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Machine learning techniques for jet flavour identification at CMS

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Jet flavour identification is a fundamental component for the physics program of the LHC-based experiments. The presence of multiple flavours to be identified leads to a multiclass classification problem. We present results from a realistic simulation of the CMS detector, one of two multi-purpose detectors at the LHC, and the respective performance measured on data. Our tagger, named DeepJet, relies heavily on applying convolutions on lower level physics objects, like individual particles. This approach allows the usage of an unprecedented amount of information with respect to what is found in the literature. DeepJet stands out as the first proposal that can be applied to multi-classification for all jet flavours as well as different widths of jets. We demonstrate significant improvements by the new approach on the classification capabilities of the CMS experiment in simulation in several of the tested classes. At high momentum improvements of nearly 90% less false positives at a standard operation point are reached. The application of jet flavour identification at the high level trigger of CMS is also discussed, based on recent Deep Learning developments.

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