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Action estimation with continuous-mixture autoregressive networks

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In this study, we introduce a novel approach in quantum field theories to estimate the action using the artificial neural networks (ANNs). Our approach leverages system configurations governed by the Boltzmann factor, e^{-S} at different temperatures within the imaginary time formalism of thermal field theory. We focus on a 0+1 dimensional quantum field with kink/anti-kink configurations to demonstrate the feasibility of the method. The integration of continuous-mixture autoregressive networks (CANs) enables the construction of accurate effective actions. Our numerical results demonstrate that this methodology not only facilitates the construction of effective actions at specified temperatures but also adeptly estimates the action at intermediate temperatures using data from both lower and higher temperature ensembles. This capability is especially valuable for the detailed exploration of phase diagrams.

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