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Perturbatively Regularized Neural Networks

We present a class of Neural Networks which extends the notion of Energy Flow Networks (EFNs) to higher-order particle correlations. The structure of these networks is inspired by the Energy-Energy Correlators of QFT, which are particularly robust against non-perturbative corrections. By studying the response of our models to the presence and absence of non-perturbative hadronization, we can identify and design networks which are insensitive to the simulated hadronization model, while still optimized for a given performance objective. Moreover, the trained models can give surprising insights into the physics of the problem, for example by spontaneously learning to identify relevant energy scales. We demonstrate our method by training an effective tagger for boosted bosons with minimal sensitivity to theory systematics, which are notoriously difficult for experimentalists to quantify.

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