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Particle Transformer for Jet Tagging

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Jet tagging is a critical yet challenging classification task in particle physics. While deep learning has transformed jet tagging and significantly improved performance, the lack of a large-scale public dataset impedes further enhancement. In this work, we present JetClass, a new comprehensive dataset for jet tagging. The JetClass dataset consists of 100 M jets, about two orders of magnitude larger than existing public datasets. A total of 10 types of jets are simulated, including several types unexplored for tagging so far. Based on the large dataset, we propose a new Transformer-based architecture for jet tagging, called Particle Transformer (ParT). By incorporating pairwise particle interactions in the attention mechanism, ParT achieves higher tagging performance than a plain Transformer and surpasses the previous state-of-the-art, ParticleNet, by a large margin. The pre-trained ParT models, once fine-tuned, also substantially enhance the performance on two widely adopted jet tagging benchmarks.

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