

Institute of Statistics



STAT2413 Non parametric statistics

[22.5h+7.5h exercises] 5 credits

This course is taught in the 1st semester

Teacher(s): Ingrid Van Keilegom
Language: French
Level: Second cycle

Aims

The students will obtain knowledge about the basic concepts of nonparametric statistical inference. They will learn about elementary nonparametric testing procedures. They will be able to use these nonparametric procedures for analyzing real data, and this by using, for example, statistical software packages.

Main themes

The topics treated during this course are :

- The location problem: one sample
- Nonparametric estimation of a distribution function and a density function (via kernel method)
- Two independent samples: location and dispersion problems
- Goodness-of-fit tests
- Analysis of association (association measures)
- Order statistics and linear rank statistics
- Nonparametric inference for partially observed (censored) data

Content and teaching methods

Content

- Hypothesis tests concerning location and dispersion of a population, given an i.i.d. sample
- Detection of differences in location and/or dispersion between two populations
- Goodness-of-fit tests for checking whether an unknown distribution belongs to a given parametric family of distributions, or equals a specific parametric distribution
- Measures of association between two (or more) random variables
- The use of order statistics and rank statistics in nonparametric estimation and testing procedures
- Nonparametric estimation of a distribution function, a probability density and quantile functions
- Nonparametric estimation based on partial observations

Teaching methods

During the lectures we will explain for each of the statistical procedures the following :

the motivation behind a test statistic, how to obtain the distribution of the test statistic under the null hypothesis, and how to construct the testing procedure.

The aim is to get insight into nonparametric testing procedures and to learn about the different aspects of such procedures. At the end of the course the students have to work through some course work (a project) that will allow them to get more familiar with the use of nonparametric methods in practical applications, when for example analyzing real data.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)**Prerequisites**

Basic knowledge about probability and statistics: descriptive statistics, calculating probabilities, distributions, distribution function, probability density, means, variances (conditionally or not), linear regression, principles of parametric hypothesis testing

Evaluation

The evaluation consists of two parts: a project-work and an oral exam. The project concerns, among others, the use of nonparametric methods discussed in the course when analyzing real data, and the use of statistical software for getting answers to questions. A written report on the accomplished project and analysis of real data has to be provided. The oral exam consists also of two parts: questions about the project (defense of the project) and questions on the topics treated during the course

Teaching materials

There are course notes, as well as statistical tables for most nonparametric tests. Some material on statistical software packages for this course is also available.

Teachers

Professor: I. Gijbels, Tel: 010/474306

Teaching Assistant: A. Delaigle, Tel: 010/478828

References

Gibbons, J.D. (1971). *Nonparametric Statistical Inference*. McGraw-Hill, New York.

Hollander, M. et Wolfe, D.A. (1999). *Nonparametric Statistical Methods*. Second Edition. Wiley, New York.

Lehmann, E.L. (1998). *Nonparametrics: Statistical Methods Based on Ranks*. Revised First Edition. Prentice Hall, New Jersey.

Maritz, J.S. (1995). *Distribution-free Statistical Methods*. Second Edition. Chapman and Hall, New York.

Mouchart, M. et Simar, L. (1978). *Méthodes nonparamétriques*. Recyclage en statistique, volume 2. Université catholique de Louvain, Louvain-la-Neuve, Belgique.

Randles, R. and Wolfe, D. (1979). *Introduction to the Theory of Nonparametric Statistics*. Wiley, New York.

For more information:

<http://www.stat.ucl.ac.be/cours/stat2413/index.html> <http://www.stat.ucl.ac.be/cours/stat2413/index.html>

Other credits in programs

ECGE3DS/MK	Diplôme d'études spécialisées en économie et gestion (Master in business administration) (marketing)	(5 credits)	Mandatory
FSA12BA	Deuxième année de bachelier en sciences de l'ingénieur, orientation ingénieur civil	(5 credits)	
STAT21MS/DM	Première année du master en statistique, orientation générale, à finalité spécialisée (data management et data mining)	(5 credits)	
STAT21MS/EA	Première année du master en statistique, orientation générale, à finalité spécialisée (économie et assurance)	(5 credits)	
STAT21MS/MM	Première année du master en statistique, orientation générale, à finalité spécialisée (méthodes mathématiques)	(5 credits)	
STAT21MS/MS	Première année du master en statistique, orientation générale, à finalité spécialisée (marketing et sondage)	(5 credits)	
STAT21MS/ST	Première année du master en statistique, orientation générale, à finalité spécialisée (sciences et technologie)	(5 credits)	
STAT22MS/DM	Deuxième année du master en statistique, orientation générale, à finalité spécialisée (data management et data mining)	(5 credits)	
STAT22MS/EA	Deuxième année du master en statistique, orientation générale, à finalité spécialisée (économie et assurance)	(5 credits)	
STAT22MS/MM	Deuxième année du master en statistique, orientation générale, à finalité spécialisée (méthodes mathématiques)	(5 credits)	
STAT22MS/MS	Deuxième année du master en statistique, orientation générale, à finalité spécialisée (marketing et sondage)	(5 credits)	
STAT22MS/ST	Deuxième année du master en statistique, orientation générale, à finalité spécialisée (sciences et technologie)	(5 credits)	
STAT3DA/B	diplôme d'études approfondies en statistique (biostatistique et épidémiologie)	(5 credits)	
STAT3DA/M	Diplôme d'études approfondies en statistique (méthodologie de la statistique)	(5 credits)	Mandatory
STAT3DA/P	diplôme d'études approfondies en statistique (pratique de la statistique)	(5 credits)	