Simulation of forward-reverse stochastic representations for conditional diffusions

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We derive stochastic representations for the finite dimensional distributions of a multidimensional diffusion on a fixed time interval, conditioned on the terminal state. The conditioning can be with respect to a fixed point or more generally with respect to some subset. The representations rely on a reverse process connected with the given (forward) diffusion as introduced in Milstein et al. [Bernoulli 10(2):281–312, 2004] in the context of a forward-reverse transition density estimator. The corresponding Monte Carlo estimators have essentially root-N accuracy, hence they do not suffer from the curse of dimensionality. We provide a detailed convergence analysis and give a numerical example involving the realized variance in a stochastic volatility asset model conditioned on a fixed terminal value of the asset. We show that the algorithm can be applied for inference under incomplete data for the calculation of the expectation step in the EM algorithm. Finally, we give some applications.

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