Web Data Collection with R

Regular Expressions / RegEx - A Case Study

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Getting to know the page

first glance at:

http://ajps.org/list-of-reviewers/

```r
url <- "http://ajps.org/list-of-reviewers/"
browseURL(url)
```

getting to know the page

- look at the source code (Cntr-U)
- inspecting elements (Cntr-Shift-I)

surprise

- reviewer lists are not part of the web page but available as PDF downloads

Scraping Strategy

getting PDFs

1. download page / load into R
   - `read_html()` *[rvest]*
2. extract anker nodes `<a ...>`
   - `html_nodes(..., xpath=...)` *[rvest]*
3. extract `href` attribute from nodes
   - `html_attr(..., "href")` *[rvest]*
4. filter links (keep those entailing: ‘review’; four digits; ‘pdf’)
   - `str_detect(..., "review.*\\d{4}.*pdf")` *[stringr]*
5. download PDFs to disk
   - `download.file(..., ..., mode="wb")` *[utils]*

extracting information from PDF

6. converting PDF to something we can work with
    - e.g. Adobe Acrobat Pro
        - HTML, XML, TXT, ...
    - e.g. Xpdf (`http://www.foolabs.com/xpdf/download.html`)
        - HTML, TXT, ...
        - WINDOWS: `http://www.foolabs.com/xpdf/download.html` - add install path to path variable / see: `http://www.computerhope.com/issues/ch000549.htm`
        - Linux e.g.: `sudo apt-get install poppler-utils`
7. load into R and use Regular Expressions extract information

Scraping

getting PDFs

```r
# packages needed
require(rvest)
require(stringr)
```

getting PDFs

```r
# url with list of reviews
url <- "http://ajps.org/list-of-reviewers/"

# get page
content <- read_html(url)

# get anker (<a href=...>) nodes via xpath
ankers  <- html_nodes(content, xpath = "//a")

# get value of ankers' href attribute
hrefs   <- html_attr(ankers, "href",
                     default="NO HREF IN HERE")
```

getting PDFs

```r
# filter links: should entail ...
# 'review', four-digit number, 'pdf'
pdf <- hrefs[ str_detect(hrefs, "review.*\\d{4}.*pdf") ]
pdf
```

```
## [1] "http://ajpsblogging.files.wordpress.com/2015/04/aj
## [2] "http://ajpsblogging.files.wordpress.com/2014/01/aj
## [3] "http://ajpsblogging.files.wordpress.com/2013/08/re
## [4] "http://ajpsblogging.files.wordpress.com/2013/08/re
## [5] "http://ajpsblogging.files.wordpress.com/2013/08/re
```

getting PDFs

```r
# names for PDFs on disk
basename(pdf)
```

```
## [1] "ajps-reviewers-2014.pdf" "ajps_reviewers_2013.pdf"
## [3] "reviewers_2012.pdf"      "reviewers_2011.pdf"
## [5] "reviewers_2010.pdf"
```

```r
str_extract(pdf, "\\d{4}.pdf")
```

```
## [1] "2014.pdf" "2013.pdf" "2012.pdf" "2011.pdf" "2010.pd
```

```r
pdf_names <- str_extract(pdf, "\\d{4}.pdf")
```

```r
# download pdfs
for(i in seq_along(pdf)) {
  download.file(pdf[i], pdf_names[i], mode="wb")
}
```

Transforming / Reading Data

transforming PDFs - function

```r
# WINDOWS: xpdf: http://www.foolabs.com/xpdf/download.html
#   add install path to path variable / see: http://www.co
# Linux: sudo apt-get install poppler-utils
pdftotext <- function(fname){
  fname_txt <- str_replace(fname, ".pdf", ".txt")
  system2(command = "pdftotext", args = fname)
  return(fname_txt)
}
```

transforming PDFs - execution

```
# transform PDFs to text
pdftotext(pdf_names[1])
pdftotext(pdf_names[2])
pdftotext(pdf_names[3])
pdftotext(pdf_names[4])
```

loading text

```r
# laod text of PDF
text1 <- readLines("2013.txt", warn=FALSE)
```

first glance at text

```r
substring(text1, 1, 60)[6:14]
```

```
## [1] "parentheses!at!the!end!of!each!reviewer’s!name!ind
## [2] "completed!in!2013.!!"
## [3] "!"
## [4] "Max!!Abrahms,!Johns!Hopkins!(!2!)!"
## [5] "Alan!I.!Abramowitz,!Emory!University!(2!)!"
## [6] "James!Adams,!UC!Davis!(4)!"
## [7] "Claire!L.!Adida,!UCSD!(!2!)!"
## [8] "Marina!Agranov!,!Caltech!(!1!)!"
## [9] "John!S!Ahlquist!,!University!of!Wisconsin,!Madison
```

- some useless/wrong characters → cleansing
- get rid of spaces
- get rid of parantheses
- information scheme is:
  `FirstName Lastname, Institution (NumberOfReviews)`
- followed by actual extraction

preparation

```
text1_tmp <-
  text1 %>%
  str_replace_all("[!\f]"," ") %>%   # drop form feed
  str_replace_all("\\]"," ") %>%     # drop ]
  str_replace_all("\\(|\\)", "") %>% # drop ( )
  str_replace(" ,", ",") %>%         # correct space
  str_replace_all("  ", " ") %>%     # correct space
  str_trim()                         # correct space

text1_tmp <-
  text1_tmp[text1_tmp != ""] # drop empty lines

text1_tmp <-
  text1_tmp[-c(1:5 )]        # drop non data
```

cleaned up

```
text1_tmp[1:10]
```

```
##  [1] "Max Abrahms, Johns Hopkins 2"
##  [2] "Alan I. Abramowitz, Emory University 2"
##  [3] "James Adams, UC Davis 4"
##  [4] "Claire L. Adida, UCSD 2"
##  [5] "Marina Agranov, Caltech 1"
##  [6] "John S Ahlquist, University of Wisconsin, Madison
##  [7] "Faisal Ahmed, Oxford University 2"
##  [8] "T.K. Ahn, Seoul National University 1"
##  [9] "Ariel Ahram, Virginia Tech 1"
## [10] "Deniz Aksoy, Princeton University 1"
```

First Result

Reviewers

```r
length(grep("Konstanz", text1_tmp))
```

```
## [1] 6
```

```r
length(grep("Harvard", text1_tmp))
```

```
## [1] 24
```

```r
length(grep("Berlin", text1_tmp))
```

```
## [1] 3
```

```r
length(grep("Bamberg", text1_tmp))
```

```
## [1] 0
```

```r
length(grep("UCLA", text1_tmp))
```

```
## [1] 2
```

Extraction

names

```r
names <-
  text1_tmp %>%
  str_extract("^.*?,") %>%
  str_replace_all("  |,", " ") %>%
  str_trim( )
sample(names, 10)
```

```
##  [1] "David Karol"           "Charles Daniel Myers"
##  [3] "Anna Harvey"           "Kåre Vernby"
##  [5] "Sean Cain"             "Kent Tedin"
##  [7] "Matthew Lee Blackwell" "Amanda Driscoll"
##  [9] "Jay Gatrell"           "Andrew Therriault"
```

institutions

```
institution <-
  text1_tmp %>%
  str_extract(",.*\\d") %>%
  str_replace_all("^ ,|^,|\\d$","") %>%
  str_trim()
sample(institution, 7)
```

```
## [1] "University of Wisconsin"        "Hebrew University
## [3] "Bucknell University"            "Erasmus Universit
## [5] "University of Mississippi"      "The World Bank"
## [7] "University of Houston"
```

reviews

```
reviews <-
  text1_tmp %>%
  str_extract("\\d+") %>%
  as.numeric
table(reviews)
```

```
## reviews
##   1   2   3   4   5
## 947 181  34   7   1
```

reviews

```r
data.frame(n=reviews, names, institution)[reviews > 3, ]
```

```
##         n                 names                institution
## 3       4           James Adams                   UC Davis
## 27      4        Scott Ashworth      University of Chicago
## 541     4          Cindy D. Kam      Vanderbilt University
## 592     5         Gregory Koger        University of Miami
## 684     4         Neil Malhotra        Stanford University
## 950     4 Leslie Schwindt Bayer            Rice University
## 1095    4           Erik Voeten      Georgetown University
## 1152    4         Jonathan Woon University of Pittsburgh
```

save data gathered so far

```r
revdat <- data.frame(
  reviews,
  names,
  institution,
  stringsAsFactors = FALSE
)
save(revdat, file = "revdat.Rdata")
```

Extension (1)

geocoding institutions

```r
require(ggmap)
# geocoding takes a while -> save results
# 2500 requests allowed per day
if ( !file.exists("scenario1_inst_geocoded_pos.rdata")){
  pos <- geocode(institution)
  geocodeQueryCheck()
  save(pos, file="scenario1_inst_geocoded_pos.rdata")
} else {
  load("scenario1_inst_geocoded_pos.rdata")
}
```

plot coordinates

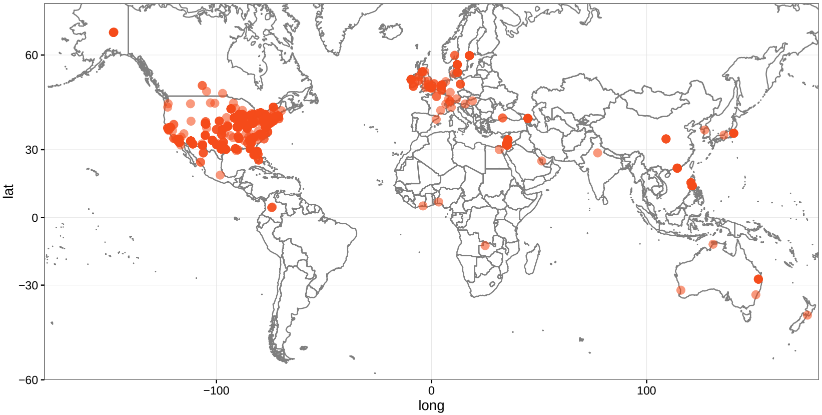
```
mapWorld <- borders("world")
```

```
##
##  # maps v3.1: updated 'world': all lakes moved to separa
##  # 'lakes' database. Type '?world' or 'news(package="maj
```

```
map <-
  ggplot() +
  mapWorld +
  geom_point(aes(x=pos$lon, y=pos$lat) ,
             color="#F54B1A90", size=3 ,
             na.rm=T) +
  theme_bw() +
  coord_map(xlim=c(-180, 180), ylim=c(-60,70))
```

plot coordinates

```
map # ajps 2013 reviewers worldwide
```



Extension (2)

- grab articel authors for some years
- and compare to reviewers