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Flow-based sampling of CP^{N-1} models: how important is equivariance?

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Numerous studies have demonstrated that the rapid decline in the efficiency of traditional sampling algorithms caused by Critical Slowing Down can be alleviated or even sidestepped completely using flow-based sampling. Such approaches trade off a reduction in autocorrelation times with an increase in the cost of generating new field configurations and an up-front training cost. The two-dimensional CP^{N-1} models exhibit severe Critical Slowing Down in their topological observables, making them good candidates for testing flow-based sampling in a more challenging setting without invoking the full complexity of QCD.

Part of the difficulty with the flow-based approach is in identifying suitable ways of parametrising families of invertible transformations, which need to balance expressivity with efficiency in computing the Jacobian determinant. Equivariance with respect to known symmetries of the action is widely understood to be desirable, or even crucial, depending on which theory is being studied. Here we consider parametrisations of flows based on coupling layers (pointwise transformations with triangular Jacobian), and look at the effect of enforcing equivariance under $\mathrm{U}(1)$ transformations.

Topical area

Algorithms and Artificial Intelligence

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