



University of Stuttgart
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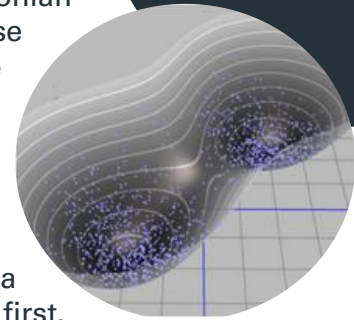
Department for Stochastic Simulation
and Safety Research for Hydrosystems (LS³)

Sampling with Noisy Gradients

Project / B.Sc / M.Sc. Topic

Sampling from a distribution is an important step in a Bayesian inference workflow. In many contexts, it is fair to assume that information about the gradient of the non-normalized density function is also available, especially since the advent of automatic differentiation (AD). Many sampling algorithms (such as Hamiltonian Monte Carlo) make use of this additional information to increase efficiency. However, with complex models giving rise to the density function, it can happen that there is some (numerical) noise which is then also present in the gradients.

It is the goal of this thesis, to design and execute numerical experiments to evaluate the robustness of a variety of gradient based sampling algorithms against such noise. To this end, a literature review to identify algorithms of interest is performed first. These are then implemented or imported from existing libraries with special attention on comparability. Useful characterizations of “robustness” and “noisiness” need to be developed in order to eventually ascertain desirable and undesirable properties of the algorithms. A successful execution of this thesis is likely to result in participation in a publication.



Prospective Tasks

- Literature review on sampling algorithms
- Definition of desired algorithmic properties
- Implementation of sampling algorithms
- Design of numerical experiments
- Visualization of results and discussion

General Information

- Advisor: Tim Brünnette,
- Examiner: Prof. Wolfgang Nowak (Stuttgart)
- Possible cooperation with SIAM, EAWAG, Switzerland

Desirable Skills

- scientific programming
- basic understanding of statistics and probability theory



Apply now!

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