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Deep Learning for Boosted Objects

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Deducing whether the substructure of an observed jet is due to a low-mass single particle or due to multiple decay objects of a massive particle is an important problem in the analysis of collider data. Traditional approaches have relied on expert features designed to detect energy deposition patterns in the calorimeter, but the complexity of the data make this task an excellent candidate for the application of machine learning tools. The data collected by the detector can be treated as a two-dimensional image, lending itself to the natural application of image classification techniques. In this work, we apply deep neural networks with a mixture of locally-connected and fully-connected nodes. Our experiments demonstrate that without the aid of expert features, such networks match or modestly outperform the current state-of-the-art approach for discriminating between jets from single hadronic particles and overlapping jets from pairs of collimated hadronic particles, and that such performance gains persist in the presence of pileup interactions.

In addition, we will present initial studies on using deep networks to perform b-tagging inside boosted objects.

Summary

Deep Learning applied to the tasks of jet substructure identification (via calorimetry), b-tagging inside boosted jets (via tracking) and holistic tagging (via calorimetry and tracking)

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