UCLouvain

lstat2430

2019

Nonparametric curve estimation : Fourier-based methods

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	30.0 h	Q2

This biannual learning unit is not being organized in 2019-2020 !

Teacher(s)	von Sachs Rainer ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	The objective of this lecture is to develop applications of non-parametric curve estimation methods to two modern fields of statistics: for the one, to the estimation of spectral densities of time series, including multivariate time series, for the other the interpretation of projection-based estimators as (linear and non-linear) smoothers in a general regression or density estimation context.
Aims	1 Students will be able to understand and appreciate finite sample and asymptotic properties of modern curve estimation methods, along the problem of estimating spectral densities of time series (an alternative and compact way to describe the correlation structure in a given time series in an enhanced and interpretable way). For projection based estimators (e.g. wavelet estimators), the emphasis will be on understanding the link to classical kernel estimation and why non-linear (threshold) based projection estimators can oer interesting advantages, both in theory and practice. Beyond developing the theoretical background, the numerical performance of the studied methods will be analysed by the students along a practical project (in R or matlab). Hence, having followed this course, the students will have seen all facets of the methodology on nonparametric curve estimation in two more advanced set-ups for which a deeper understanding of the concepts behind should enable them to correctly apply the shown methods and interpret their results in a concrete data situation. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Content	1. Spectral density estimation: Definition, periodogram-based kernel estimators(properties, asymptotics, higher order kernels, multivariate spectral densities, bandwidth selection, time-varying spectral densities), interpretations. 2. Projection-based estimators: General definition, specific wavelet approach (properties and asymptotics, mainly via simple Haar basis estimators), comparison of linear and non-linear methods (link to kernel estimation, overview on dierent thresholding methods), examples.
Bibliography	• Brockwell, P. and Davis, R. (2009). Time Series: Theory and Methods. Springer Series in Statistics. • Shumway, R. and Stoer, D. (2011). Time Series and its Applications. Springer. • Brillinger, D. (1981). Time Series; Data Analysis and Theory. Holden Day. • Vidakovic, B. (1999). Statistical Modellng by Wavelets. Wiley. • Härdle, W., Kerkyacharian, G., Picard, D., Tsybakov, A.B. (1998). Wavelets, Approximation and Statistical Applications. Springer Lecture Notes in Statistics. • Nason, G.P. (2008). Wavelet Methods in Statistics with R. Springer.
Faculty or entity in charge	LSBA

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Certificat d'université : Statistique et sciences des données (15/30 crédits)	STAT2FC	5		
Master [120] in Statistic: General	STAT2M	5		