Fundamentals of Quantitative Text Analysis

Mate Akos

2019 September

MTA TK PTI

For today

1. Introduction
2. Goal of the course
3. What is QTE?
4. Key concepts, assumptions
5. Workflow of QTE
6. Data

About me

- Research Fellow at MTA Centre for Social Sciences
- Previous work on text analysis of IMF Article IV reports, network analysis of fiscal instututions
- PhD (soon to be defended) from CEU (with a brief visiting position at KU Leuven)

Contact

- email: aakos.mate@gmail.com

- all course materials: slides and code on github; readings on dropbox

About you?

- your background, interests
- experience with R (or Python?)
- specific interest in this course

Goals of the course

- Provide bird's-eye view of quantitative text analysis
- Some lecture content but heavy emphasis on applied work
- Befriending R
- Learn to critically evaluate competing methods and when to use which
- Provide the ability to carry out a project using the QTA toolset

course requirements

- Attendance and participation - **15%**
- Small assignments - **5% each**
- Project proposal presentation - **10%**
- Final project - **55%**
  - **3500 word limit**
  - topic up to your imagination
  - structure in the syllabus

Quantitative Text Analysis

2019.09.03. kedd, Hilda | 16°C / 22°C | Origo kereső

ORIGO ITTHON NAGYVILÁG GAZDASÁG SPORT TÉVÉ FILM TUDOMÁNY MÉG TÖBB

Az ügyészség vádat emelt Hassan F. ellen

Gyanúsan drága és értelmetlen szerződést kötöttek a szocialisták az ügyvédjükkel

Majdnem ötmillió forintot kap azért, hogy az önkormányzati választásról felvilágosítsa az országgyűlési képviselőket. Azokat a képviselőket, akik önkormányzati választáson nem is indulhatnak.

Fájdalmas emlékeztető érkezett: az autósport még mindig nagyon veszélyes

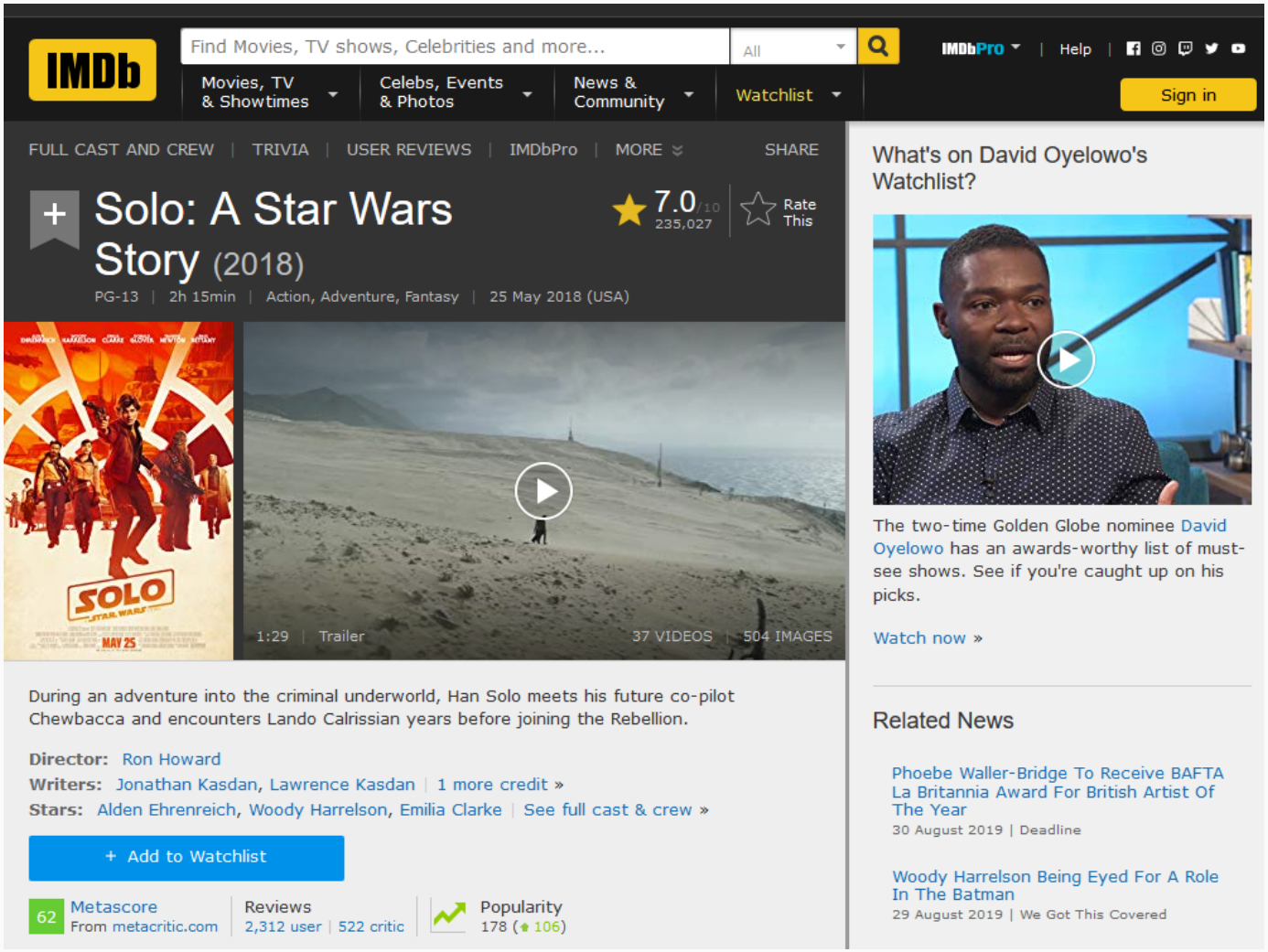
A hétvégi halálos baleset után világossá vált, általában épségben ki lehet szállni a roncsokból. De nem mindig.

→ Még súlyosabb is lehetett volna a spái F2-es baleset

ÍGY LEHET FELISMERNI, HA VALAKI ÉTELFÜGGŐ

Csűrös Karola: Örökké fog tartani az a fájdalom, amit érzek

Soha nem tudja már feldolgozni férje, Horváth Ádám elvesztését.


IMDb
Find Movies, TV shows, Celebrities and more...
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FULL CAST AND CREW | TRIVIA | USER REVIEWS | IMDbPro | MORE | SHARE
Solo: A Star Wars Story (2018)
7.0/10
235,027
Rate This
PG-13 | 2h 15min | Action, Adventure, Fantasy | 25 May 2018 (USA)
SOLO
A STAR WARS STORY
MAY 25
1:29 | Trailer
37 VIDEOS | 504 IMAGES
During an adventure into the criminal underworld, Han Solo meets his future co-pilot Chewbacca and encounters Lando Calrissian years before joining the Rebellion.
Director: Ron Howard
Writers: Jonathan Kasdan, Lawrence Kasdan | 1 more credit »
Stars: Alden Ehrenreich, Woody Harrelson, Emilia Clarke | See full cast & crew »
+ Add to Watchlist
62 Metascore
From metacritic.com
Reviews
2,312 user | 522 critic
Popularity
178 (106)
What's on David Oyelowo's Watchlist?
The two-time Golden Globe nominee David Oyelowo has an awards-worthy list of must-see shows. See if you're caught up on his picks.
Watch now »
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Phoebe Waller-Bridge To Receive BAFTA La Britannia Award For British Artist Of The Year
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Latest Tweets

What's happening?

Tweet

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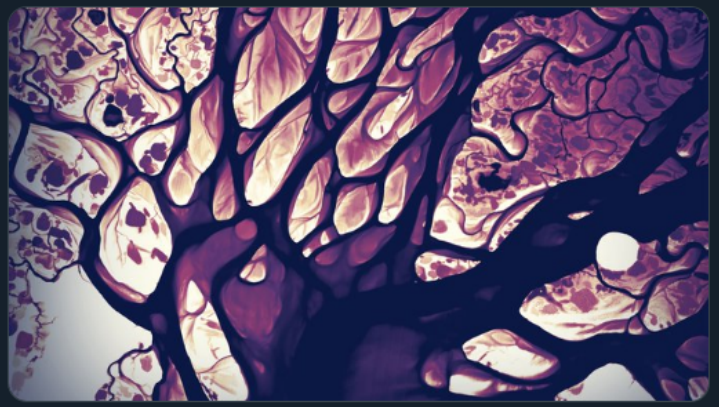
Tenure-Track-Professorship for #PoliticalCommunication @unikonstanz
bit.ly/2KaCXku Apply by Friday 20 September

Maarten Lambrechts Retweeted

Daniel Coe @geo_coe · 4h
Wow—#ArcticDEM is such an incredible data resource! This is a single 2m res. tile of the #LenaRiver Delta in #Russia—such a captivating image! Can't wait to visualize the delta in its entirety. #geography
data: arcgis.com/apps/webappvie...
hi-res image: flickr.com/photos/1657359...



10 48

New York Times World @nytimesworld · 44s
Filled with women stripped of hope and children who die before receiving medical care, a detention camp in Syria has become what aid workers, researchers and American military officials warn is a disaster in the making

The goals and reasons of QTE

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- New era of open source statistical computing: R and Python
- Cheap and accessible way to deal with huge amount of data
- "*amplifying* and *augmenting* careful reading and thoughtful analysis" (Grimmer and Stewart 2012)

But

The other side of the coin

- Be mindful of the assumptions made during the analysis (e.g.: bag of words approach)
- validate, validate, validate
- Be especially cautios with unsupervised learning methods (more on this later)

Four Principles of Quantitative Text Analysis

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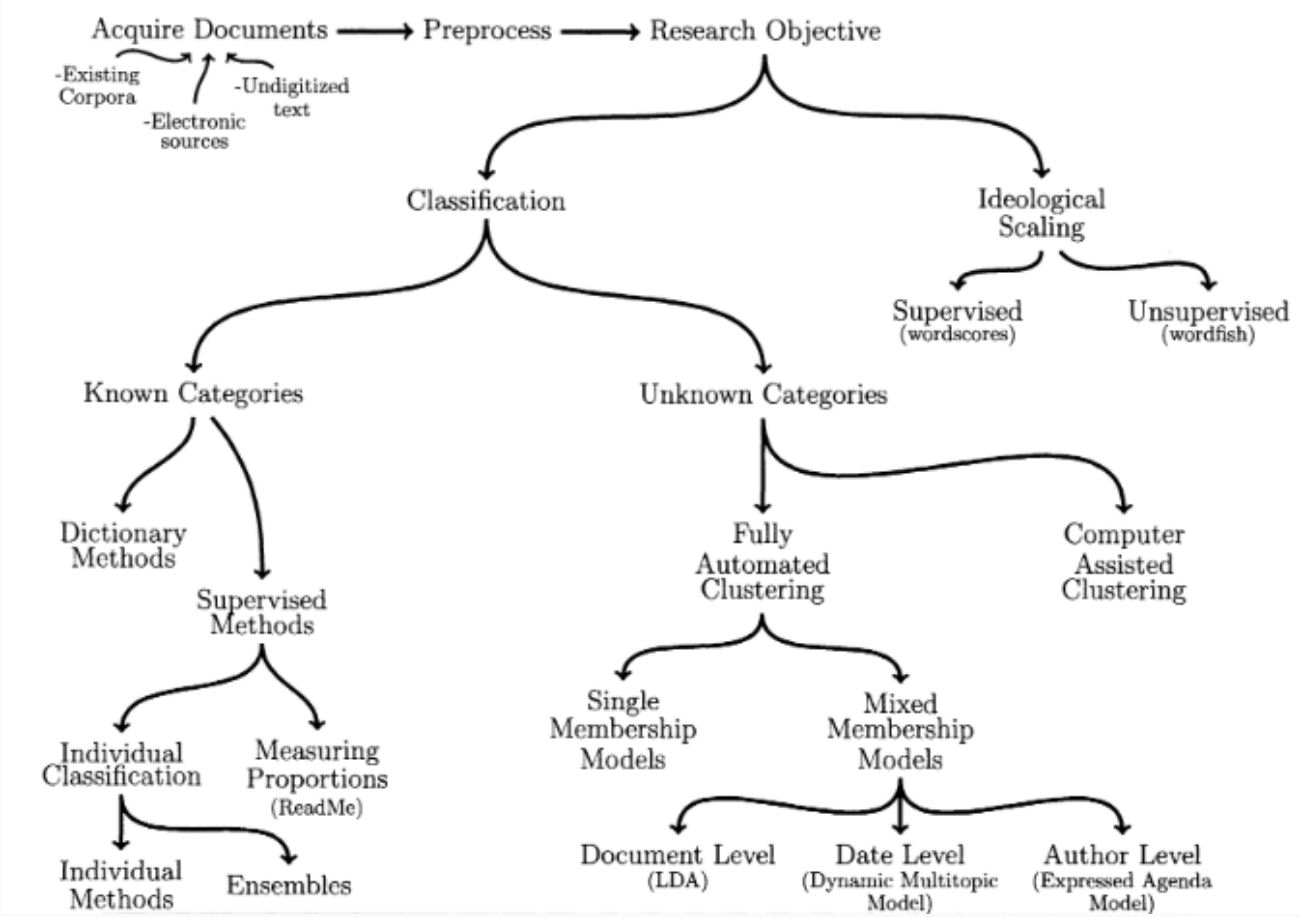
1. ”All quantitative models of language are wrong–but some are useful.
2. Quantitative methods for text amplify resources and augment humans.
3. There is no globally best method for automated text analysis.
4. Validate, Validate, Validate.”

Workflow and methods of QTA



Key concepts

- Unit of analysis: documents or texts (depends on your research)
- Population of documents: the corpus (collection of corpus: corpora)

Bag of words assumption:

- word orders rarely matter
- break the text into smaller units (tokens), usually individual words
- Single words: unigram
- If word ordering matters: n-grams (for 2 words: bi-grams; 3 words: tri-grams)

n-gram example

```
tokens from 1 document.
text1 :
[1] "The"   "quick" "brown" "fox"   "jumps" "over"
[7] "the"   "lazy"  "dog"

tokens from 1 document.
text1 :
[1] "The_quick"   "quick_brown" "brown_fox"
[4] "fox_jumps"   "jumps_over"  "over_the"
[7] "the_lazy"    "lazy_dog"
```

Key terms

- types: unique word
- tokens: any word (total count = total words)
- stemming: removing suffixes from the words
- stop words: set of words to be removed from the documents, because they do not contain relevant information.
- dictionary: A set of tokens with equivalent meaning

Stemming example

```
tokens from 1 document.
text1 :
[1] "political"   ","           "losing"      ","
[5] "parliament" ","           "John"

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text1 :
[1] "polit"       ","           "lose"        ","
[5] "parliament" ","           "John"
```

Stop words

What would be your stopwords for this sentence?

”My fellow citizens: I stand here today humbled by the task before us, grateful for the trust you’ve bestowed, mindful of the sacrifices borne by our ancestors. ”

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”fellow citizens: stand today humbled task, grateful trust you’ve bestowed, mindful sacrifices borne ancestors. ”

Stop words

```
 [1] "i"          "me"         "my"
 [4] "myself"     "we"         "our"
 [7] "ours"       "ourselves"  "you"
[10] "your"       "yours"      "yourself"
[13] "yourselves" "he"         "him"
[16] "his"        "himself"    "she"
[19] "her"        "hers"       "herself"
[22] "it"         "its"        "itself"
[25] "they"       "them"       "their"
[28] "theirs"     "themselves" "what"
[31] "which"      "who"        "whom"
[34] "this"       "that"       "these"
[37] "those"      "am"         "is"
[40] "are"        "was"        "were"
[43] "be"         "been"       "being"
```

Typical workflow

1. Selecting texts, compiling the corpus
2. Cleaning text
    - Make the text machine readable
    - Stemming
    - Removing stop words, numbers, separators
    - Define documents/unit of analysis (reports, sentences, paragraphs, etc.)
3. Preprocess text
    - From words to numbers
    - Defining features (ngrams)
    - Creating a document-feature matrix
4. Reporting

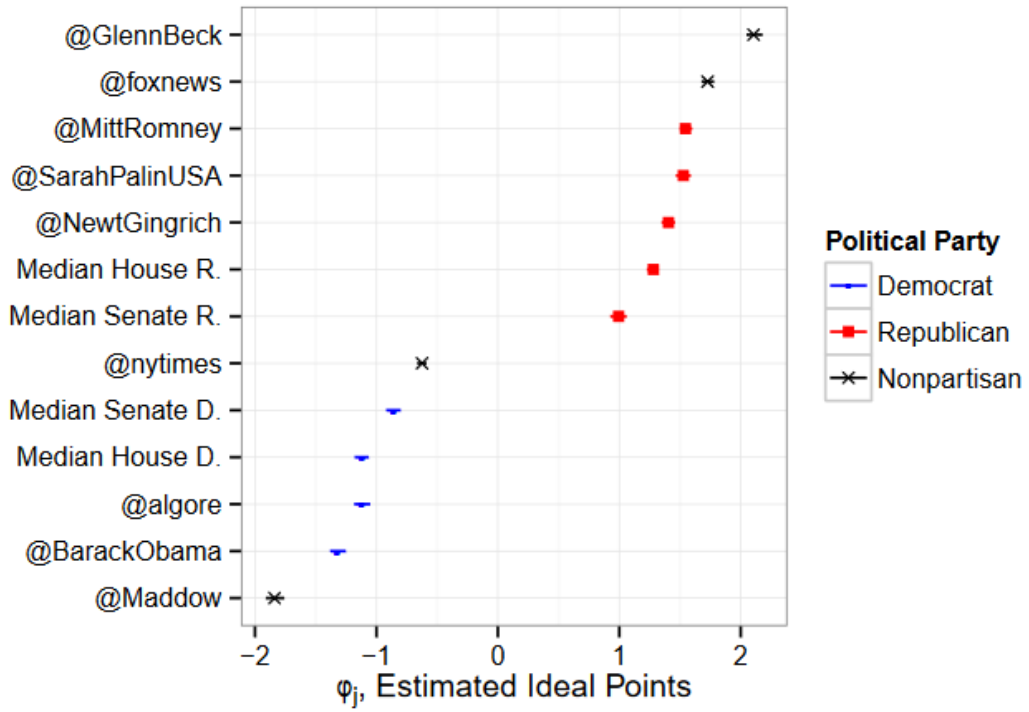
Some examples of applications

Figure 1. The Net Index and the change of the Riksbank's policy rate

Note: Net Index is on the right-hand axis, policy rate change is on the left-hand axis.

Sentiment analysis of central bank minutes (dictionary method) in Apel, M., & Grimaldi, M. (2012). The information content of central bank minutes. *Riksbank Research Paper Series*, (92).

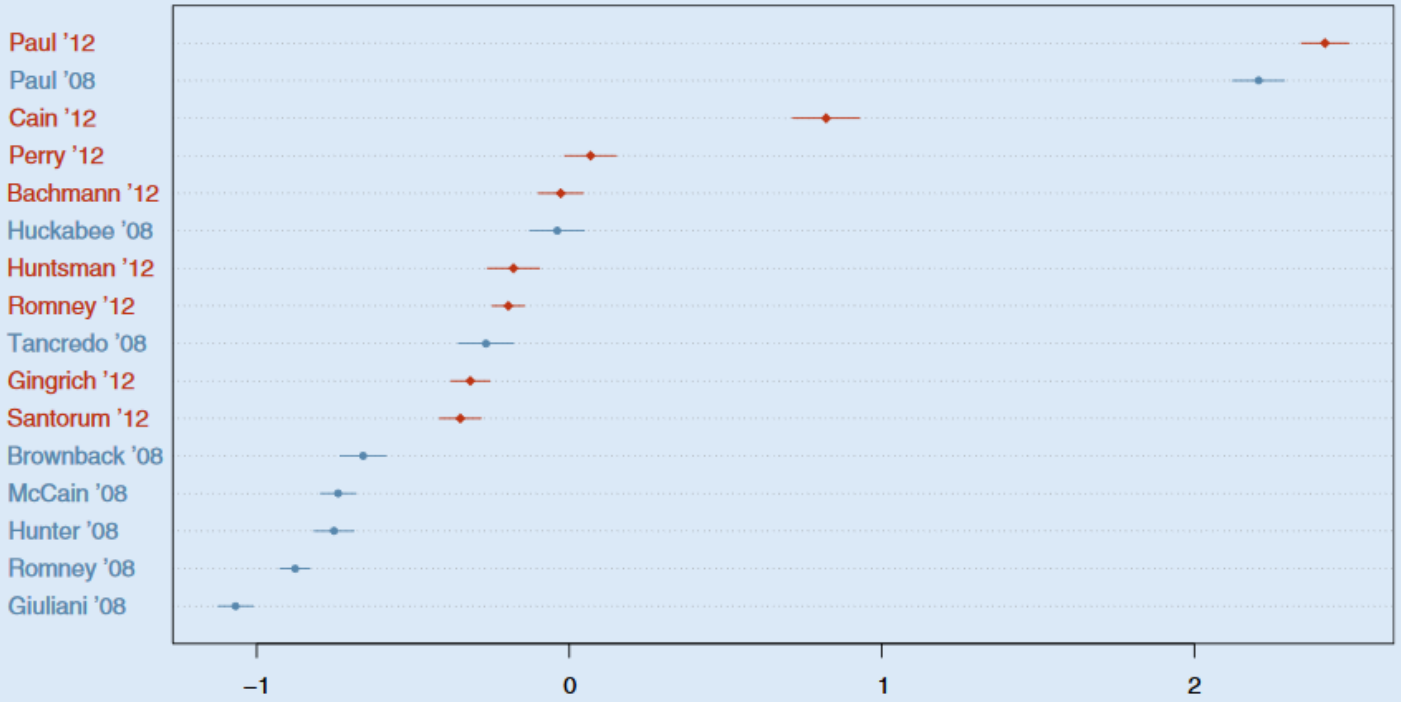
Figure 5: Estimated Ideal Points for Key Political Actors



Ideational scaling of twitter users, in Barberá, Pablo. 2015. "Birds of the Same Feather Tweet Together: Bayesian Ideal Point Estimation Using Twitter Data." *Political Analysis* 23(1):76–91.

Figure 1

Candidate Positions



Candidate positions extracted from their pre-Iowa debate speeches with bootstrapped 95% confidence intervals (1,000 replications). 2008 candidates denoted by circles (blue) and 2012 candidates by diamonds (red).

Unsupervised scaling of US politicians, in Medzihorsky, J., Littvay, L., & Jenne, E. K. (2014). Has the tea party era radicalized the republican party? Evidence from text analysis of the 2008 and 2012 republican primary debates. *PS: Political Science & Politics*, 47(4), 806-812.

Where to get data

- already existing datasets (party manifesto data, un speeches, etc)
- news aggregators (lexis nexis is the cheapest)
- webscraping websites (rvest for R, beautilfulsoup for Python)
- replication data repositories
- social/news media APIs (Twitter, NYT, etc.)
- Optical Character Recognition (OCR)

using R for QTE

Why R?

- Open source and free
- Designed for statistical analysis
- Widespread use in academic and data science community
- Great transferable skillset
- Huge and versatile package ecosystem

For the next week

Download and install R and RStudio (both free)

- Download R for windows from here: `https://cran.r-project.org/bin/windows/base/`
- Download R for OSX from here: `https://cran.r-project.org/bin/macosx/`
- Download RStudio: `https://www.rstudio.com/products/rstudio/download/`

What we'll do with R

- Learn the basic operations for handling data in R
- Learn to use packages designed for text analysis and handling texts
- Learn how to write papers/reports in R in publication quality