Canadian Association of Physicists
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Contribution ID: **3892** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Simulating noise waveforms in the Belle II electromagnetic calorimeter (ECL) using generative adversarial neural networks (GANs)

Monday 19 June 2023 17:00 (15 minutes)

The Belle II experiment, based at SuperKEKB, is collecting e+e- collision data at the Upsilon(4S) resonance energy. The Belle II physics program is enabled by the (all-time high) record luminosity of SuperKEKB; a metric that also incurs record high beam background in the detector. Accurate simulation of physics events in the detector during collisions is vital to obtaining quality physics results.
The effects of beam background are currently represented in simulations by overlaying background data measured randomly during data taking. The large size of these background data samples is a technical problem; they are challenging to use on distributed computing grids. As Belle II approaches higher luminosity, saving and using data samples will become unsustainable. An alternative scheme where data-like beam background samples are generated in lieu of data samples directly while simulating is necessary to continue producing the quality simulations essential for the Belle II physics program.
The novel generative adversarial network (GAN) implemented in the Belle II electromagnetic calorimeter (ECL) is capable of simulating data-like background waveforms in the 8736 CsI(Tl) ECL crystals, which will mitigate this problem. GANs can be used in High Energy Physics (HEP) experiments as a novel simulation method to generate random yet accurate background waveforms on the fly from lightweight neural networks that can be overlayed onto more complex physics simulations such as those coming from GEANT4. This talk will show GAN designs at Belle II, their training framework and the tests performed to determine their performance.

Keyword-1

Belle II

Keyword-2

GAN

Keyword-3

Simulation

Primary author: BEAUBIEN, Alexandre

Presenter: BEAUBIEN, Alexandre

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