Contribution ID: **79** Type: **Oral**

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

Wednesday 13 March 2024 15:50 (20 minutes)

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 foundation model 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, e.g. large sets of collision data. We demonstrate that a jet representation obtained through SSL can be readily fine-tuned for downstream tasks of jet kinematics prediction and jet classification. 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.

Significance

Going beyond previous work, we present novel approaches to the training of our foundation model, with the aim of leveraging large unlabeled datasets (opening the door to novel data-driven analysis techniques) and learning transferable jet representations that are invariant to detector properties.

References

- Presentation at the ML4Jets Workshop, Hamburg, 2023: https://indico.cern.ch/event/1253794/contributions/5588641/
- Paper presenting the collider detector simulation used in this work: "Configurable calorimeter simulation for AI applications"

Experiment context, if any

Primary authors: KOBYLIANSKII, Dmitrii (Weizmann Institute of Science (IL)); GROSS, Eilam (Weizmann Institute of Science (IL)); DREYER, Etienne (Weizmann Institute of Science (IL)); MERZ, Garrett; CRANMER, Kyle Stuart (University of Wisconsin Madison (US)); SOYBELMAN, Nathalie (Weizmann Institute of Science (IL)); KAKATI, Nilotpal (Weizmann Institute of Science (IL)); RIECK, Patrick (New York University (US))

Presenter: RIECK, Patrick (New York University (US))

Session Classification: Track 2: Data Analysis - Algorithms and Tools

Track Classification: Track 2: Data Analysis - Algorithms and Tools