

Advanced statistical methods in scientific research
Zaawansowane metody statystyczne w badaniach naukowych

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45 hours – lectures and tutorials

3 ECTS. Exam.

Overall plan of lectures:

1. **Basic concepts of the probability theory:** random experience, random events, random variable (introduction of the concept), random sample, population, probability concept, combinatorics
2. **Probability:** definitions, conditional probabilities, independent events, total probability, Bayes theorem
3. **Random variable:** definitions and examples, cumulative distribution function, probability density function, empirical and theoretical characteristics of a random variable
4. **Distributions of random variables:** estimators, statistical moments, discrete, continuous and mixed distributions, selection of distribution to a random sample, estimation of distribution parameters
5. **Monte Carlo methods:** definitions, use, types, jackknife and bootstrap resampling
6. **Multivariate random variables:** definitions, cumulative distribution, boundary distributions, statistical moments, multidimensional normal distribution as an example of a multivariate distribution, covariance, correlation, conditional distributions, linear and non-linear regression, copulas
7. **Statistical inference:** definitions, verification of hypotheses, power of statistical tests, examples of statistical tests
8. **Basics of programming language R:** introduction, examples and exercises
9. **Stochastic models:** stochastic process, ARMA, ARIMA