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Generative modeling for shower simulation in ATLAS

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Modeling the physics of a detector's response to particle collisions is one of the most CPU intensive and time consuming aspects of LHC computing. With the upcoming high-luminosity upgrade and the need to have even larger simulated datasets to support physics analysis, the development of new faster simulation techniques but with sufficiently accurate physics performance is required. The current ATLAS fast calorimeter simulation technique, based on parametrizations of the calorimeter response in the longitudinal and transverse direction given a single particle's eta and energy, is being updated to higher accuracy including machine learning approaches. Here we report on a prototype using cutting edge machine learning approaches to learn the appropriate detector output response, which are expected to lead to an improved modelling of correlations within showers. The model is trained on a set of fully simulated events and the goal is to generate new outputs. We are studying Variational Auto-Encoders (VAEs) and Generative Adversarial Networks (GANs) to model particle showers in the ATLAS calorimeter. In this study we present an exploratory analysis of both models trained with different optimization tricks and criteria. Thus, our goal is get a deeper understanding of the learning process and how it leads to better improvement of the generation performance.

Consider for promotion

Yes

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