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Optimising simulations for diphoton production at hadron colliders using amplitude neural networks

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Phenomenological studies of high-multiplicity scattering processes at collider experiments present a substantial theoretical challenge and are increasingly important ingredients in experimental measurements. We investigate the use of neural networks to approximate matrix elements for these processes, studying the case of loop-induced diphoton production through gluon fusion. We train neural network models on one-loop amplitudes from the NJet library and interface them with the Sherpa Monte Carlo event generator to provide the matrix element within a realistic hadronic collider simulation. Computing some standard observables with the models and comparing to conventional techniques, we find excellent agreement in the distributions and a reduced simulation time by a factor of 30.

Significance

We extend previous work which pioneered the emulation of scattering amplitudes with neural networks, studying these techniques for the first time within a full hadronic collider simulation.

References

https://arxiv.org/abs/2106.09474
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