

Data Visualization

Winter Term - 3 ECTS

Elective Course

Prerequisites to Enrol

Students should be familiar with R programming and have some knowledge of basic statistical concepts.

Overview and Objectives

The course deals with the visualization of all kinds of data sets, from small to very large, as a means of communicating relevant patterns in the form of graphical displays, as well as supporting the interpretation and understanding of the data itself.

The first five weeks deal with "exact" data visualization and visualization of simple data summaries. We begin by covering topics on visual literacy, exploring the graphical elements used to create effective data visualizations, and rooting the choice of graphical display in the purpose for which it is intended. Next, we explore methods for visualizing univariate, bivariate and multivariate data types, as well as tools for preparing the data. The last five weeks cover advanced techniques for visualizing temporal and spatial data, designing interactive web apps, "approximate" data visualization using multivariate techniques, and ML model interpretability.

Prerequisite reading / requirements

To Be Announced.

Course Outline

Week 1

- Introduction to visual literacy • Identifying key factors and learning about data • Basic principles of data presentation and color theory • Taxonomy of data visualization methods • Tufte's principles of scientific graphics

Week 2

- R programming basics • Guide to using dplyr • Guide to using tidyr • R base graphics

Week 3

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- Introduction to ggplot2 • Basic plot types • Grammar of Graphics (ggplot2)

Week 4

- Mappings • Layers • Scales • Facets • Themes • Visualization of multivariate data • Revealing uncertainty • Dealing with overplotting

Week 5

- Advanced techniques and tools for visual representation of temporal data (part 1)

Week 6

- Advanced techniques and tools for visual representation of temporal data (part 2)

Week 7

- Advanced techniques and tools for visual representation of spatial data (part 1)

Week 8

- Advanced techniques and tools for visual representation of spatial data (part 2)

Week 9

- Designing interactive web apps with Plotly and Shiny

Week 10

- Data visualization in action (various real-life use cases) • ML applications and model interpretability

Required Activities and Evaluation

- Homework during the course (40%) • One short practical project, done individually, at weeks 9-10 (50%).
- Class attendance/participation (10%)

Competences

To be announced

Learning Outcomes

To be announced

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Materials

Recommended Books:

Online links to relevant material on the web (visualization examples, readings, videos) will be given as well as the class material and homeworks.

For an introduction to the visualization of multivariate data, you can consult the following books, all available for free download:

Blasius, J. and Greenacre, M. (2014). Visualization and Verbalization of Data. Chapman & Hall / CRC.

Cook, D. and Swayne, D.F. (2007). Interactive and Dynamic Graphics for Data Analysis. Springer UseR! Series

Greenacre, M. (2016). Correspondence Analysis in Practice, 3rd edition. Chapman & Hall / CRC.

Maindonald J. and Braun J. (2003). Data Analysis and Graphics Using R. Third Edition. Cambridge University Press.

Wickham H. and Grolemund G. (2016). R for Data Science - Import, Tidy, Transform, Visualize, and Model Data. First Edition. O'Reilly Media,

Wickham H. (2016). ggplot2. Elegant Graphics for Data Analysis. Second Edition. Springer UseR! Series.

Zettl, H. (2011). Sight Sound Motion. Applied Media Aesthetics. Sixth Edition. Wadsworth.

Recommended Articles:

To be announced