Data Science and Data Analytics

Getting started

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Course design

Welcome to Data Science and Data Analytics!

- This is **B-GV-12 Data Science and Data Analytics**.
- The goal of this course is to teach you…
  - about the nature and role of data science in a data-driven world.
  - about the data science workflow.
  - to use open-source software to analyse, visualize and model data from various sources.
  - about different machine learning algorithms.
  - to implement your own data science projects.
  - to communicate the results of your analyses effectively.
  - and much more…

Lectures

- With a few exceptions, lectures will be held on **Fridays from 13:30 to 16:30**.
- Please regularly check your course schedule to not miss any lectures.
- Lectures will consist of theory and practice discussed with the help of **slides** as well as **live coding sessions**.
- You are highly encouraged to **actively participate**!
- Exercises to practice what you have learned will be provided (but not graded).

Grading

- There will be **no** final exam in this course!
- Instead, grading will be based on **group projects**:
  - Teams of 4 - 5 students will initiate and design a small data science project autonomously.
  - Each group will:
    - identify a business case mimicking a real-world research problem and an accompanying available data set.
    - formulate research questions on the basis of the chosen data set.
    - perform analyses using the concepts and methods learned throughout this course.

Grading

- Grading will therefore be based on the following components:
  - **Group project report** (5-10 pages per group member): **65 %**
  - **Group presentation** ($\leq$ 20 mins/group and $\geq$ 2 mins/group member): **25 %**
  - **Peer review: 10 %**
- In line with the usual grading scheme, grades will be given as follows:

Percentage	Grade
95 - 100 %	1,0
90 - 94 %	1,3
85 - 89 %	1,7
80 - 84 %	2,0
75 - 79 %	2,3
70 - 74 %	2,7

Percentage	Grade
65 - 69 %	3,0
60 - 64 %	3,3
55 - 59 %	3,7
50 - 54 %	4,0
below 50 %	5,0

Grading: Group project

- The **structure** of the group project (reflected in report and presentation) should be something like this:
  - Introduction / Motivation and research question
  - Data (sources, description, statistics, visualizations, …)
  - Models and model evaluation
  - Results
  - Discussion and comments
- Aspects that will influence your grade will be: the originality of the question, understanding of the business case, data and methods, correctness of application, thoroughness of evaluation, creativity and quality of report and presentation (both verbal and visual)
- Deductions will be made for purely AI-generated contributions.

Grading: Group project

Choice of topic: while you are completely free in your choice of topic in the group, here are some areas of suggestion:

- Finance / Economics / Marketing
- Text analysis
- Entertainment (in particular: movies and music)
- Social network analysis
- Social sciences

Sources for data sets: while you are again free also in your choice of data set, good places to get you started are:

- Statistik Austria
- Kaggle
- UCI Machine learning repository
- World bank
- EU
- …

Caution

When selecting a data set, make sure, you are **allowed** to use this data for the purposes of your project! When selecting from the sources given, this should generally be ensured.

Grading: Peer review

- After final project presentations, each **individual** student will be asked to write a **peer review** of one of the other groups' projects.
- Each student will be randomly assigned **two projects**, out of which **one** should be reviewed (based on their presentation only).
- Evaluation is based on the **quality of review** that you write, not on the feedback that your project receives.
- The review should be **max 250 words** answering the following questions:
  - Briefly describe the topic, research questions and the employed methods.
  - State and briefly explain two positive comments about the work.
  - State and briefly explain two improvement suggestions.

Important

In your peer review, focus on **content**, not on the formatting or quality of the slides, for instance.

Schedule

March

14th: Getting started, Introduction to Data Science (DS)

21st: The essentials of R programming

31st: The DS workflow – Part I: Import, Tidy and Transform

April

4th/11th: The DS workflow – Part II: Visualize

30th: The DS workflow – Part III: Model

May

6th/9th/16th/23rd: The DS workflow – Part III: Model

28th: The DS workflow – Part IV: Communicate

June

6th: Buffer session

13th: Final presentations of the group projects

Deadlines

- **21st March**: organize in teams, send team members via e-mail
- **12th June**: Send presentations via e-mail
- **27th June**: Hand in group project reports and peer reviews

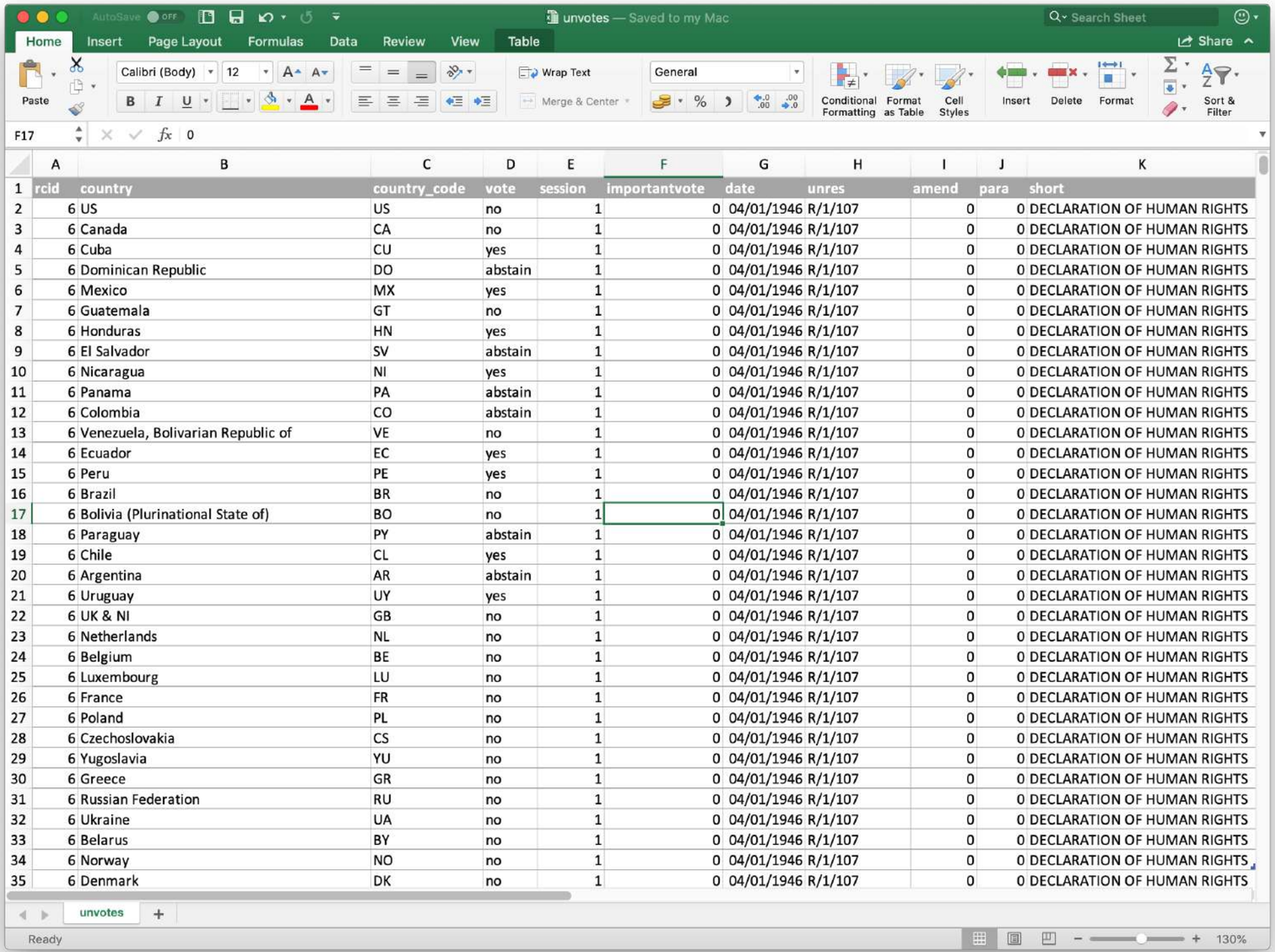
Questions and contact

- Any questions?

- Contact:
  - Anytime via e-mail: julianamonphd@gmail.com

Course toolkit

Software – Excel? ❌



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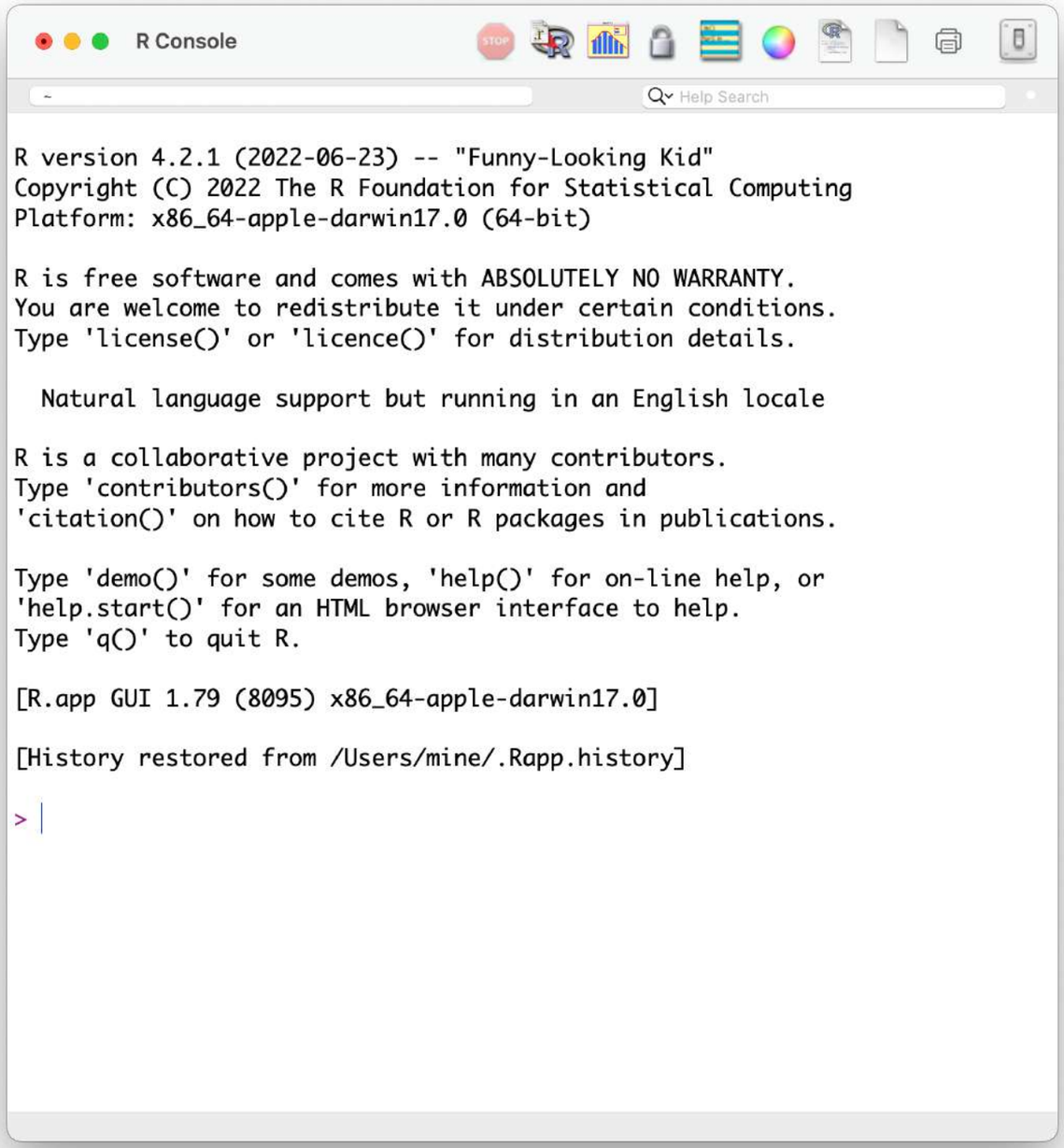
Software – R ✅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Platform: x86_64-apple-darwin17.0 (64-bit)
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R is a collaborative project with many contributors.
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Type 'demo()' for some demos, 'help()' for on-line help, or
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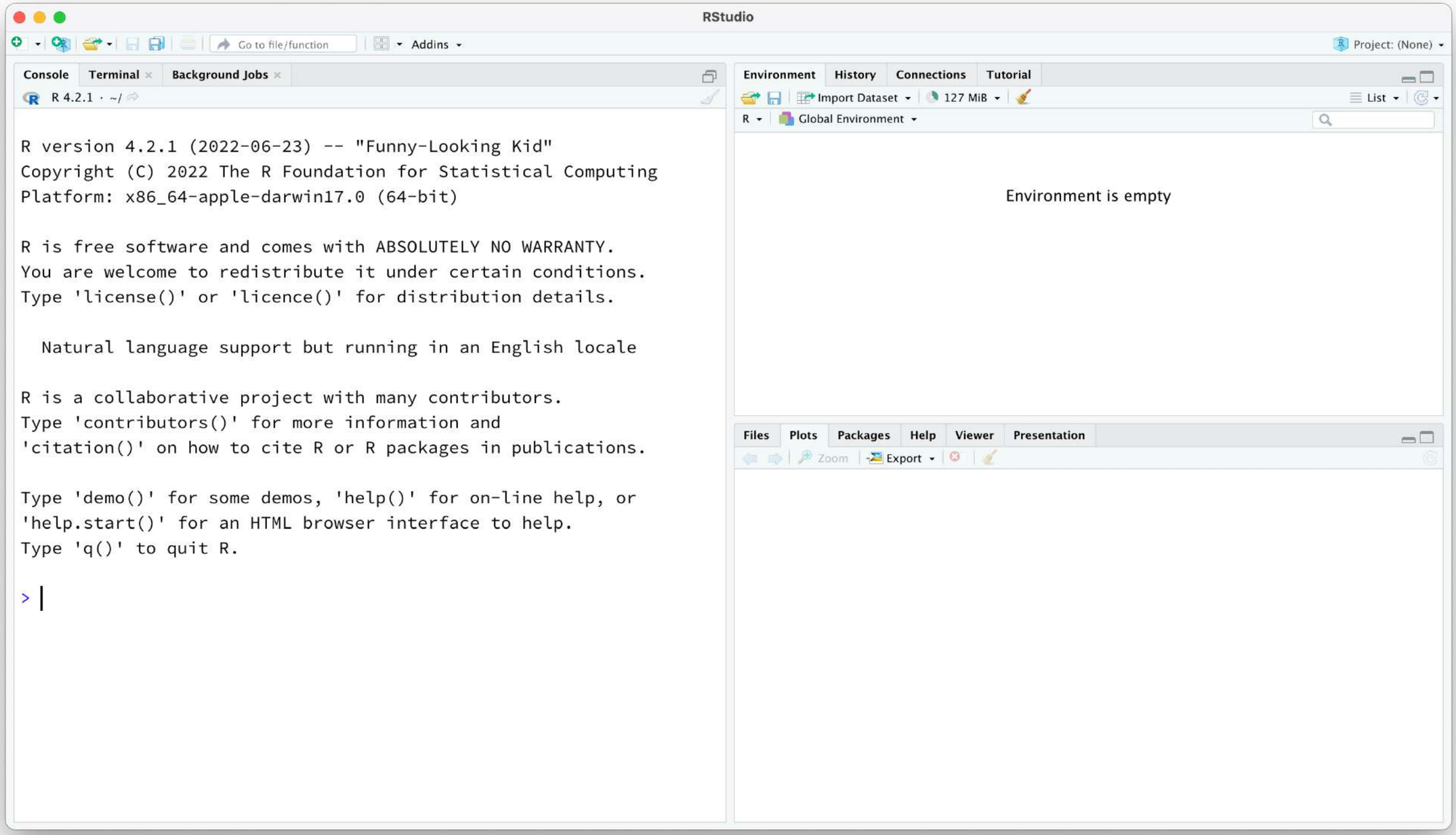
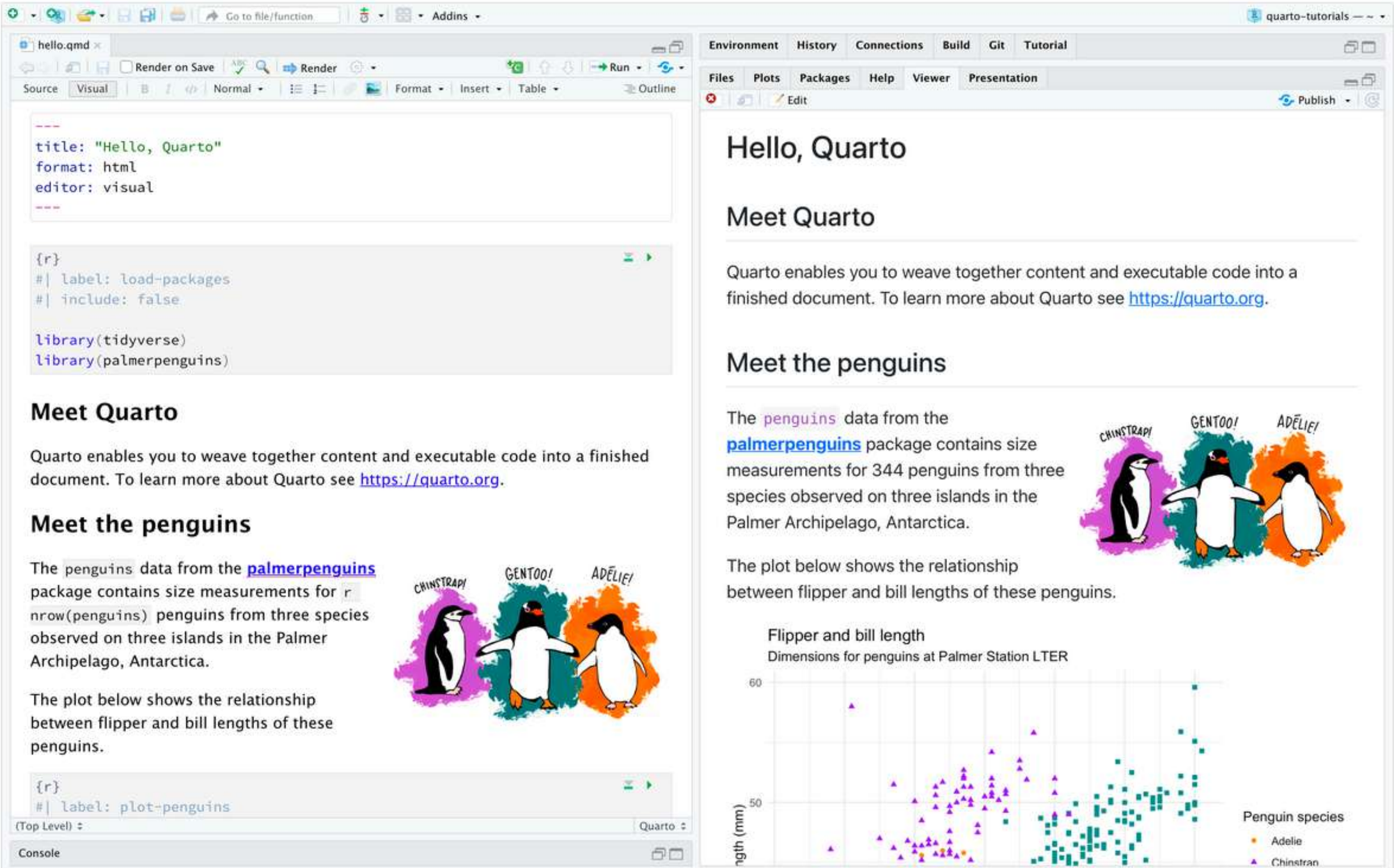
Software – RStudio ✅



Software – Quarto ✅



Software

- Modern data science is unthinkable without **computer programming**: typically, either Python or R is used.
- For the purposes of this course, we will use:
  - The open-source statistical programming language R.
  - A bespoke integrated development environment (IDE) for R called RStudio.
  - An authoring framework for creating beautiful reports, presentations, web sites, etc., combining text, code, results and visualizations, called Quarto.
- Until next time, therefore please
  - either **install** R, RStudio and Quarto on your laptop (recommended) or
  - register for a free account at Posit Cloud.

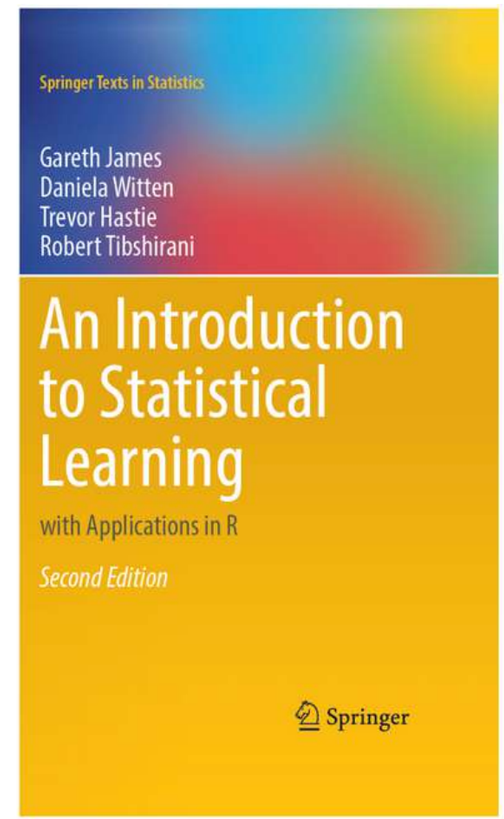
Resources

- **Primarily**: slides and exercises provided
- However, for a deeper dive and additional materials, I recommend:

For R programming

Excellent courses from Harvard Professor Rafael Irizarry, available for free here and here.

For machine learning



Excellent book, available for free here.

Resources – How about AI?

- With the large-scale adoption of AI tools like **ChatGPT**, the way data scientists work is rapidly changing.
- This course therefore **actively encourages** the use of AI tools for R programming. Here are some guidelines:
  - Use ChatGPT for **programming**, not for writing the project report.
  - Do **not** just copy-paste code generated by ChatGPT. Run it line-by-line, try to understand and edit as needed.
  - Engineer your prompts until the response starts to look like code you are learning in this course.
  - If the response is not correct, ask for a correction.
- With the arrival of AI, programming is becoming ever more **accessible**, but the need for people like you who actually **understand** the code they are running, is also increasing.

Resources – How about AI?