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Electromagnetic-shower generation with Graphical GANs

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At this moment the most convenient approach in electromagnetic shower generation is Monte-Carlo simulation produced by software packages like GEANT4. However, one of the critical problems of Monte-Carlo production is that it is extremely slow since it involves simulation of numerous subatomic interactions.

Recently, generative adversarial networks(GANs) addressed speed issue in the simulation of calorimeters response with significant speeding-up a two-three order of magnitude in comparison with the current approach. However, it is challenging to define network architecture that converges within a reasonable timeframe and define a proper figure of merit that yields realistic synthetic objects.

In this work, we propose a metric that deals successfully with the structure of the showers. The architecture of the neural network that performs nicely with shower-like objects is called graphical network. Plus the approach for the generation of electromagnetic showers with graphical neural networks fits well into a GAN-based training and produces the meaningful result. The novelty of this approach lies, firstly, in the generation of complex recursive physical process with neural network and, secondly, in significant speed-up in comparison with traditional simulation approaches.

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