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Machine Learning Fixed-Point Actions for Lattice Gauge Theory

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Fixed-point actions offer a powerful way to reduce discretization artifacts in lattice gauge theory, but their practical use has long been limited by the difficulty of finding accurate parametrizations. We address this challenge using machine learning with gauge-equivariant convolutional neural networks, which can represent general gauge-invariant structures on the lattice. This allows us to construct classically perfect actions for 4D SU(3) gauge theory that suppress lattice artifacts even on coarse lattices. The learned actions are suitable for both gradient flow and Hybrid Monte Carlo simulations, opening new possibilities for efficient and systematically improved lattice studies.

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