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Particle-based Fast Jet Simulation at the LHC with Variational Autoencoders

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At the LHC, the full-simulation workflow requires a large fraction of the computing resources available for experiments. With the planned High Luminosity upgrade of the LHC, the amount of needed simulated datasets would even increase. Speeding up the simulation workflow is of crucial importance for the success of the HL-LHC program and Deep Learning is considered as a promising approach to achieve this goal. In this study, we employ Deep Variational Autoencoders to train a fast simulation of jets of particles at the LHC. Starting from a generator-level view of a jet, we train a variational autoencoder to model the detector response and get the corresponding jet at reconstruction-level bypassing the time-consuming detector simulation and reconstruction steps. This approach achieves inference time comparable to that of a rule-based fast simulation and an accurate description of the momenta of the jet and its constituents.

Primary authors: TOURANAKOU, Mary (National and Kapodistrian University of Athens (GR)); CHERNYAVSKAYA, Nadya (CERN); DUARTE, Javier Mauricio (Univ. of California San Diego (US)); Prof. GUNOPULOS, Dimitrios (National and Kapodistrian University of Athens); KANSAL, Raghav (Univ. of California San Diego (US)); ORZARI, Breno (UNESP - Universidade Estadual Paulista (BR)); PIERINI, Maurizio (CERN); TOMEI FERNANDEZ, Thiago (UNESP - Universidade Estadual Paulista (BR)); VLIMANT, Jean-Roch (California Institute of Technology (US))

Presenter: ORZARI, Breno (UNESP - Universidade Estadual Paulista (BR))

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