On the inference of hidden Markov models with weakly informative observations

Matti, Vihola (a)

(a): Department of Mathematics and Statistics, University of Jyväskylä, Finland

Abstract

Particle Markov chain Monte Carlo methods (PMCMC) [1] allow for practical Bayesian inference with a general class of dynamic models: the so-called hidden Markov models (a.k.a. general non-linear/non-Gaussian state space models). The PMCMC methods rely on combination of Markov chain Monte Carlo and particle filters. We discuss certain challenges that arise with models having 'weakly informative' observations, and present improved methods that mitigate/overcome such challenges [2,3]. The weakly informative setting arises with time-discretised path-integral models, such as a stochastic differential equation whose law is modulated by 'penalising' its paths by state-dependent (non-homogeneous and irregular) potentials.

The talk is basd on joint works with Nicolas Chopin (ENSAE), Santeri Karppinen (Jyväskylä), Sumeetpal S. Singh (Cambridge) and Tomás Soto (LUT).

[1] C. Andrieu, A. Doucet and R. Holenstein (2010). Particle Markov chain Monte Carlo methods. *J. R. Stat. Soc. Ser. B. Stat. Methodol.* 72(3), 269-342.

[2] N. Chopin, S. S. Singh, T. Soto and M. Vihola (2022). On resampling schemes for particle filters with weakly informative observations. *Ann. Statist.*, to appear. http://arxiv.org/abs/2203.10037

[3] S. Karppinen, S. S. Singh and M. Vihola (2022). Conditional particle filters with bridge backward sampling. https://arxiv.org/abs/2205.13898