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Adversarial Neural Network based shape calibrations of observables for jet-tagging at CMS

Scale factors are commonly used in HEP to improve shape agreement between distributions of data and simulation. We present a generalized deep-learning based architecture for producing shape changing scale factors, investigated in the context of bottom-quark jet- tagging algorithms within the CMS experiment.

The method utilizes an adversarial approach with three networks forming the central part, and a separate preprocessing network. The preprocessing aims at subtracting different charm quark contributions using binary classification to reweight a multidimensional jet variable distribution.
In the central part of the architecture, the scale factor for each jet is produced by the main network using the jet variables. A second network, the adversary, aims to differentiate between data and rescaled simulation events and facilitates the training of the scale factor network. An additional third network is used as regularization to prevent undesirable shape changes of correlated variables.

We present the conceptual design and resulting scale factors in comparison to the previously applied methods.

Significance

In this presentation we go beyond the common application of shape calibration to reach agreement of data and simulation. A new way of reweighting jet distributions and subtracting hadron flavor portions as a preprocessing step is presented. Both the preprocessing step and the central adversarial network are very generalizable and could find far reaching applications beyond b-tagging.

References

Speaker time zone

Compatible with Europe

Authors: FISCHER, Benjamin (RWTH Aachen University (DE)); RUDI, Erwin (Rheinisch Westfaelische Tech. Hoch. (DE)); SCHMIDT, David Josef (Rheinisch Westfaelische Tech. Hoch. (DE)); NOLL, Dennis (RWTH Aachen University (DE)); MIDDENDORF, Jan (RWTH Aachen University (DE)); RIEGER, Marcel (CERN); ERDMANN, Martin (Rheinisch Westfaelische Tech. Hoch. (DE)); RATH, Yannik Alexander (RWTH Aachen University (DE))

Presenter: RUDI, Erwin (Rheinisch Westfaelische Tech. Hoch. (DE))

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