Computation and Econometrics Workshop @ The National Art Center, Tokyo (July 27, 2018) Agenda

(13:00-13:05)
Opening remarks

1. (13:05-14:05)
   "A few topics on state space modeling"
   Prof. Takashi Tsuchiya (National Graduate Institute for Policy Studies)

   Abstract: In this talk, we present two specific topics on state space modeling; one on algorithm, the other on application. The first topic is an application of check-pointing to smoothing in particle filter. Check-pointing is a technique proposed by Griewank to save memory required in a generic forward-backward computational procedure. If we apply the technique to particle filter smoothing, we can reduce the required memory from $O(TM)$ to $O(M\log T)$ at the cost of $O(\log T)$ times of filtering (instead of once), where T is the length of the time series and M is the number of particles. We show an easy implementation of this procedure using binary number representation. The second topic is an application of space-state model for analyzing the video image of two mice moving around in a cage. Human observers are asked to score the degree of social interaction from zero to a hundred point. We develop a hidden Markov model to segment the video according into two states "interactive" and "indifferent" automatically. We analyze how this binary time series is related to the aforementioned score by observers. The first part is a joint work with Kazuyuki Nakamura, and the second part is a joint work with Toshiya Arakawa, Aki Takahashi and Tsuyoshi Koide.

2. (14:10-15:10)
   "Controlled sequential Monte Carlo"
   Jeremy Heng, Ph.D. (Harvard University)
   (https://arxiv.org/pdf/1708.08396.pdf)
   Joint work with:
   Adrian N. Bishop: Data61 (CSIRO) and the University of Technology, Sydney, Australia
   George Deligiannidis: Department of Statistics, Oxford University, UK
   Arnaud Doucet: Department of Statistics, Oxford University, UK

   Abstract: Sequential Monte Carlo (SMC) methods are a set of simulation-based techniques used to approximate high- dimensional probability distributions and their normalizing constants. They have found numerous applications in statistics as they can be applied to perform state estimation for state-space models and inference for complex static models. Like many Monte Carlo sampling schemes, they rely on proposal distributions which have a crucial impact on their performance. In this talk, I will introduce a class of controlled SMC algorithms where the proposal distributions are determined by approximating the solution of an associated optimal control problem using an iterative scheme. Connections to existing work and some theoretical results on our proposed methodology will be discussed. Significant gains over state-of-the-art methods at a fixed computational complexity will also be illustrated on a variety of applications.

3. (15:20-16:20)
   "Multivariate Stochastic Volatility with Partial Homoscedasticity"
   Prof. Roberto Leon-Gonzalez (National Graduate Institute for Policy Studies)
   Joint work with:
   Joshua Chan : University of Technology Sidney
   Arnaud Doucet: University of Oxford
   Rodney W. Strachan: University of Queensland

   Abstract: This paper develops a new methodology that decomposes the shocks into homoscedastic and heteroscedastic components. The heteroscedastic part of the model uses a multivariate stochastic volatility inverse Wishart process. The model is invariant to the ordering of the variables, and allows estimation in relatively high-dimensions. The computational strategy uses a novel particle filter algorithm and a reparameterization that substantially improves algorithmic convergence. We apply the methods to a large VAR using US macroeconomic variables, and estimate the impact of monetary policy on the homoscedastic and heteroscedastic components of macroeconomic variables.

4. (16:25-17:25)
   "The Correlated Pseudo-Marginal Method"
   Prof. Arnaud Doucet (University of Oxford)

   Abstract: The pseudo-marginal algorithm is a popular Metropolis–Hastings-type scheme which samples asymptotically from a target probability density when we are only able to estimate unbiasedly an unnormalised version of it. However, for the performance of this scheme not to degrade as the number T of data points increases, it is typically necessary for the number N of Monte Carlo samples to be proportional to T to control the relative variance of the likelihood ratio estimator appearing in the acceptance probability of this algorithm. The correlated pseudo-marginal algorithm is a modification of the pseudo-marginal method using a likelihood ratio estimator computed using two correlated likelihood estimators. For random effects models, we show under regularity conditions that the parameters of this scheme can be selected such that the relative variance of this likelihood ratio estimator is controlled when N increases sublinearly with T and we provide guidelines on how to optimise the parameters of the algorithm based on a non-standard weak convergence analysis. The efficiency of computations for Bayesian inference relative to the pseudo-marginal method empirically increases with T and is higher than two orders of magnitude in some of our examples.

   (17:25-17:30)
   Closing remarks