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Simulating Lattice Gauge Theories with Continuous Flows

A well-known challenge when simulating Lattice Gauge theories (LGT) is so-called critical slowing down, which refers to the exponential increase of the autocorrelation time as the lattice spacing is reduced and approaches the continuum limit. Previously, normalizing flows, combined with Lüscher's trivializing maps, have been proposed as an alternative approach to Hybrid Monte Carlo (HMC), involving flowing gauge-field configurations, sampled independently from a uniform distribution, to the desired theory. The flow can be modelled by a parametrized function, namely a bijective map with parameters that can be trained using machine learning techniques. The trained model can then be used to generate proposals in a Markov Chain Monte Carlo (MCMC). In this talk, we present an application of this approach to simulate the U(1) gauge theory in two dimensions. We begin with an introduction of the method, details of the approach used, discuss its scalability, and conclude with some preliminary results.

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