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Tagging large-radius b-jets from Higgs decays dropping unneeded information

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Among the high-energy physics community, there is a growing interest in replacing cut-based selections using different types of multivariate analysis. This transformation made it possible to use high-level variables produced by complex reconstruction algorithms.
Within this context, Deep Learning approaches are rapidly spreading to improve the selection performances by combining all the available information. The development of these algorithms often relies on a brute force approach where all available event features are tested for multiple combinations of the algorithm hyperparameters. Nonetheless, the significance of the prediction does not necessarily increase with the amount of information given as input to the algorithm. The opposite is often true.
Herein, we propose an effective method to choose the most valuable variables to give as input to a Deep Neural Network using a CancelOut layer. Indeed, given a fixed number of variables, the CancelOut layer selects during training only the most relevant features to achieve the best performances. We use as a study case the selection of events where a boosted large and massive jet contains both of the b-quarks originated from H boson decays. We show how the Deep Neural Network classifier performance can be affected by keeping irrelevant variables in input and how our method can naturally get rid of them. The proposed method can be easily implemented in already developed Deep Neural Network classifiers through a retraining campaign.

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