Contribution submission to the conference SMuK 2023

Multi-parameter Conditioning of Generative Models for Fast Simulation of Highly Granular Calorimeter Showers —
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High fidelity detector simulation is crucial for modern high energy physics experiments. While traditional simulation tools based on Monte Carlo methods are powerful, they consume significant computational resources. For this reason at the upcoming high luminosity stage of the LHC and for future colliders, simulation is expected to produce a major computational bottleneck. Particle showers in calorimeters are particularly computationally intensive due to the many interactions that occur with the detector material. Given the vast increases in the granularity of these detectors for future experiments, a high degree of fidelity is required of a surrogate simulator.

Deep generative models hold promise to provide significantly faster, yet accurate, simulation tools. Significant progress has been made in the simulation of both electromagnetic and hadronic showers in highly granular calorimeters. However challenges remain when broadening the scope of these simulators. In particular, these tools must be able to accept multiple conditioning parameters, for example to be able to handle particles incident at arbitrary angles. This talk will review the development of such a simulation tool, with a particular focus on the high degree of physical fidelity achieved, as well as the performance after interfacing with reconstruction algorithms.

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