

Smoothing Estimates of Diffusion Processes

PICE Smoother Method

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Smoothing Estimates of Diffusion Processes

PICE Smoother is a novel adaptive importance sampling method to sample efficiently from the posterior distribution in continuous-time, continuous-space hidden processes. In general, this is a very hard problem due to weight degeneracy.

A bit of theory:

KL-Control Problem


Process τ : $\dot{x} = f(x, t) + u_\theta(x, t) + \eta$  Noise

Cost = $KL[q_\theta(\tau) || p_0(\tau)] + E_q[-\log(p(y|\tau))]$

 Time series

Posterior/Smoothing

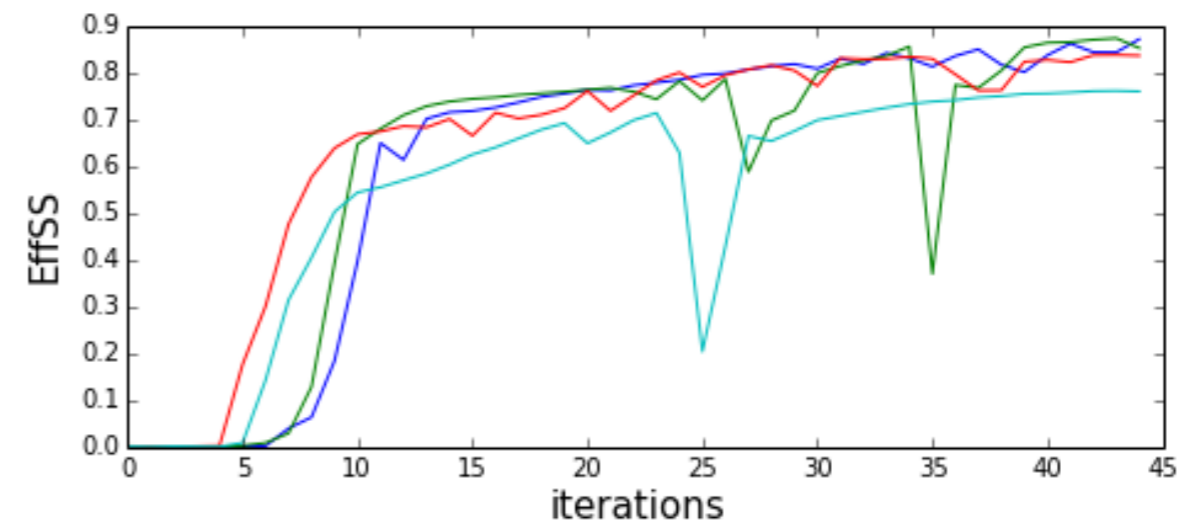
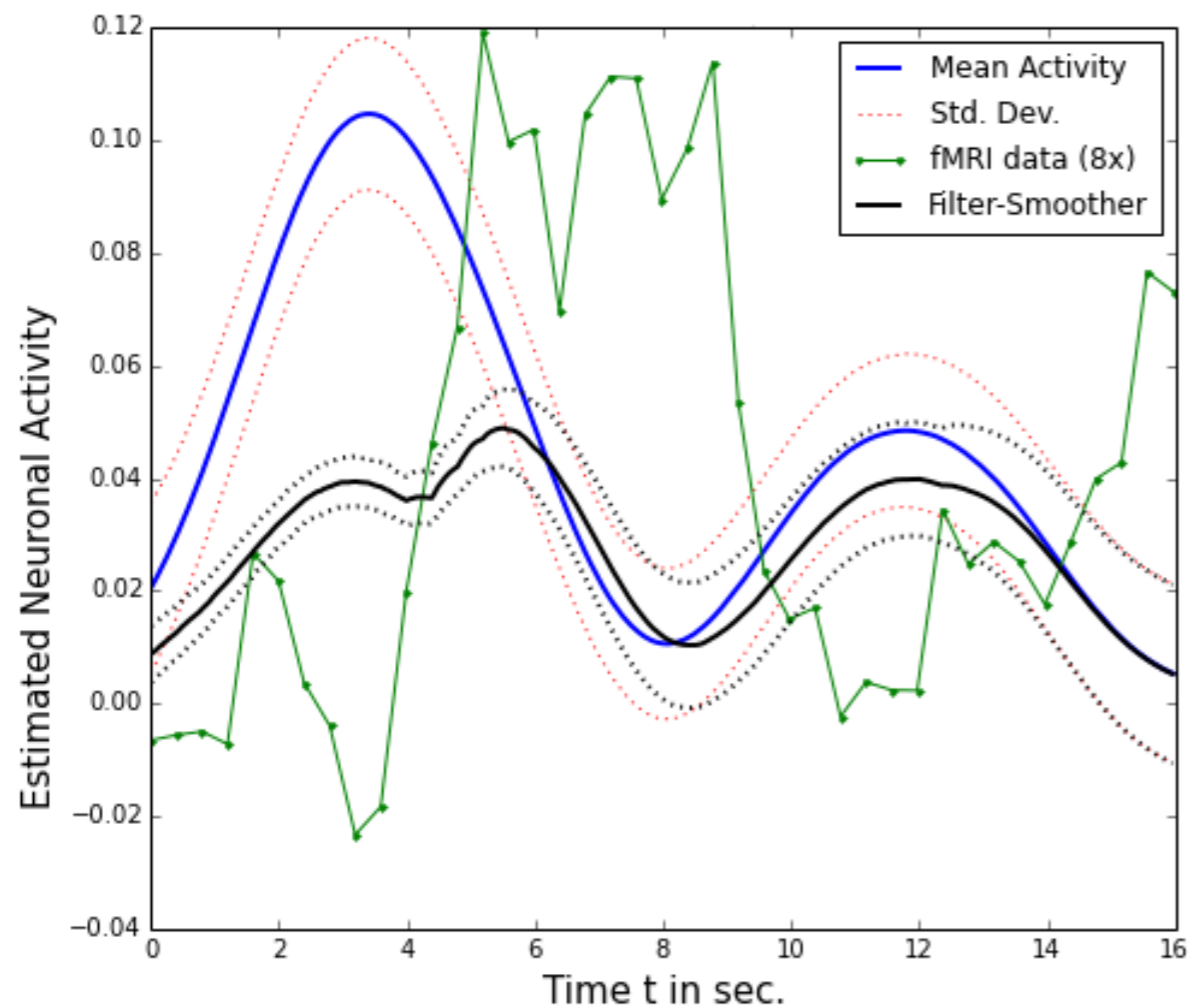
$$p(\tau|y) \propto p(y|\tau)p_0(\tau)$$

Control: $u_\theta(x, t)$  Importance sampler: $q_\theta(x)$

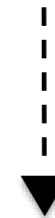
Optimal Control  Posterior: $p(\tau|y)$

We parametrize $u_\theta(x, t)$ as a deep neural network

Application: Neuronal Activity Estimation from fMRI Data



Learn $u_{\theta}(x, t)$ iteratively



Efficient sampling from posterior

Comparison with Bootstrap Filter-Smoother

Thank you
See you in poster #15

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