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Interpretable Deep Learning for Two-Prong Jet Classification with Jet Spectra (15'+5')

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Classification of jets with deep learning has gained significant attention in recent times. However, the performance of deep neural networks is often achieved at the cost of interpretability. Here we propose an interpretable network trained on the jet spectrum $S_2(R)$ which is a two-point correlation function of the jet constituents. The spectrum can be derived from a functional Taylor series of an arbitrary jet classifier function of energy flows. An interpretable network can be obtained by truncating the series. The intermediate feature of the network is an infrared and collinear safe C-correlator which allows us to estimate the importance of an $S_2(R)$ deposit at an angular scale R in the classification. The performance of the architecture is comparable to that of a convolutional neural network (CNN) trained on jet images, although the number of inputs and complexity of the architecture is significantly simpler than the CNN classifier. We consider two examples: one is the classification of two-prong jets which differ in color charge of the mother particle, and the other is a comparison between Pythia 8 and Herwig 7 generated jets.

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