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Efficiency parametrization with Neural Networks

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An overarching issue of LHC experiments is the necessity to produce massive numbers of simulated collision events in very restricted regions of phase space. A commonly used approach to tackle the problem is the use of event weighting techniques where the selection cuts are replaced by event weights constructed from efficiency parametrizations. These techniques are however limited by the underlying dependencies of these parametrizations which are typically not fully known and thus only partially exploited.
We propose a neural network approach to learn multidimensional ratios of local densities to estimate in an optimal fashion the efficiency. Graph neural network techniques are used to account for the high dimensional correlations between different physics objects in the event. We show in a specific toy model how this method is applicable to produce accurate efficiency maps for heavy flavor tagging classifiers in HEP experiments, including for processes on which it was not trained.

The work is based on: https://arxiv.org/abs/2004.02665

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