

Inferential Statistics and Test Theory

Objectives

Introducing the theoretical background of Mathematical Statistics. Learning how to build, judge the performance, improve and compare the statistical procedures of point estimation, interval estimation and hypotheses testing.

Contents

1. Statistical model
 - a. Definition, parametric and nonparametric models
 - b. Sampling models
 - c. Exponential families
 - d. Location-scale families
2. Point estimation
 - a. Statistics and estimators
 - b. Classical methods of obtaining estimators: empirical estimation, method of moments, maximum likelihood method
 - c. Criteria to judge the performance of estimators: consistency, bias, risk, Fisher information, Cramer-Rao inequality
 - d. Improving estimators: sufficient statistic, Rao-Blackwell and Lehmann-Scheffé theorems
 - e. Asymptotic behaviour: Asymptotic normality, δ -method, the particular cases of the empirical estimators, the maximum likelihood estimators and method of moments estimators
3. Interval estimation
 - a. Exact confidence intervals
 - b. Asymptotic confidence intervals
4. Testing statistical hypothesis
 - a. Introduction and definition : hypothesis, test statistics and critical regions, type I and type II errors, level of significance, power, p -value, bias, UMP tests, asymptotic tests
 - b. Parametric tests: Neyman-Pearson Lemma, nonrandomized and randomized tests
 - c. The particular case of gaussian samples: Hypothesis about the mean, hypothesis about the variance
 - d. Nonparametric tests: Kolmogorov test, χ^2 tests, Kolmogorov-Smirnov test, Mann-Whitney test

Evaluation

According curriculum 2009-2010 :

- ES : 2-hour final written test during the last week of the semester)
- *Reexamination session (September) : 2h written test*

Textbooks

- J. Shao, *Mathematical Statistics*, 2nd edition, Springer, 2003
- R. Bartoszynski and M. Niewiadomska-Bugaj, *Probability and Statistical Inference*, Wiley series in Probability and Statistics, 1996.

Characteristics

- 6 ECTS credits
- Compulsory course for master in statistics
- Autumn Semester
- Course : 2 hours / Exercises : 2 hours
- Prerequisite : Probability Theory

Teaching team

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Exercises