Team project:

Programming Statistical Illusions in R with ShinyApps

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Abstract

The goal of this team project is to develop a collection of simple, interactive apps that illustrate common illusions (i.e. paradoxes, problems, fallacies) within probability theory and statistics. These should later be used as didactic supplement for the statistics lecture (B.Sc. Kognitionswissenschaft).

1 Structure

The project will be structured in two phases: The first phase will consist of theory sessions covering (a) the details of specific statistical illusions and (b) the main programming tools we will later use. In the second phase the actual development of the ShinyApp will take place. This phase will follow a 'scrum light'-like structure with several sprints.

1.1 Theory Sessions

During the theory sessions each of you will give:

(a) A presentation of a statistical illusion (20 min + 5-10 min discussion).
The idea is that you do some research and get familiar with different illusions. A presentation should include the following:

- ☐ A short description of the illusion.
  This should also mention the historical background.
- ☐ What are conflicting views, intuitions, interpretations?
- ☐ What are proposed resolutions?
- ☐ At least one possible extension of the illusion that further illustrates its mechanism.
  For example changing one of the main variable's value.

This illusion can but does not need to serve as basis for an individual sub app in the development phase.

(b) A tutorial on a programming tool (20 min + 5-10 min discussion).
The idea is that you distribute knowledge among each other and make sure all team members are on the same page. A tutorial should include the following:

- ☐ A short introduction of the tool.
- ☐ A demo of key features.
- ☐ A cheat sheet.
- ☐ A simple homework exercise.
  This homework exercise should be reviewed by you until the next session. Please give short feedback (1-5 min) in the next session.

For both, presentation and tutorial, you have the opportunity to get feedback by me beforehand. For that, please contact me via email (until Wednesday evening the latest).

1.2 Development Phase

In this phase you will develop as a team **one** collective ShinyApp that bundles several sub apps each illustrating one statistical illusion. This phase will be organized according to scrum and consist of 5 sprints (normally 2 weeks long). Each sprint will usually consist of the following meetings:

1. Planning meeting
2. Intermediate meeting
3. Review (+ Retrospective) meeting

In this phase I will primarily act as 'product owner' giving you specification of features the product should have. In each sprint, one of you takes the role of the sprint leader organizing and documenting the development. It may also be helpful to organize additional tutorials for certain topics in this phase. Overall, you have a lot of choices here, and this is where the *real* team project happens.

2 Tools

We will use `git` and `github` for (collaborative) version control. For programming we will use `R` (I recommend you use `RStudio` for that). For buildung the interactive apps we will use the R-package `shiny`. For project management we will use `scrum`-like principles. In our github repository you will also find all shared materials: `https://github.com/fgoepp/tp24-statistical-illusions`.

3 Grading

The final grade will be made up as follows:

15%	presentation
15%	tutorial
15%	description text for illusion in the final product (more details tba)
55%	overall performance in the development phase: including sprint leading, code contributions, code reviews and potential tutorials

4 Attendance

Attendance is mandatory. Please send me a doctor's certificate if you miss a session due to sickness.

5 Schedule

Theory sessions will begin at 10:00 and end at 12:00. Sprint meetings will usually also take place in this time window but can also be more flexible.

19-04	Introduction
26-04	Theory Session 1
03-05	Theory Session 2
10-05	Kick-off / Sprint 1 planning
17-05	Sprint 1 intermediate
24-05	no meeting (pentecost break)
31-05	Sprint 1 review / Sprint 2 planning
07-06	Sprint 2 intermediate
14-06	Sprint 2 review / Sprint 3 planning
21-06	Sprint 3 intermediate
28-06	Sprint 3 review / Sprint 4 planning
05-07	Sprint 4 intermediate
12-07	Sprint 4 review / Sprint 5 planning
19-07	no meeting
27-07	Final project presentation

6 Content of Theory Sessions

Theory Session 1

Presentation Statistical Illusion 1 (by Immanuel)
Presentation Statistical Illusion 2 (by Niman)
Tutorial git and github (by Hossein)
Suggested resources: `https://rogerdudler.github.io/git-guide/`
+ `https://docs.github.com/en/get-started/quickstart`
Homework requirement: check out team project repository
Tutorial R (by David)
Suggested resources: `https://www.statmethods.net/r-tutorial/index.html`
Homework requirement: use dataframes, plot data
Suggestions, announcements, ideas

Theory Session 2

Presentation Statistical Illusion 3 (by David)
Presentation Statistical Illusion 4 (by Hossein)
Tutorial Shiny (by Niman)
Suggested resource: `https://shiny.rstudio.com/tutorial/#get-started`
Homework requirement: create a simple ShinyApp + a pull request for it
Tutorial Scrum with github (by Immanuel)
Suggested resources: `https://scrumguides.org/scrum-guide.html`
+ `https://github.com/se-tuebingen/teamprojekt-vorlage`
Homework requirement: let team members interact with a sprint board on a github repository
Suggestions, announcements, ideas