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Conditional Normalizing Flow for Markov Chain Monte Carlo Sampling in the Critical Region of Lattice Field Theory

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In Lattice Field Theory, one of the key drawbacks of the Markov Chain Monte Carlo(MCMC) simulation is the critical slowing down problem. Generative machine learning methods, such as normalizing flows, offer a promising solution to speed up MCMC simulations, especially in the critical region. However, training these models for different parameter values of the lattice theory is inefficient. We address this issue by interpolating or extrapolating the flow model in the critical region. We demonstrate the effectiveness of the proposed method for MCMC sampling in critical regions for multiple parameter values of phi4 scalar theory and U(1) gauge theory in 1+1 dimensions and compare its performance against HMC and flow-based methods.

Significance

Our flow-based approach for MCMC simulation in the critical region of lattice theory outperforms the existing flow-based method and algorithm like HMC.

References

http://arxiv.org/abs/2207.00980

Experiment context, if any

Primary authors: Prof. CHAKRABORTI, Dipankar; Prof. ARORA, Vipul; SINGHA, ankur

Presenter: SINGHA, ankur

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