UNIVERSITY OF CYPRUS

DEPARTMENT OF MATHEMATICS AND STATISTICS

INVITATION

The Department of Mathematics and Statistics of the University of Cyprus invites you to the

2nd Probability and Statistics Seminar Series

Theme: ' Recent Advances in Nonparametric Statistics'

(Organised by: K. Fokianos, E. Paparoditis & T. Sapatinas)

Speakers:

1) Professor Ludwig Fahrmeir (University of Munich, Germany)

Title: Structured Additive Regression
Date: Friday, 4th November 2005
Time: 10:00 – 12:00
Place: Room 039

2) Professor Yuri Ingster (St. Petersburg State Electrotechnical University, Russia)

Title: Minimax Nonparametric Testing and Related Topics
Date: Friday, 18th November 2005
Time: 10:00 – 12:00 & 14:30 – 15:30
Place: Room 039

3) Professor Gerard Kerkyacharian (Université de Paris X, France)

Title: Bases and Approximation; Statistical Application ; Maxiset Theory
Date: Friday, 2th December 2005
Time: 10:00 – 12:00
Place: Room 039

4) Professor Dominique Picard (Université de Paris VII, France)

Title: Second-Generation Wavelet Estimation in Inverse Problems
Date: Friday, 2th December 2005
Time: 14:30 – 16:30
Place: Room 039

Structured Additive Regression

Professor Ludwig Fahrmeir

Department of Statistics
University of Munich
Germany

Place: 039

Date: 04/11/2005

Time: 10.00—12.00

Abstract

In many regression situations with different types of responses the usual assumption of a linear parametric predictor is too restrictive. We propose regression models which generalize the linear predictor to a structured additive predictor, incorporating nonparametric terms for nonlinear effects of covariates, time trends and spatial effects. An emphasis is on penalized splines and Markov random fields, but geostatistical modelling of the spatial component will also be considered. Modelling and inference is developed from a Bayesian point of view, but there are close connections to penalized likelihood approaches. Inference is either fully Bayesian, using MCMC approaches, or based on mixed model or based on mixed model representations. Real data applications will illustrate the methods.

Minimax Nonparametric Testing and Related Topics

Professor Yuri I. Ingster

Department of Mathematics II
St. Petersburg State Electrotechnical University
Russia

Place: 039

Date: 18/11/2005

Time: 10.00—12.00 & 14:30 – 15:30

Abstract

We describe some methods and results on minimax nonparametric goodness-of-fit testing under the Gaussian white noise model. Mainly the simple null-hypothesis is considered.

The plan of the morning lectures is the following:

- Minimax and Bayesian approaches in hypothesis testing; least favorable priors.
- Spherical priors and chi-square tests; effects on dimensions.
- Minimax testing and geometry for infinite-dimensional case; rates of testing for ellipsoids.
- Duality for product two-point priors and tests of chi-square type; sharp asymptotics for ellipsoids.
- Generalized duality: Hilbert structure on the space of sequences of measures and extreme convex problems.
- Degenerate asymptotics and thresholding.
- Short review of the asymptotics for the Sobolev and Besov balls under the white noise model.

The plan of the afternoon lecture is the following:

- Adaptation in hypothesis testing.
- Multi-channels signal detection and related problems.

Bases and Approximation; Statistical Application; Maxiset Theory

Professor Gerard Kerkyacharian

Département de Mathématiques
Université de Paris X
France

Place: 039

Date: 02/12/2005

Time: 10.00—12.00

Abstract

In the first lecture we will develop some analytical tools that are of fundamental importance for statistics.

In the general atomic setting of an unconditional basis in a (quasi-) Banach space, we show that representing the spaces of m-terms approximation with weight as Lorentz spaces, is equivalent to the verification of two inequalities (Jackson and Bernstein), and that either of these properties is equivalent to some kind of 'democratic' property of the basis. These properties are also equivalent to some control of the thresholding procedure.

We will provide some examples of bases verifying these properties

The aim of the second lecture is to synthetically analyse the performances of thresholding and wavelet estimation methods. To attain this aim we propose to describe the maximal sets where these methods attain a special rate of convergence. We connect these "maxisets" to other problems naturally arising in the context of non-parametric estimation, as approximation theory or information reduction.

Second-Generation Wavelet Estimation in Inverse Problems

Professor Dominique Picard

Laboratoire de Probabilités et Modéles Aleatoires
Université de Paris VII
France

Place: 039

Date: 02/12/2005

Time: 14:30 —16:30

Abstract

We consider the usual formulation of a statistical linear inverse problem: an unknown object of interest f is to be recovered from $y(e)=Kf+eW$, where $y(e)$ is the observation, K is a known linear operator, and W is a Gaussian white noise model.

The most typical example is the case where K is the convolution with a regular and known function. Another typical example is the Wicksell problem: Suppose a population a spheres is embedded in a medium. The sphere have radii that are assumed to be drawn independently from a density f. A random plane slice is taken through the medium and those spheres that are intersected by the plane furnish circles which radii are the points of observation. The unfolding problem is then to infer the density of the sphere radii from the observed circle radii.

A main difficulty lies in the fact that this problem contains a forced set of bases, which are natural: the singular value decomposition (SVD) bases, allowing explicit calculation of the inverse and preserving the decorrelation structure of the noise: in the convolution case, the two bases coincide with the standard Fourier bases, in the Wicksell problem, we find two bases of particular Jacobi polynomials. However, these bases may not be appropriate to recover some important properties of the signal. For instance these bases may very well have bad local properties, which will lead to bad behaviour of estimators based on the SVD, for signals with inhomogeneous smoothness for instance.

In this precise situation, wavelet methods require a cautious pre-processing, which may be instable and do not work in every situations.

Our aim here will be to develop a method trying to take advantages of the SVD basis to invert the operator, as well as those of the wavelet basis to be able to analyse the local features of the signal.

This method depends on the operator at hand, essentially through its eigenvectors. We will show that it may require the construction of second generation ' wavelet' bases built on the eigenvectors of the operator.

In the case where the eigenvectors are precisely the Fourier basis, there is no need for this special construction, and the *Meyer wavelet* for instance is perfectly designed to solve our problem: this is the *WAVE-VD* scenario which will be detailed.

In the more complicated case where the SVD bases are not so close to the Fourier basis, as it is the case for a basis of Jacobi polynomials, we take advantage of the construction of a *wavelet-type* basis (called needlet basis) modelled on the Jacobi basis, developed in Petrushev and Xu.

We show that this method achieve minimax rates of convergence in a large class of spaces, depending on the regularity of the operator *K*.