


5.00 credits

30.0 h

Q2

This biannual learning is being organized in 2021-2022

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.
Learning outcomes	<p>At the end of this learning unit, the student is able to :</p> <p>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).</p> <p>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 offer 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.</p>
Content	<ol style="list-style-type: none"> 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 different thresholding methods), examples.
Bibliography	<ul style="list-style-type: none"> • Brockwell, P. and Davis, R. (2009). Time Series: Theory and Methods. Springer Series in Statistics. • Shumway, R. and Stoffer, D. (2011). Time Series and its Applications. Springer. • Brillinger, D. (1981). Time Series; Data Analysis and Theory. Holden Day. • Vidakovic, B. (1999). Statistical Modelling by Wavelets. Wiley. • Härdle, W., Kerkycharian, 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	Learning outcomes
Master [120] in Statistics: General	STAT2M	5		
Certificat d'université : Statistique et sciences des données (15/30 crédits)	STAT2FC	5		