Contribution ID: **21** Type: **Oral**

A Deep Generative Model for Hadronization

Wednesday 13 March 2024 14:30 (20 minutes)

Hadronization is a critical step in the simulation of high-energy particle and nuclear physics experiments. As there is no first principles understanding of this process, physically-inspired hadronization models have a large number of parameters that are fit to data. We propose an alternative approach that uses deep generative models, which are a natural replacement for classical techniques, since they are more flexible and may be able to improve the overall precision. We first demonstrate using neural networks to emulate specific hadronization when trained using the inputs and outputs of classical methods. A protocol is then developed to fit a deep generative hadronization model in a realistic setting, where we only have access to a set of hadrons in data. Finally, we build a deep generative hadronization model that includes both kinematic (continuous) and flavor (discrete) degrees of freedom. Our approach is based on Generative Adversarial Networks and we show the performance within the context of the cluster model within the Herwig event generator.

Significance

This presentation shows results that demonstrate our proposed new methods for simulating hadronization in particle physics. It provides better flexibility and can fit to data, which can potentially replace the current standard hadronization models in the future.

References

This presentation will be mainly based on the following papers:
1. https://arxiv.org/abs/2203.12660
2. https://arxiv.org/abs/2305.17169
3. https://arxiv.org/abs/2312.08453

Experiment context, if any

Primary authors: CHAN, Jay (Lawrence Berkeley National Lab. (US)); JU, Xiangyang (Lawrence Berkeley National Lab. (US)); KANIA, Adam; NACHMAN, Ben (Lawrence Berkeley National Lab. (US)); SIODMOK, Andrzej Konrad (Jagiellonian University (PL))

Presenter: CHAN, Jay (Lawrence Berkeley National Lab. (US))

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

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