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Machine learning a fixed point action

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Lattice gauge-equivariant convolutional neural networks (LGE-CNNs) can be used to form arbitrarily shaped Wilson loops and can approximate any gauge-covariant or gauge-invariant function on the lattice. Here we use LGE-CNNs to describe fixed point (FP) actions which are based on inverse renormalization group transformations. FP actions are classically perfect, i.e., they have no lattice artefacts on classical gauge-field configurations satisfying the equations of motion, and therefore possess scale invariant instanton solutions. FP actions are tree–level Symanzik–improved to all orders in the lattice spacing and can produce physical predictions with very small lattice artefacts even on coarse lattices. They may therefore provide a solution to circumvent critical slowing down towards the continuum limit.

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