Workshop: "Efficient algorithms for nonlinear time series analysis"

Programme:

- 13:30 - 13:45 Introduction
- 13:45 - 14:45 Quinten Meertens (Statistics Netherlands and UvA) "Measuring Cross-Border Internet Purchases within the European Union: a Supply-Side Approach"
- 14:15 - 15:15 Siem Jan Koopman (VU) "Optimal Formulations for Nonlinear Autoregressive Processes"
- 15:15 - 15:45 Francisco Blasques (VU) "Transformed Polynomials for Semi-Nonparametric Conditional Volatility Models"
- 15:45 - 16:00 Coffee/tea break
- 16:00 - 17:00 Howell Tong (University of Electronic Science and Technology of China, LSE) "A nested sub-sample search algorithm (NeSSA) that can convert a big data problem into a small data problem (from N to log N)"

--

Speakers

Quinten Meertens (Statistics Netherlands and University of Amsterdam)
Title: *Measuring Cross-Border Internet Purchases within the European Union: a Supply-Side Approach*

Abstract:
The digital economy is a highly relevant item on the European Union's policy agenda. Cross-border internet purchases are part of the digital economy, but cannot be accurately measured using existing approaches based on consumer surveys or business surveys. We demonstrate why and propose an alternative supply-side approach based on VAT registrations. We implement a data-driven classification algorithm, based on two additional, open data sources: European business registers and internet data. We find that total cross-border internet purchases within the European Union by Dutch consumers is over EUR 1.3 billion in 2016, which is approximately five times higher than existing estimates.

Siem Jan Koopman (VU University Amsterdam)

Title: *Optimal Formulations for Nonlinear Autoregressive Processes*

Abstract:
We develop optimal formulations for a nonlinear autoregressive model by representing the model as a linear autoregressive model with a time-varying temporal dependence coefficient. We propose a novel and flexible framework for the estimation of time-varying temporal

dependence by adopting a recursive updating procedure based on the score of the predictive likelihood function at each time point. The resulting autoregressive model can be expressed in reduced form and thus compared with threshold and smooth-transition autoregressive models. We establish the information theoretic optimality of the score driven update of the autoregressive coefficient and the asymptotic theory of the maximum likelihood parameter estimates. The performance of our model in extracting the time-varying or nonlinear dependence for finite samples is studied in a Monte Carlo exercise. Our empirical study is for a weekly time series of unemployment insurance claims. It illustrates the model performance in comparison to other nonlinear autoregressive models. We both assess the model performances in-sample and out-of-sample.

Speaker:
Francisco Blasques (VU University Amsterdam)

Title: *Transformed Polynomials for Semi-Nonparametric Conditional Volatility Models*

Abstract: This paper proposes a new flexible semi-nonparametric model for filtering unobserved time-varying conditional volatilities. We update the conditional volatilities using a class of transformed polynomial functions that lies dense in the space of continuous functions and has known convergence rates on smooth Sobolev spaces. Using the properties of the transformed polynomials, we derive conditions for strict stationarity, ergodicity, fading memory and filter invertibility. We also establish the existence, consistency and convergence rate of the sieve maximum likelihood estimator. A Monte Carlo study and an empirical application demonstrate that the model performs well in empirically relevant settings. Unlike its competitors, the new model captures volatility dependent leverage effects in stock return dynamics.

Speaker:
Howell Tong (University of Electronic Science and Technology of China,
London School of Economics)

Title:
A nested sub-sample search algorithm (NeSSA) that can convert a big data problem into a small data problem (from N to log N)

Abstract:
Threshold models have been popular for modelling nonlinear phenomena in diverse areas, in part due to their simple fitting and often clear model interpretation. A commonly used approach to fit a threshold model is the (conditional) least squares method, for which the standard grid search typically requires O(n) operations for a sample of size n; this is substantial for large n, especially in the context of panel time series. This paper proposes a novel method, the nested sub-sample search algorithm, which reduces the number of least squares operations drastically to O(log n) for large sample size. We demonstrate its speed and reliability via Monte Carlo simulation studies with finite samples. Possible extension to change-point over time (i.e. non-stationarity) is indicated.