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Generic representations of jets at detector-level with self supervised learning

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Supervised learning has been used successfully for jet classification and to predict a range of jet properties, such as mass and energy. Each model learns to encode jet features, resulting in a representation that is tailored to its specific task. But could the common elements underlying such tasks be combined in a single model trained to extract features generically? To address this question, we explore self-supervised learning (SSL), inspired by its applications in the domains of computer vision and natural language processing. Besides offering a simpler and more resource-effective route when learning multiple tasks, SSL can be trained on unlabeled data. We demonstrate that a jet representation obtained through self-supervised learning can be readily fine-tuned for downstream tasks of jet kinematics prediction and tagging, and provides a solid basis for unsupervised anomaly detection. Compared to existing studies in this direction, we use a realistic full-coverage calorimeter simulation, leading to results that more faithfully reflect the prospects at real collider experiments.

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