Contribution ID: **45** Type: **not specified**

High Granularity Calorimeter Simulation using Generative Adversarial Networks

Wednesday, April 17, 2019 9:55 AM (20 minutes)

High Energy Physics simulation typically involves Monte Carlo method. Today >50% of WLCG resources are used for simulation that will increase further as detector granularity and luminosity increase. Machine learning has been very successful in the field of image recognition and generation. We have explored image generation techniques for speeding up HEP detector simulation. Calorimeter responses can be treated as images with energy deposition interpreted as "pixel intensities". One important difference is that pixel luminosity usually cover a range of 0-255 while energy depositions can vary over many orders of magnitude. We have implemented a three dimensional detector simulation tool using Generative Adversarial Networks. Our initial implementation could generate detector response for different energies of the incoming particles at fixed angles in a 25x25x25 cell grid. We present an upgraded version able to simulate electron showers for variable angles of impact in addition to variable primary energies. The inclusion of angles required increasing the sample size in transverse direction to 51x51x25 cells, multiplying by four the number of outputs. Due to the complexity of the task, the range of primary energies has been initially limited to 100-200 GeV. Training was has been improved raising cell energies to power less than one. A check for correct angle is added to the cost function together with comparisons of cell energy distribution. Currently, the accuracy of the result is a bit lower than the fixed angle version but still within 10% for relevant shower parameters.

Preferred contribution length

30 minutes

Primary authors: CARMINATI, Federico; KHATTAK, Gul Rukh (University of Peshawar (PK)); VALLECORSA, Sofia

Presenter: KHATTAK, Gul Rukh (University of Peshawar (PK))

Session Classification: Submitted contributions