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Interpretable Machine Learning applications to Jet Background Subtraction

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Previous applications of machine learning to jet background subtraction have shown improvements over the traditional background subtraction methods, especially at low jet momentum. While machine learning applications generally lead to improvements, care must be taken to ensure they are not at the cost of interpretability and bias from models used for training. We present a novel application of symbolic regression to extract a functional representation of a deep neural network trained to subtract background for measurements of jets. With this functional representation we show that the relationship learned by a neural network is approximately the same as a new background subtraction method using the particle multiplicity in a jet. This multiplicity method uses measured features, rather than learned weights, to achieve most of the improvements demonstrated by the deep neural network. Additionally, we show the algorithmic complexity of the deep neural network can be decreased by reducing it to a shallower representation while still achieving similar performance. Our study demonstrates that interpretable machine learning methods can provide insights into underlying physical processes and achieve the performance of black-box machine learning without the opaqueness and model bias.

Category

Experiment

Collaboration (if applicable)

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