

Online Variational Sequential Monte Carlo

Alessandro Mastrototaro

KTH Royal Institute of Technology, Stockholm, Sweden
alemas@kth.se

Coauthor(s): Jimmy Olsson

In this talk, we build upon the *variational sequential Monte Carlo* (VSMC) method, which provides computationally efficient and accurate model parameter estimation and Bayesian latent-state inference in state-space models by combining particle methods and variational inference. While standard VSMC operates in the offline mode, by re-processing repeatedly a given batch of data, we distribute the approximation of the gradient of the VSMC surrogate ELBO in time using stochastic approximation, allowing for online learning in the presence of streams of data. This results in an algorithm, *online VSMC*, that is capable of performing efficiently, entirely on-the-fly, both parameter estimation and particle proposal adaptation. In addition, we provide rigorous theoretical results describing the algorithm's convergence properties as the number of data tends to infinity as well as numerical illustrations of its excellent convergence properties and usefulness also in batch-processing settings.

[1] Mastrototaro, A., & Olsson, J. (2023). Online Variational Sequential Monte Carlo. arXiv preprint arXiv:2312.12616.