Exercise 1: Information Coding & Data Structures

Exercise 1 for the lecture ‘Foundations of Data Science’

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This session covers

- General data science process
- Introduction to git
- Introduction to our working case
- Data import in R

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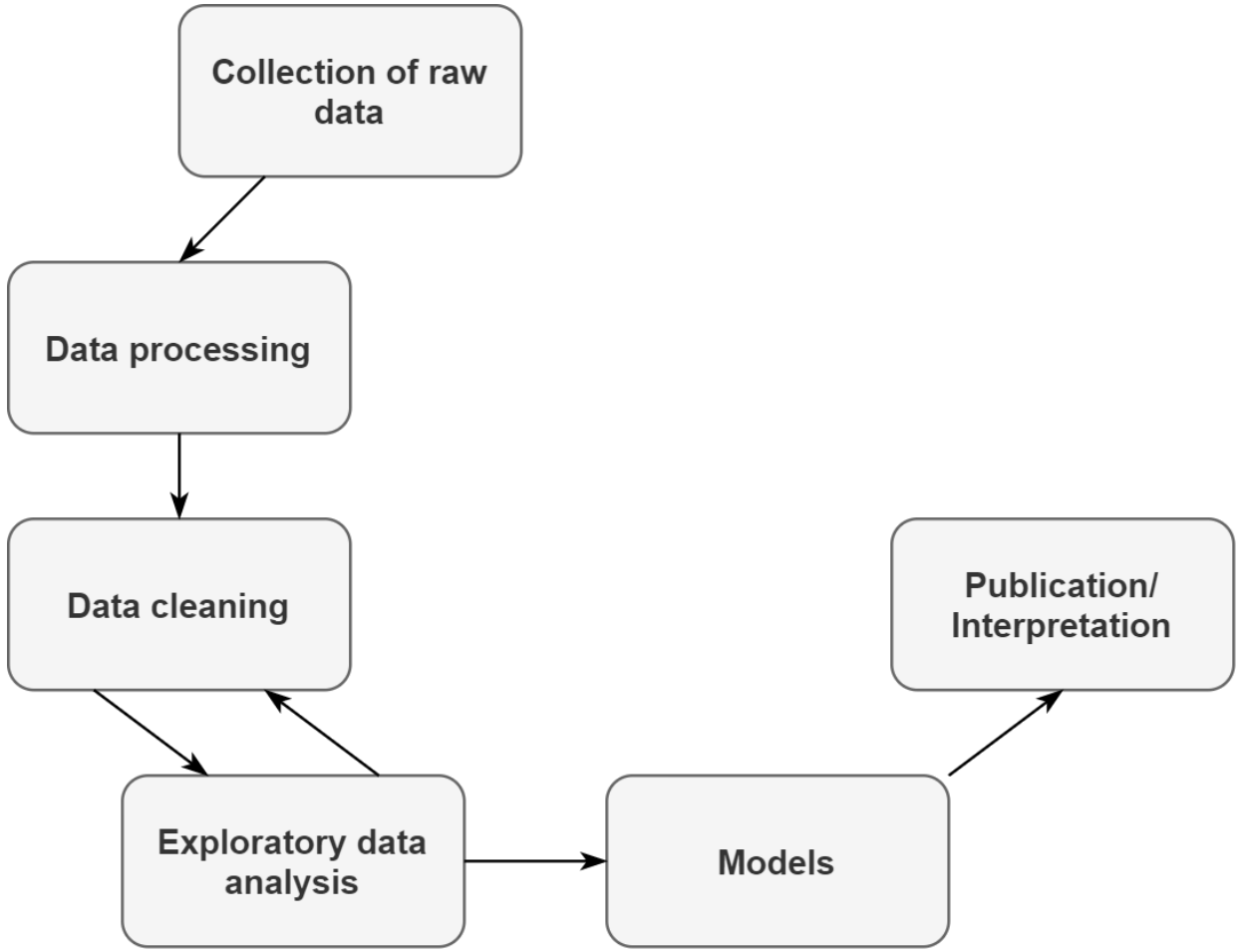
Data science process

Data science process

"Make sense of new and/or large data and communicate insight"

- Access innovative and large data resources
- Process data to make it machine readable
- Use statistical methods or machine learning to detect structure in the data
- Provide meaningful insights into data



Data science process

- What is good science?
- **peer review**, **transparency** and **replicability** (Apart from other criteria)
  - Karl Popper (1934): “non-reproducible single occurrences are of no significance to science”
  - Emphasizes the need for publication of employed methods, documentation of the data collection and cleaning process, and the provision of datasets.

Data science process

- Why is reproducibility in data science difficult?
  - Available resources (e.g. computing power, storage)
  - Data on the Internet often in flux (e.g. websites change, Tweets get deleted…)
  - Permission to use data (e.g. Facebook data)
- Git is one way to improve on one part of the reproducibility crisis: make method transparent and easily accessible.

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Introduction to git

Git (Version control)

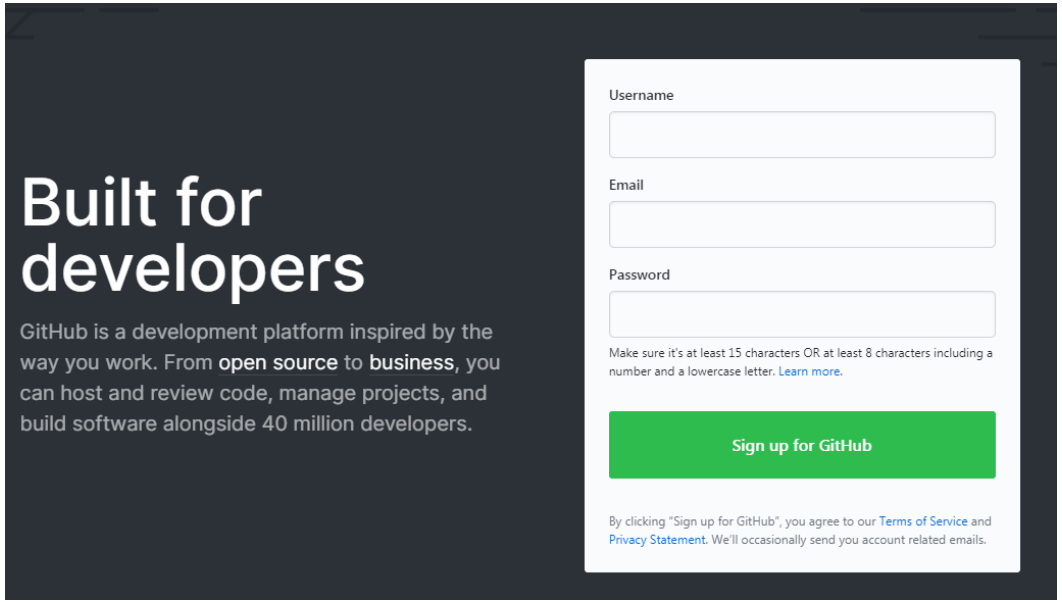
- The ‘Dropbox’ for programming
- Documents the different stages (versions) of files
- Makes it easy to track changes and restore previous versions.
- Enables controlled collaborations with others
- Eases the publication of work and increases transparency

Popular platform: Github (alternatively: bitbucket)

- Go to https://github.com/
- Select your role (student) and the purpose of usage and confirm the email.
- Create your first repository

  e.g. `github.com/philippklinguzh/datascience`

- Download and install git
  - Use notepad++ to edit (https://notepad-plus-plus.org/downloads)
  - Enable 3rd party software
  - OpenSSL library
  - Checkout Windows-style
  - Use MinTTY
  - Enable file system caching and enable Git credential manager



Version control with git

- Two possibilities:
  - download existing data from a repository
  - Initialize repository from data from your computer

- Let's add some data to your repository
  - Create a folder where you want to have your repository saved (`C:\Philipp\Documents\git`)
  - Open git bash/console
  - Navigate to the folder

    ```
    cd C:/Philipp/Documents/git
    ```

    (make sure to change the \ to /)

Version control with git

```
git clone https://github.com/username/name_of_repository.git
```

- Create a file in a folder of your choice (*test.txt*)
- Store your account information

```
git config --global user.email "YOUR GITHUB EMAIL"
git config --global user.name "YOUR GITHUB NAME"
```

- Check the status of all files in this repository

```
git status
```

- Add the file to the current list of files to be committed and check status again

```
git add test.txt
git status
```

Version control with git

- Commit your changes and add a message/description to the commit

```
git commit -m "Initial upload"
```

- Upload (“push”) your local changes to the repository

```
git push
```

- Inspect your changes by visiting your repository in the web browser
- Open your *test.txt* file and insert some text, then save it
- Check the status of all files in this repository again. You should see now that *test.txt* has changed.
- Repeat the previous steps

```
git add test.txt
git commit –m “Added some text to the test.txt”
git push
```

Version control with git

Version control with GitHub

– You can apply for educational discount (GitHub Pro for free):

https://education.github.com/

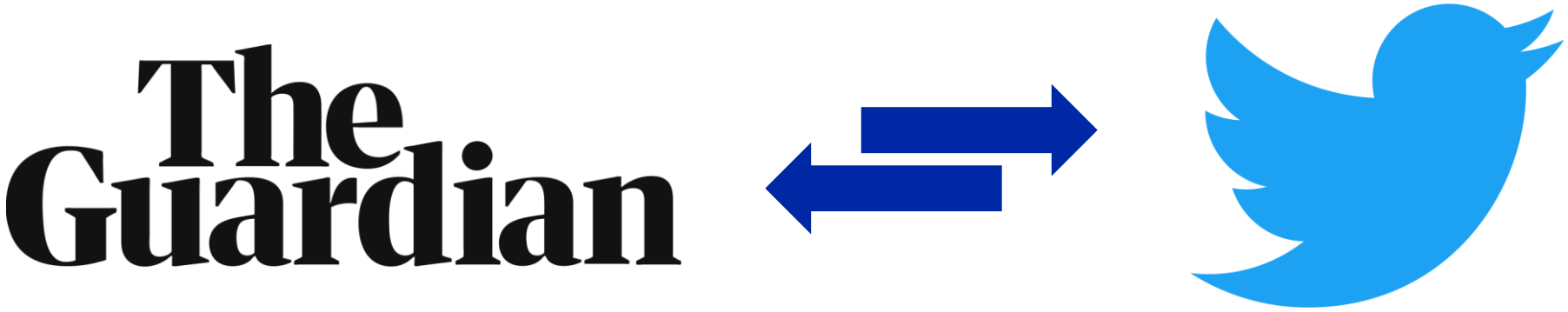
Introduction to our working case

Introduction to our working case

- While we talk about the case, you may already install the required packages for today's exercise.
  - `git clone https://github.com/css-zurich/fds-2020-exercise.git`
  - Open the Rmarkdown file "ex1/exercise1.Rmd" in Rstudio
  - Run the first lines of code

Introduction to our working case

- Hypothetical use case: How do characteristics of news articles relate to reactions on social media?
- Our two examples: The Guardian for news and Twitter for social media data



Introduction to our working case

- Goal: combine news data with social media data
- There are already established packages in R that retrieve data from these platforms. However, we will use these platforms to build some applications from scratch and demonstrate core concepts of data science using R.
- Keep in mind: before starting to build your own application, do some research on existing work. Often there are already established ways that work efficiently.
- After the five exercises you will be able to…

  …manage and process data efficiently.

  …manipulate text into formats that you can work with.

  …read data from websites into R.

  …retrieve data from application programming interfaces (APIs)

Introduction to our working case

Why use the Internet to collect data?

- Has a plethora of useful data sources:
  - Government publishes data (e.g. speeches, voting…)
  - Social media data to analyze human communication
  - News data for public discourse and attention to events
  - User interactions with e.g. products (Amazon reviews), Films (IMDB)…
- Why is this relevant?
  - Re-evaluation of existing research with new data
  - Enables entirely new research questions
  - Cost and time efficient
  - Theoretically easily reproducible

Introduction to our working case

Why use the R?

- Free and open source
- Excels in data visualization and application of statistical methods
- Also: can be used to collect data on the Internet

➡ Can be used at every stage of our workflow (no need to switch programs)!

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Data import in R

Data import in R

- You can save R objects (e.g. a dataframe) in in .Rda-files
- You use “load()” to import an .Rda file into R.

- Most datasets will not be prepared for R (e.g. .csv-files, Excel files, etc.) and we will learn in the next exercise more about those ways.

Outlook

- There are many packages suitable to load specific types of data into R:
  - **jsonlite**: for JSON data
  - **xml2**: for XML data
  - **readr**: for Text data
  - **haven**: for SPSS, SAS, Stata files
  - **readxl**: for Microsoft excel files (.xls or .xlsx)
  - **DBI**: for connections to data bases
  - **httr**: to retrieve data from APIs
  - **rvest**: to retrieve data from websites/html