Raymond Carroll
Texas A&M University

Semiparametric Measurement Error Models

Start with a response Y and predictors X, S and Z. In a general measurement error model, one of the variables is always missing, say X. Instead of observing X, we observe a guess at X, call it W. In a semiparametric measurement error model, one of the variables, say Z, is meant to affect the response via an unknown function, $\square(Z)$. Thus, for example, the partially linear measurement error model states that the mean of Y is $\square_1 X + \square_2 S + \square(Z)$, and instead of observing X we observe W.
There has been considerable recent work recently on semiparametric measurement error models, much of it motivated by nutrition, radiation epidemiology and HIV studies, but also econometrics. I will survey some of this work, starting with the partially linear model given above and then generalizing to more complex models.

Laurie Davies
TU Eindhoven / Duisburg-Essen

Approximation Regions in Non-parametric Regression

Graham Dunn
University of Manchester

Regression Models for Method Comparison Data

Regression methods for the analysis of paired measurements produced by two fallible assay methods are described and their advantages and pitfalls discussed. The difficulties for the analysis, as in any errors-in-variables problem lies in the lack of identifiability of the model and the need to introduce questionable and often naïve assumptions in order to gain identifiability. Although not a panacea, the use of instrumental variables and associated instrumental variable (IV) regression methods in this area of application has great potential to improve the situation. Large samples are frequently needed and two-phase sampling methods are introduced to improve the efficiency of the IV estimators.

David Dunson
Duke University

Bayesian isotonic density regression

In estimating and performing inferences on conditional response distributions given predictors, stochastic ordering constraints can be incorporated to express prior knowledge and improve efficiency. We propose

a nonparametric Bayes approach for modeling an uncountable collection of stochastically ordered distributions indexed by a continuous predictor. Theory is developed to allow priors to be chosen with large support through a restricted dependent Dirichlet process (rDDP). Choosing monotone splines for functional atoms within the rDDP representation, a highly efficient MCMC algorithm is developed for posterior computation. Methods are developed for local and global hypothesis testing, inverse regression problems involving estimation of a dose associated with a fixed increase in risk, and graphical presentation of results. The approach is applied to an epidemiologic study, and applications to flexible semiparametric modeling of longitudinal growth
curves are discussed.

Peter Hall
University of Melbourne

On Deconvolution with Repeated Measurements

In many statistical inverse problems it is necessary to suppose that the transformation that is inverted is known. Although this assumption might seem unrealistic, the problem is often insoluble without it. However, if additional data are available then it is possible to estimate consistently the unknown error density. Data are seldom available directly on the transformation, but repeated, or replicated, measurements increasingly are becoming available. Such data consist of ``intrinsic'' values that are measured several times, with errors that are enerally independent. Working in this setting we treat the nonparametric deconvolution problems of density estimation with observation errors, and regression with errors in ariables. We show that, even if the number of repeated measurements is quite small, it is possible for modified kernel estimators to achieve the same, optimal level of performance they would if the error distribution were known.

Oliver Linton
London School of Economics

Efficient Estimation of a Semiparametric Characteristic-Based Factor Model of Security Returns

his paper develops a new estimation procedure for characteristic-based factor models of security returns. We treat the factor model as a weighted additive nonparametric regression model, with the factor returns serving as time-varying weights, and a set of univariate nonparametric functions relating security characteristic to the associated factor betas. We use a time-series and cross-sectional pooled weighted additive nonparametric regression methodology to simultaneously estimate the factor returns and characteristic-beta functions. By avoiding the curse of dimensionality our methodology allows for a larger number of factors than existing semiparametric methods. We apply the technique to the three-factor Fama-

French model, Carhart's four-factor extension of it adding a momentum factor, and a five-factor extension adding an own-volatility factor. We find that momentum and own-volatility factors are at least as important if not more important than size and value in explaining equity return comovements. We test the multifactor beta pricing theory against the Capital Asset Pricing model using a standard test, and against a general alternative using a new nonparametric test.
joint work with with Gregory Connor and Matthias Hagmann

Yanyuan Ma
University of Neufchatel

Cure rate model with mismeasured covariates under transformation

Cure rate models explicitly account for the survival fraction in failure time data. When the covariates are measured with errors, naively treating mismeasured covariates as error-free would cause bias in the estimation of the model parameters, and thus lead to incorrect inference. Under the proportional hazards cure model, we propose a corrected score approach after implementing a transformation on the mismeasured covariates toward error normality and additivity.
The corrected score equations can be easily solved through the backfitting procedure and the biases in the parameter estimates are successfully eliminated.
We show the proposed estimators for the regression coefficients to be consistent and asymptotically normal.
We conduct simulation studies to examine the finite sample properties of the new method and apply it to a real data set for illustration.
joint work with Guosheng Yin

Ivan Mizera
University of Alberta

Alternative estimation prescriptions via duality: the enchanted world of Renyi's entropies, with applications to quasi-concave density estimation

Once an estimation prescription can be formulated as a convex optimization problem, then a natural protraction of this standpoint is to investigate its conjugate dual. This can be often helpful not only computationally, but may open new theoretical possibilities as well - in particular broaden the scope of the original task, or put it in a new perspective or context.
We illustrate this thesis on a particular example regarding the estimation of shape-constrained densities (and, if time permits, perhaps also on fully-nonparametric examples within the penalized framework). Recent interest in the maximum likelihood estimation of log-concave densities raised several related questions. It can be asked whether some more permitting shape constraints of the unimodal type, as far as densities with tails heavier than exponentially decreasing are concerned, cannot be introduced here; a natural question is also whether relevant estimates can

be considered in higher dimensions and, more seriously, whether they can be computed there.
The development via duality leads to an answer: the (dual) Hellinger alternative offers computationally viable---and bivariate too---alternative, capable of accommodating not only Normal or Exponential, but also members of the Student t family, via estimating densities with convex ``rootosparsity'' (in the spirit of Tukey terminology).
Joint work with Koenker (University of Illinois

Marc Raimondo
University of Sydney

Wavelet density deconvolution when the error distribution is unknown

We propose an implementation of the WaveD method for wavelet density deconvolution. The error distribution is not specified by the model but from an independent sample of observations. The tuning of our density estimator is data-driven and adapts both to the degree of ill-posedness of the problem (smoothness of the error distribution) and to the regularity of the target density.
Our method takes full advantage of existing fast translation-invariant band-limited wavelet algorithms. Numerical properties of our proposal are illustrated with a range finite sample examples.

Jim Ramsay
McGill University

Parameter Cascades: A parameter dictionary with an estimation strategy

We all know that not all parameters are created equal, and that nuisance parameters cause all kinds of problems unless specialized estimation, interval estimation and inference strategies are adopted. The advent of functional parameters represented by very high dimensional basis expansions combined with regularization strategies has re-emphasized this issue, and at the same time has introduced a new parameter class over and beyond nuisance and structural parameters, one that I call "complexity." We see these three classes in both multilevel modelling and functional data analysis.
A generalization of profiling combined with a multicriterion optimization strategy has worked out well in our work on parameter estimation for dynamic systems, and is described in this paper. Some early and tentative thinking on how to estimate complexity parameters will also be offered, along with an invitation to help us out with this important issue.

Richard Samworth
University of Cambridge

Computing the maximum likelihood estimator of a multidimensional log-concave density

We show that if $X_1,...,X_n$ are a random sample from a log-concave density f in $\mathbb{R}^d$, then with probability one there exists a unique maximum likelihood estimator $\hat{f}_n$ of f. The use of this estimator is attractive because, unlike kernel density estimation, the estimator is fully automatic, with no smoothing parameters to choose. The existence proof is non-constructive, however, and in practice we require an iterative algorithm that converges to the estimator. By reformulating the problem as one of non-differentiable convex optimisation, we are able to exhibit such an algorithm. We will also show how the method can be combined with the EM algorithm to fit finite mixtures of log-concave densities. The talk will be illustrated with pictures from the R package LogConcDEAD.
joint work with Madeleine Cule and Bobby Gramacy(Cambridge) and Michael Stewart(University of Sydney)

Sylvain Sardy
Ecole Polytechnique Federale De Lausanne

Sparse MAP estimation with an ℓ_ν prior: Rescaling, Hyperparameter selection, Optimization

To estimate a sparse sequence or a sequence with sparse jumps, we consider the maximum a posteriori estimators using an ℓ_ν prior distribution with \nu\leq 1$. Exemples of such estimators are lasso, Waveshrink, Markov random field- and total variation-based smoothers. We discuss issues related to the rescaling of the covariates, hyperparameter(s) selection (including that of ν) and optimization, and illustrates with various applications.

Naisyin Wang
Texas A&M University

Effects of Ignoring Measurement-Error Correlations in Longitudinal Surrogates

There is a long history that investigators would use measurement error methodologies to analyze data from a setting where the covariates in the primary regression are latent structural variables of a secondary longitudinal process. In this talk, I will use some numerical outcomes and examples to illustrate potential concerns when one ignores the correlation structure of the measurement errors in the longitudinal surrogates. I will also report the outcomes of using different
methodologies to handle such a scenario.

Joachim Weickert
Saarland University

Relations Between Wavelet Shrinkage, Diffusion Filters and Regularisation Methods

Denoising a signal is closely related to a regression problem. In signal and image processing, a large variety of discontinuity preserving denoising techniques is used, including wavelet shrinkage, nonlinear diffusion filtering, and regularisation methods. The goal of this talk is to review a number of relations between these three methods. We focus on 1-D signals.
We start with considering shift-invariant Haar wavelet shrinkage on a single scale. This can be rewritten in such a way that it can be interpreted as an explicit scheme for nonlinear diffusion filtering. Different one-to-one mappings between shrinkage functions and their corresponding diffusivities are studied.
Replacing Haar wavelets by wavelets with a higher number of vanishing moments connects these processes to higher-order differential equations.
Finally we show that using a full multiscale framework is equivalent to solving an integrodifferential equation. This equation can be regarded as a minimiser of a regularisation method that involves smoothed derivatives in the penaliser.
Joint work with Pavel Mr\'azek, Stephan Didas and Gabriele Steidl.