Web Scraping

Motivation for Web Scraping

- Relying on Downloadable CSV's Puts You at a Disadvantage
- Majority of Data Is Found Online
- Negative: Online Data is Unstructured in HTML Format
- Positive: Online Data is Often Updated, Relevant, & Untapped

Motivation for Web Scraping

- Example 1: ESPN NHL Stats

NHL Player Points Statistics - 2017-18

Statistics: Points | Shooting | Goaltending | Defensive | Time On Ice | Faceoffs | Major Penalties | Minor Penalties

Season: 2017-18 Regular Season League: NHL

Splits: Total Positions: All

Points Leaders - All Players

													PP		SH	
RK	PLAYER	TEAM	GP	G	A	PTS	+/-	PIM	PTS/G	SOG	PCT	GWG	G	A	G	A
1	Connor McDavid, C	EDM	82	41	67	108	20	26	1.32	274	15.0	7	5	15	1	3
2	Claude Giroux, LW	PHI	82	34	68	102	28	20	1.24	193	17.6	1	9	27	0	0
3	Nikita Kucherov, RW	TB	80	39	61	100	15	42	1.25	279	14.0	7	8	28	0	0
4	Evgeni Malkin, C	PIT	78	42	56	98	16	87	1.26	239	17.6	7	14	24	0	0
5	Nathan MacKinnon, C	COL	74	39	58	97	11	55	1.31	284	13.7	12	12	20	0	1
6	Taylor Hall, LW	NJ	76	39	54	93	14	34	1.22	278	14.0	7	13	24	1	0
7	Anze Kopitar, C	LA	82	35	57	92	21	20	1.12	200	17.5	6	7	20	0	2
	Phil Kessel, RW	PIT	82	34	58	92	-4	36	1.12	261	13.0	6	12	30	0	0
9	Blake Wheeler, RW	WPG	81	23	68	91	13	52	1.12	246	9.4	2	6	34	0	2
10	Sidney Crosby, C	PIT	82	29	60	89	0	46	1.09	247	11.7	6	9	29	0	0

Motivation for Web Scraping

- Example 2: Blood Pressure Chart

What Should Blood Pressure be According to Age?

Approx. BP According to Age Chart

Age	Low		Normal		Elevated		Stage 1 Hypertension		Stage 2 Hypertension	
	S	D	S	D	S	D	S	D	S	D
17-19	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
20-24	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
25-29	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
30-34	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
35-39	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
40-44	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
45-49	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
50-54	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
55-59	< 90	< 60	< 120	< 80	120-129	< 80	130-139	80-89	140+	90+
60+	< 90	< 60	120	< 80	120-129	< 80	130-139	80-89	140+	90+

Motivation for Web Scraping

- Example 3: AP Top 50 Stories

AP Top News

50 stories

20 mins ago

'Deliberate act of compassion' a reaction to Vegas shooting

LAS VEGAS (AP) — As a cloud-streaked orange sunset glowed over Las Vegas, officials, victims' families and survivors of year's mass shooting at a country music festival marked the first anniversary of the tragedy by placing roses on a tribute wall and dedicating a memorial garden Wednesday...

Shootings Las Vegas mass shooting North America Las Vegas Brian Sandoval U.S. News

2 hours ago

White House gives FBI freer rein in Kavanaugh investigation

WASHINGTON (AP) — The White House has given the FBI clearance to interview anyone it wants to by Friday in its investigation of sexual misconduct allegations against Supreme Court nominee Brett Kavanaugh.

The new guidance, described to The Associated Press by a person familiar with it, was...

Sexual misconduct Supreme courts Kavanaugh nomination Politics North America U.S. Supreme Court Courts Christine Blasey Ford

Web Scraping Defined

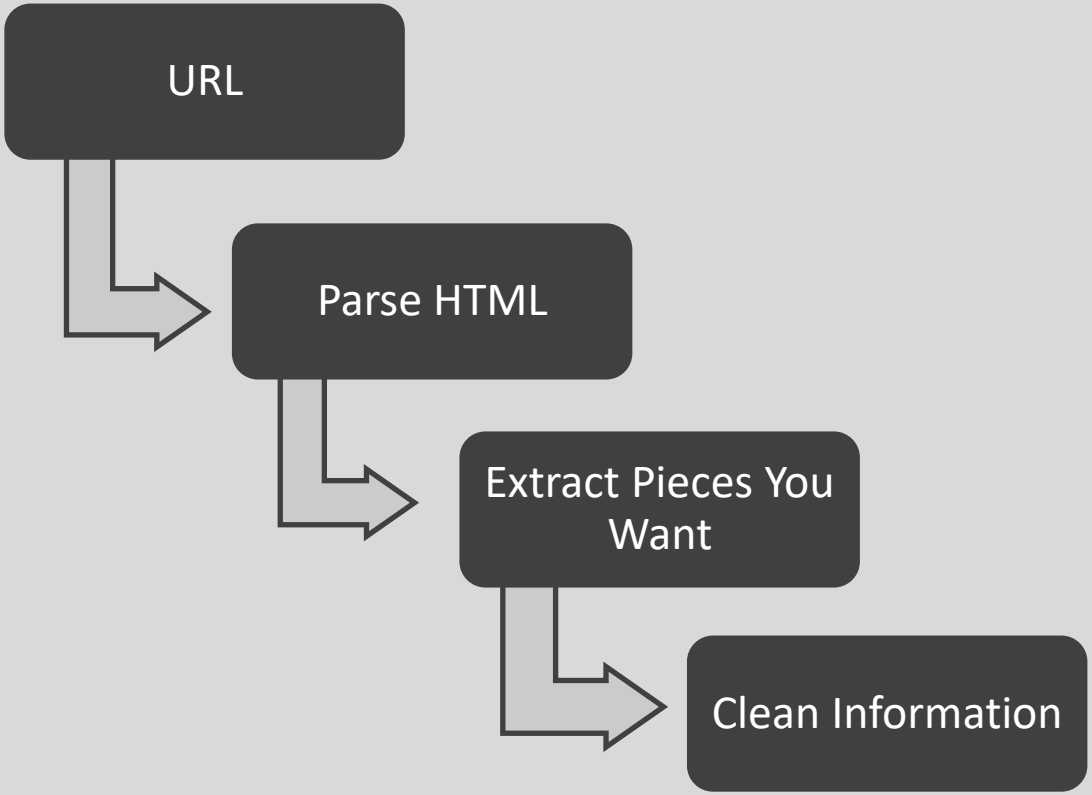
- Process of Converting Currently Unstructured Data on Web to Structured Data in R
- Ideas:
  - ESPN Table to CSV
  - Blood Pressure Chart to Tibble
  - Top News Stories to List in R
- Absolutely Crucial Skill for Modern Data Scientists

Web Scraping in R

- The rvest package

```
> library(rvest)
```

  - Written by Hadley Wickham
  - General Process:



Supplement Introduction

- Step 1: Open Supplement
- Step 2: Ensure You Have the Following R Packages Installed
  - tidyverse
  - rvest (Requires Internet)
  - devtools
  - noncensus (Install from Github)
- Step 3: Knit and Run
- Step 4: Read the Introduction

Part 1: Violent Crimes in US Cities

- Step 1: Wikipedia Violent Crimes
- Step 2: Locate the Table

State	City	Population	Total	Murder and Nonnegligent manslaughter	Rape[1]	Robbery
Alabama	Mobile[3]	248,431	6217.02	20.13	58.16	177.11
Alaska	Anchorage	296,188	6640.04	9.12	132.01	262.67
Arizona	Chandler	249,355	2589.08	2.01	52.13	56.95
Arizona	Gilbert	242,090	1483.75	2.07	16.11	21.07
Arizona	Glendale	249,273	5037.85	4.81	38.91	192.96
Arizona	Mesa	492,268	2592.49	4.67	51.19	92.23
Arizona	Phoenix	1,608,139	4443.2	9.55	69.46	200.28
Arizona	Scottsdale	251,840	2338.38	1.99	40.90	39.71
Arizona	Tucson	1,532,323	6082.78	8.64	93.55	268.82
California	Anaheim	353,400	2997.74	2.83	32.54	135.82

Goal: Read Table Into R

Part 1:
Violent Crimes
in US Cities

- Step 3: What Do You Expect to Be a Problem in the Data?
- Step 4: Run Chunk 1
  - Is This What You Expected?
  - What New Problems Arise?
- Step 5: Run Chunk 2
  - Select Wanted Information
  - Remove 1st and 2nd Rows
  - Rename Variables

Part 1:
Violent Crimes
in US Cities

- Step 6: Run Chunk 3
  - Converting Variable Types
    - as.numeric()
    - as.character()
    - as.date()
    - as.integer()
  - All Numeric Variables are Character Because of First Row
- Step 7: Run Chunk 4
  - City Variable Has Problems
  - State Variable Has Problems
  - Why Do We Care?

Part 1:
Violent Crimes
in US Cities

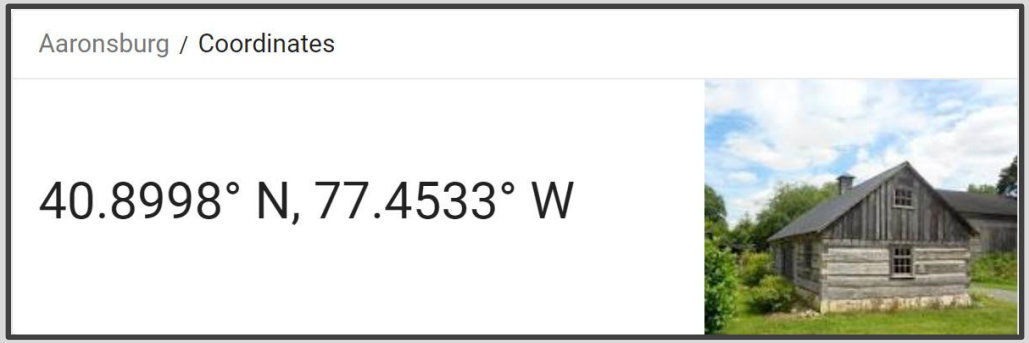
- Step 8: Run Chunk 5
  - String Functions Used
    - str_replace_all()
    - str_replace()
  - Conditional Mutation
    - ifelse()
- Step 9: Base Knit

Part 2: Geographical Locations of US Cities

- Step 1: What Additional Information Would We Need to Plot Crime Information on a Map?
- Step 2: Run Chunk 1
  - What Info is Important?
  - What Do You Notice About the City Variable?
- Step 3: Run Chunk 2
  - Goal: Find the Average Latitude and Longitude for Each City and State

Part 2: Geographical Locations of US Cities

- Step 4: Run Chunk 3
  - Examine the Output
  - Notice Aaronsburg, PA



  - Are We Ready to Merge?
    - #No
    - #WhyNot
- Step 5: Pinch Knit

Part 3: Linking State Names to State Abbreviations

- Step 1: Select Website Link
- Step 2: Examine the Table

Name	Abbreviation	Name	Abbreviation
Alabama	AL	Montana	MT
Alaska	AK	Nebraska	NE
Arizona	AZ	Nevada	NV
Arkansas	AR	New Hampshire	NH
California	CA	New Jersey	NJ
Colorado	CO	New Mexico	NM
Connecticut	CT	New York	NY

- Step 3: What is the Issue with the Way this Information is Presented and How Does this Pose a Threat to Our Existence?

Part 3: Linking State Names to State Abbreviations

- Step 4: Run Chunk 1
  - Did You Get What You Expected?
  - How Should We Fix This Data?
- Step 5: Run Chunk 2
  - Stacking Datasets
    - Horizontally

      ```
      > cbind(x,y)
      ```

    - Vertically

      ```
      > rbind(x,y)
      ```

- Step 6: Knitting Streak

Part 4: Inclusion of Expert Opinion

- Step 1: Selector Gadget Website
  - Open Source
  - Chrome Extension Exists
  - Easy: Drag Link to Bookmark Bar as Webpage Explains

- Step 2: Observe the Article on 2019's Safest and Most Dangerous States
  - What info could be of use?
  - Do you agree identification?

Part 4:
Inclusion of
Expert Opinion

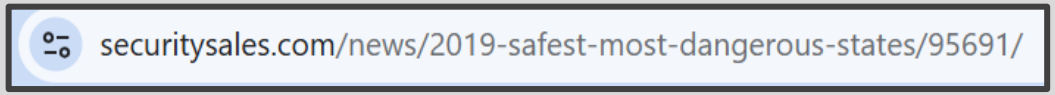
- Step 3: Information of Interest
  - Safe vs Dangerous

1. Minnesota	1. Mississippi
2. Vermont	2. Louisiana
3. Maine	3. Florida
4. Utah	4. Arkansas
5. Connecticut	5. Texas
6. New Hampshire	6. Alabama
7. Iowa	7. Oklahoma
8. Hawaii	8. Missouri
9. Massachusetts	9. Montana
10. Wyoming	10. South Dakota

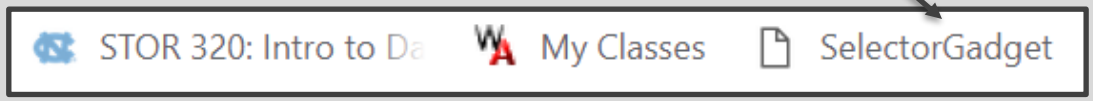
  - Goal: Scrape this Information into Vectors in R to Create a Table

Part 4:
Inclusion of
Expert Opinion

- Step 4: Identifying CSS Selector
  - Go to Web Page



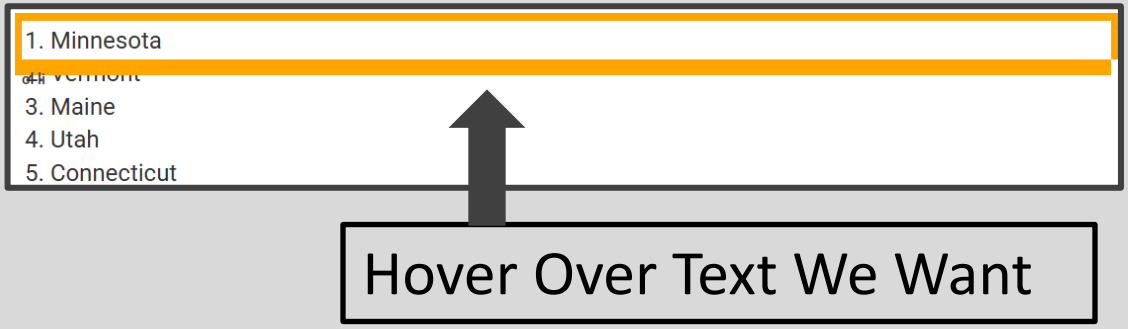
  - Choose SelectorGadget in Bookmark Tab



  - Locate This Box

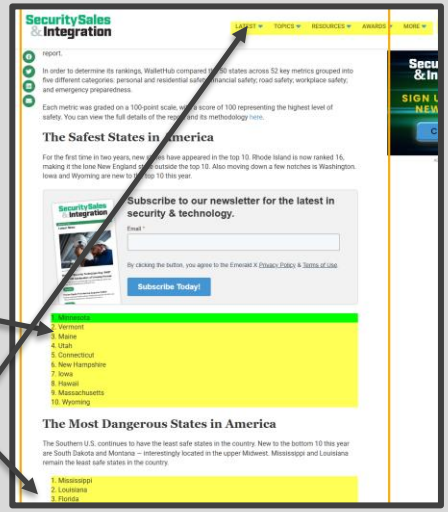
Part 4: Inclusion of Expert Opinion

- Step 4: Continued
  - Find Content You Want



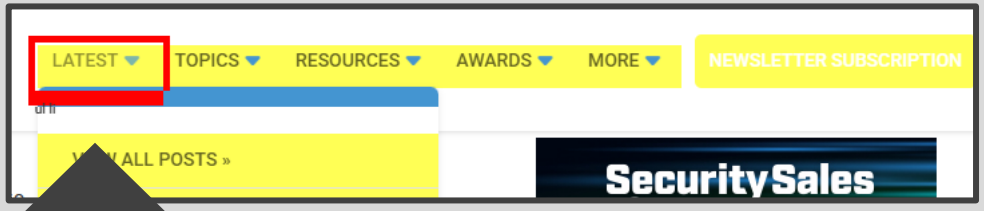
Hover Over Text We Want

- Point and Click to Select Info
- Info We Want is Highlighted
- Info We Don't Want, As Well



Part 4: Inclusion of Expert Opinion

- Step 4: Continued
  - Find Content You Don't Want

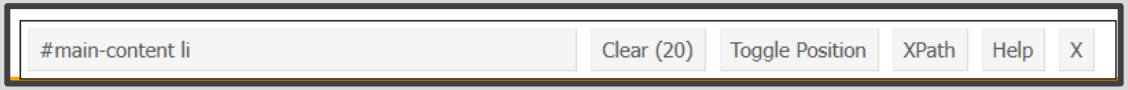


Hover Over Text We Don't Want

  - Point and Click to Deselect

Part 4: Inclusion of Expert Opinion

- Step 4: Continued
  - Relocate This Box



  - Copy CSS Selector "#main-content li"

- Step 5: Run Chunk 1

```
URL.SAFE_VS_DANGEROUS =
"https://www.securitysales.com/news/2019-safest-most-dangerou
s-states/95691/"
SAFE_VS_DANGEROUS = URL.SAFE_VS_DANGEROUS %>%
                      read_html() %>%
                      html_nodes(css="#main-content li") %>%
                      html_text()
```

- Step 6: Run Chunk 2
  - What About the Other States?
- Step 7: Walk-off Knit

Closing

Disperse and Make Reasonable Decisions