Colloquium
in
Mathematical Engineering

neapōlis

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II
SCUOLA POLITECNICA E DELLE SCIENZE DI BASE

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MOX, Politecnico di Milano

A leap into Functional Data Analysis: from theory to applications

MONDAY, JANUARY 21, 2019, 13:45 - 14:00
Scuola Politecnica e delle Scienze di Base, P.le V. Tecchio, 80 - Aula E
Introduzione
Anna Mercaldo, Coordinatore del CdS in Mathematical Enginnering
Biagio Palumbo, Dipartimento di Ingegneria Industriale

MONDAY, JANUARY 21, 2019, 14:00 - 17:00
Scuola Politecnica e delle Scienze di Base, P.le V. Tecchio, 80 - Aula E

Lecture 1: Exploration and model inference for functional data

Abstract - After a gentle introduction to functional data, the lecture will focus on non-parametric inference for functional regression models. In detail, two different approaches to null hypothesis testing will be presented: global inference (according to which the functional null hypothesis is tested relying on a unique test statistic) and local inference (according to which the null hypothesis is continuously tested along the domain): With respect to the latter, the notion of Family-wise Error Rate and False Discovery Rate in the setting of functional data will be presented. The lecture will then illustrate the extension of principal component analysis to the functional setting pointing out the importance of a suited and computationally tractable mathematical embedding of functional data.

TUESDAY, JANUARY 22, 2019, 14:00 - 17:00
Scuola Politecnica e delle Scienze di Base, P.le V. Tecchio, 80 - Aula E

Lecture 2: Functional data with dependence: from time series to spatial random fields

Abstract - This lecture shall explore recent methods to deal with functional data when their dependence – spatial or temporal – is an important issue. Recent methodologies to deal with time series of (constrained) functional data will be presented, with particular regard to an application on forecasting of functional data in the natural gas market sector. This lecture will also illustrate the state-of-the-art methods for spatial functional data analysis, particularly for the estimation of the spatial dependence (variogram) and for spatial prediction of functional observations (kriging).

WEDNESDAY, JANUARY 23, 2019, 10:00 - 12:00
Scuola Politecnica e delle Scienze di Base, P.le V. Tecchio, 80 - Aula E

Lecture 3: Functional data analysis in statistical process control: functional control charts

Abstract - The lecture will illustrate the use of functional data analysis in statistical process control, with particular reference to control chart schemes. The lecture will provide an introduction to the problem of profile monitoring, which is nowadays mainly based on a first dimensionality reduction of the response (e.g., via FPCA), and a subsequent monitoring of the reduced response and of the residuals after the reduction. The lecture will then illustrate methods to deal with constrained profiles (e.g., in the form of a probability density function) and to account for secondary information collected together with the response (functional control charts).

Dipartimento di Matematica e Applicazioni
"Renato Caccioppoli"

Simone Vantini
MOX, Politecnico di Milano

Simone Vantini is Associate Professor of Statistics at MOX (Modeling and Scientific Computing, in the Dept of Mathematics of Politecnico di Milano, Italy, since 2015. He received his MSc degree (cum laude) in Nuclear Engineering in 2004 and his PhD degree in Mathematical Engineering in 2008. He has published widely in Functional and High-dimensional Data Analysis with more than 40 publications indexed in Wos and/or Scopus. His current research interests include object-oriented data analysis, functional data analysis, high-dimensional data analysis, permutation testing, dimension reduction, blind source separation, risk analysis and in general statistical applications motivated by business or industrial problems. He has indeed continuously collaborated with many national and international research centers, institutions, and companies from the private sector.

Alessandra Menafoglio
MOX, Politecnico di Milano

Alessandra Menafoglio is Assistant Professor of Statistics at MOX (Modeling and Scientific Computing Lab), in the Dept of Mathematics of Politecnico di Milano, Italy. She received her PhD in Mathematical Models and Methods for Engineering in 2015. She is author of 29 publications, mainly in Functional, Compositional and Object-Oriented Data Analysis and in Spatial Statistics. Her doctoral thesis has been awarded of the “Eni Award, Debut in Research Prize” in 2016. She is the first author of the article winner of the 2016 Editor Choice Award of the journal Water Resources Research, and has been also awarded the “2018 Young Statistician Award” given by ENBIS (European Network for Business and Industrial Statistics). Her research interests are mainly focused on the study of innovative models and methods for the analysis of complex data (e.g., curves or images) particularly if georeferenced (Object Oriented Spatial Statistics). Further scientific interests include statistical process control and profile monitoring, statistical data fusion for multi-fidelity modeling and statistical meta-modeling.