Import module

[E1.10]	Modern Statistical Data Analysis for Practitioners	Compulsory elective module	5 CP (total) = 150 h		4 SWS
			Contact hours 4 SWS / 60 h	Independent study 90 h	

Content

We introduce the basics of probability theory, classical statistics, and classical error analysis (p-values, confidence intervals), which serves as the starting point to explore modern methods of statistics (Maximum Likelihood, Bayes). We use these methods to extract information from noisy data through (non-) linear parameter estimation (fitting) and model comparison. We show how to analyze data containing dynamical information by time series analysis (correlation functions, error analysis) and Markov-Chain models and kinetic models described by rate equations. We introduce and discuss the main concepts of machine learning and discuss supervised and unsupervised learning. We introduce and discuss clustering methods to analyze high-dimensional data. We give a primer on neural networks and how to train them by using state-of-the-art software.

Learning outcomes and skills

The overarching goal is to equip the students with the necessary statistical tools to extract information from noisy data reliably and with quantified uncertainties. The students should be able to identify the common pitfalls of statistical data analysis in their own work and be able to critically assess the quality of published data and statistical analysis. In the practical course, students learn the tools to achieve these goals in practice.

Admissions requirements/Conditions for participation in the module/courses

None

Recommended prior knowledge

Basic knowledge of physics and mathematics. Programming experience in any language is desirable. In the practical course, we read, minimally adapt, and run Python code.

Organizational details

Import module, the registration and cancellation deadlines of the Bachelor's/Master's Biophysics regulations apply. (The exam requires online **registration**, no later than **seven days** before the exam date. You can withdraw up to one working day before the exam date without giving reasons.)

Module allocation (degree programme/faculty)	Master Biophysics / FB13
Eligibility of the module for other courses	Master Chemistry / FB14, Master Biochemistry / FB14
Module offered	winter semester
Duration	1 semester
Module coordinator	Dr. Jürgen Köfinger, Dr. Roberto Covino, Dr. Jakob T. Bullerjahn
Course requirements for credits	
Participation record	Tutorial: Regular and active participation, processing of the tutorials
Coursework	Oral exam (30 min.) or written exam (120 min.)
Forms of teaching / learning	lecture, tutorial
Language teaching and instruction	English
Module assessment	**Form / duration / content, if applicable**
Final module assessment	None
Cumulative module assessment consisting of	
Composition of the module grade for cumulative module assessment	

	Mode of teaching / study	Semester hours per week	Semester CP			
			1	2	3	4
Modern statistical data analysis for practitioners	L+T	2.5+1.5	5			
TOTAL		4	5			