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A novel approach for discriminating hadronically decaying W+, W-, and Z bosons in the CMS experiment

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Identifying particles that form jets in the CMS detector is a crucial part of many physics analyses. It has generally proven quite difficult to infer the charge of the originating particles. In this poster, we demonstrate a novel method to discriminate between Lorentz-boosted W+, W-, and Z boson jets. In order to do so, we have designed a specialized Dynamic Graph Convolutional Neural Network (DGCNN), based on the ParticleNet framework, which is trained on dedicated Monte Carlo simulation samples. It treats the jet as a "particle cloud", and learns the intrinsic differences between different types of jets by exploiting low-level features of the particle constituents inside the jet. Utilizing this jet charge tagger, we were able to significantly enhance the discrimination power compared to traditional variable-based methods. The poster also explains a possible use case of such a tagger within a physics analysis at the CMS experiment: isolating same-sign WW events from opposite-sign WW, and WZ, events in vector boson scattering.

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