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Refinement of calorimeter showers simulated with normalizing flow model

The simulation of calorimeter showers is computationally expensive, leading to the development of generative models as an alternative. Many of these models face challenges in balancing generation quality and speed. A key issue damaging the simulation quality is the inaccurate modeling of distribution tails. Normalizing flow (NF) models offer a trade-off between accuracy and speed, making them a promising approach. This work builds on the CaloINN NF model and introduces a set of post-processing modifications of analysis-level observables aimed at improving the accuracy of distribution tails. We used CaloChallenge datasets as well as simulations produced with Open Data Detector (ODD) to validate the method. The results show that introduced refinements enhance overall performance, achieving accuracy comparable to the most precise calorimeter shower models while maintaining the simulation speed of NF models. The study is conducted as part of the interTwin project, which develops Digital Twins for applications in physics and earth observation, demonstrating the use of the intertwin platform for calorimeter simulation.

AI keywords

normalizing flow, generative model, post-processing

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Track Classification: Simulations & Generative Models