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Multi-Jet Event classification with Convolutional neural network at Large Scale

We present the first application of scalable deep learning with a high-performance computer (HPC) to physics analysis using the CMS simulation data with 13 TeV LHC proton-proton collision. We build a convolutional neural network (CNN) model which takes low-level information as images considering the geometry of the CMS detector. The CNN model is implemented to discriminate R-parity violating supersymmetry (RPV SUSY) signal events from the background events with inelastic quantum process from the Standard Model (QCD multi-jet). We compare the classification performance of the CNN method with the traditional cut-based method that has been widely used in high-energy physics so far. We show that the obtained signal efficiency (and expected significance) of the CNN method is 1.85 (1.2) higher than that of the cut-based method. To speed up the training, we perform the studies at the Nurion HPC system at Korea Institute of Science and Technology Information (KISTI) up to thousands of parallel "Xeon Phi" CPUs. We demonstrate the scalability with our CNN model up to 1024 nodes based on the HPC.

Significance

This is the first application of scalable deep learning with high performance computer to physics analysis using the CMS simulation data with 13 TeV LHC proton-proton collision.

This study prospects that the training time can be effectively shortened through scalable deep learning in the SUSY model, which requires a long training time due to its large number of parameters, and the HL-LHC era, which will generate enormous data in the future.

References

http://www.kps.or.kr/conference/event/content/program/search_result_abstract.php?id=1692&tid=162

Speaker time zone

Compatible with Asia

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