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Pulling Out All the Tops with Computer Vision and Deep Learning (20'+5')

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We apply computer vision with deep learning – in the form of a convolutional neural network (CNN) – to build a highly effective boosted top tagger. Previous work (the "DeepTop" tagger of Kasieczka et al) has shown that a CNN-based top tagger can achieve comparable performance to state-of-the-art conventional top taggers based on high-level inputs. Here, we introduce a number of improvements to the DeepTop tagger, including architecture, training, image preprocessing, sample size and color pixels. Our final CNN top tagger outperforms BDTs based on high-level inputs by a factor of $\sim$ 2–3 or more in background rejection, over a wide range of tagging efficiencies and fiducial jet selections.

As reference points, we achieve a QCD background rejection factor of 500 (60) at 50% top tagging efficiency for fully-merged (non-merged) top jets with p_T in the 800–900 GeV (350–450 GeV) range.

Our CNN can also be straightforwardly extended to the classification of other types of jets, and the lessons learned here may be useful to others designing their own deep NNs for LHC applications.

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