

Title:

Practical use of statistical and numerical methods

Course Description and Objectives:

The aim of this course is to equip students with a toolbox of statistical and numerical methods, enabling them to effectively achieve their scientific goals. Emphasis will be placed on good practices in collaborative work, allowing students to operate more productively within modern research teams. The selected topics also provide a deeper understanding of others' work, helping students gain confidence in their own scientific pursuits.

Prerequisites:

No prior experience in the topics listed below is required. Students will need to bring their own computers with the necessary software installed, as specified before the start of classes.

Course Contents:

- * Collaborative tools (git, github, indico, googledoc, ...)
- * Basics of Bash Unix shell and related scripting language, computing farms
- * Python (basics)
Note: Python is introduced as an example of a programming language used in science. All exercises and projects in later segments of this course can be completed in any programming language chosen by the student.
- * Selected analysis framework
- * Fitting methods, including genetic algorithms
- * Propagation of uncertainties and Monte Carlo techniques
- * Elements of machine learning (artificial neural networks and decision trees)
- * Introduction to Mathematica (used e.g. to solve symbolic expressions)

Hours:

3h/week, 45h in total

In person, typically 1.5h of lecture followed by 1.5h of supervised hands-on exercises.

Grading Policy:

Students will pass this course by completing three minor personal projects (related to Bash, Python, analysis framework) and one major project (focused on machine learning). The latter will be completed in small groups. Each project will be graded on a scale from 2 to 5 (with 0 for non-submission). To pass the course, the arithmetic mean of these scores must be greater than 3. The final grade will be determined using the half-round-up arithmetic mean. Students with advanced knowledge in a particular topic may request to complete personal projects extramurally.

Points:

6 ECTS