MASTER OF SCIENCE IN WEALTH MANAGEMENT
MAÎTRISE UNIVERSITAIRE EN GESTION DE PATRIMOINE

ADVANCED STATISTICAL INFERENCE (S403109)
Prof. Elvezio RONCHETTI
6 ECTS
Semester: Autumn
Teaching language: English

Objective
Statistical inference is presented by covering the theory and the applications at an advanced level. In the first part we focus on the general theory of estimation, tests and confidence intervals by deriving in particular the asymptotic properties of the maximum likelihood estimator and the likelihood ratio, Wald, and scores tests (and their generalizations). The results for some important models are discussed in detail. In the second part we give an overview on some recent developments including e.g. robustness and resampling techniques. The seminar is part of the course. It is compulsory.

Description
1. Introduction
1.1. Statistical models
1.2. Review of some probability concepts (conditional expectation)

2. Principles of data reduction
2.1. Sufficiency
2.2. Ancillarity
2.3. The likelihood principle
2.4. The fiducial argument

3. Optimal estimators
3.1. Unbiasedness
3.2. Stein estimator
3.3. Bias reduction; jackknife and crossvalidation
3.4. Rao-Blackwell theorem and exponential families
3.5. Application to linear models
3.6. Cramér-Rao inequality
3.6.1. Univariate case
3.6.2. Multivariate case

MASTER OF SCIENCE IN WEALTH MANAGEMENT
MAÎTRISE UNIVERSITAIRE EN GESTION DE PATRIMOINE

4. Maximum likelihood and M-estimation
4.1. Introduction
4.2. Examples; the logit model
4.3. Optimality properties
4.4. Consistency
4.5. Asymptotic normality
4.6. Quasilikelihood, profile likelihood
4.6.1. Quasilikelihood
4.6.2. Profile likelihood
4.7. GMM estimation
4.8. E-M algorithm
4.9. Model selection

5. Tests and confidence regions for general parametric models
5.1. Principles
5.1.1. The Neyman-Pearson approach
5.1.2. P-values
5.1.3. Simple hypothesis and simple alternative
5.1.4. Asymptotic power and Pitman efficacy
5.1.5. Composite alternatives
5.2. Likelihood ratio, Wald, and scores test
5.2.1. Definition and interpretation
5.2.2. Asymptotic distribution under the null hypothesis
5.2.3. Asymptotic distribution under the alternative
5.3. Confidence regions
5.3.1. Problem and example
5.3.2. Definition and construction of confidence regions
5.3.3. Confidence regions and tests

6. Introduction to Bayesian statistics
6.1. Basic concepts
6.2. Prior and posterior probabilities
6.3. Bayesian confidence regions and Bayes estimators
6.4. Discussion

7. Robust statistics
7.1. Introduction
7.2. The influence function and the breakdown point
7.3. M-estimators and optimal robust estimators
7.4. Robust inference
7.5. Applications

8. Generalized linear models and generalized additive models

9. Second-order asymptotic theory
9.1. Basic concepts
9.2. Edgeworth expansions
9.3. Bootstrap techniques

Bibliography
* Azzalini A., 1996, Statistical Inference Based on the Likelihood, Chapman and Hall, London.
* Casella G. & Berger R. L., 1990, Statistical Inference, Duxbury Press, Belmont (CA).
* Cox D. R. & Hinkley D. V., 1986, Theoretical Statistics, Chapman and Hall, New York.
* Gourieroux C. & Monfort A., 1995, Statistics and Econometric Models , Vol. I and II, Cambridge University Press.
* Knight K., 2000, Mathematical Statistics,Chapman and Hall, New York.
* Silvey, S. D., 1991, Statistical Inference, Chapman and Hall, New York
* Welsh A., 1996, Aspects of Statistical Inference, Wiley, New York.

Assessment
Written exam

UNIVERSITÉ DE GENÈVE
GENEVA SCHOOL OF ECONOMICS AND MANAGEMENT

GENWeM
GEneva Master in Wealth Management

gfri
Geneva Finance Research Institute