023361" data-tweet-
 nonce="856292091131023361-
 a99e8fef-332b-4ce8-b744-
 67e2b7450e6b" data-tweet-stat-
 initialized="true" data-screen-
 name="hadleywickham" data-name=
 "Hadley Wickham" data-user-id=
 "69133574" data-you-follow=
 "true" data-follows-you="false"
 data-you-block="false" data-
 reply-to-users-json="[{"id_str":
 "69133574","screen_name":
 "hadleywickham","name":"Hadley
 Wickham","emojified_name":
 {"text":"Hadley
 Wickham","emojified_text_as_html
 ":"Hadley Wickham"}}]" data-
 disclosure-type data-has-cards=
 "true"> == $0
   <div class="context">
```

```
div.tweet.js-stream-tweet.js-actionable-tweet.js-profile-popup-actionable.dismissible-content.has-cards.conversation-root.conversation-twe
et.has-content
```

Windows: F12, Ctrl + Shift + I
+ I

Mac: Cmd + Opt

Transform [Info Systems]

Reshaping and restructuring data for the target database

- Clean
- Filter
- Apply models
- Business rules
- Aggregate
- Et cetera

Transform [Mathematics]

- Geometry:
  - Reflect
  - Rotate
  - Scale (resize)
  - Translate (shift position)
- Generally:
  - An invertible function mapping one domain to another

Transform [Comp & Data Sci]

Why not both?

[Scrape.R Demo]

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- System-building [sometimes]
- Versioning/archival
- Communication

“Homework” Exercise 1

1. Use R with "rvest" package to extract data from website of your choice
2. Use "tidytext" package to transform into tibble

See "Scrape.R" @https://goo.gl/z6OqUS

Load (Stage/Publish) & Archive

- We've "loaded" the data from our chosen website into the *R* environment
  - Not a reliable way to warehouse. Why? *Low permanence*
  - Also not a great publication / communication platform
- In a more complete information or business system, we would:
  - Perform further transformations
  - Load into database with well-defined schema (*higher permanence*)
  - We're skipping that today

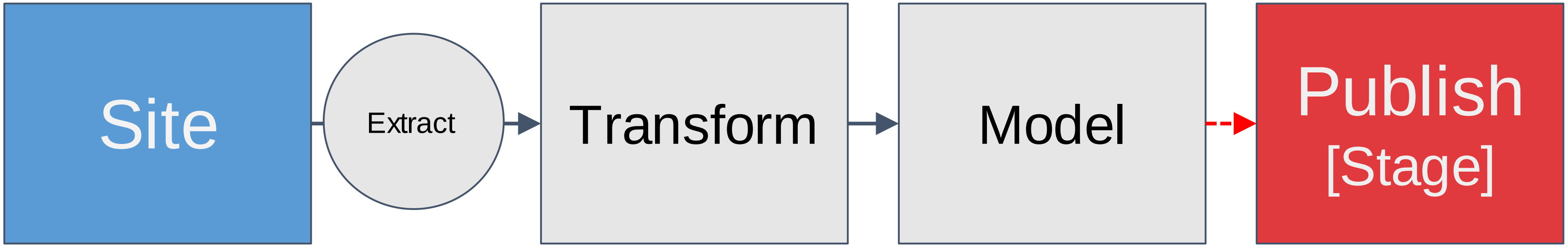
Streaming Visualization

What is "streaming?"

- Transfer of continuously-generated data in real time
- "Real-time" somewhat subjective, contextual

"Streaming visualization," then, is any vis that is continuously updated based on newly-generated, high frequency data

Our process so far & next step

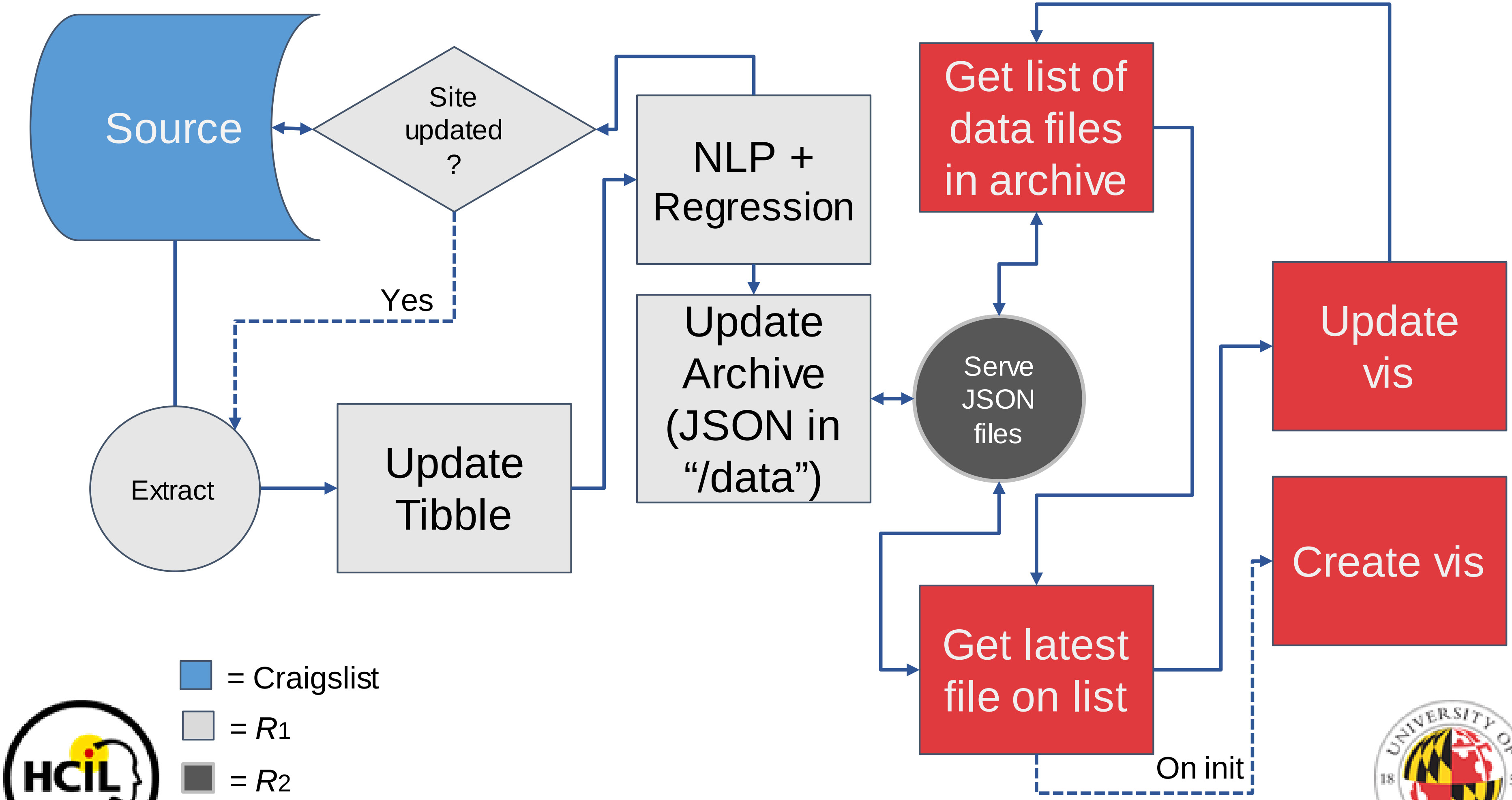


[Streaming Vis Demo]

“Homework” Exercise 2

1. Download index.html, Bind.R, and serve.R from https://goo.gl/z6OqUS
2. Change "outDir" (Bind.R) and "rootDir" (serve.R)
3. Run bind.R
4. Run serve.R
5. Explain what's happening to the data

Our finished network of continuous processes



🟦 = Craigslist

⬜ = *R*1

⬛ = *R*2

🟥 = D3 JS/CSS/HTML Vis

CLOSING REMARKS

QUESTIONS?