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Fast detector modeling using machine learning algorithms

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Accurately and computationally rapidly modeling stochastic detector response for complex LHC experiments involving many particles from multiple interaction points, up to 200 interactions per proton-proton crossing in the HL-LHC requires the development of novel techniques. A study aimed at finding a fast transformation from truth level physics objects to reconstructed detector level physics objects is presented. This study used Delphes fast simulation based on an LHC-like detector geometry for inputs for machine learning (ML) algorithms, i.e. feed-forward regression neural networks, generative adversarial networks, and variational autoencoders. These ML transfer algorithms, with sufficient optimizations could have a wide range of applications to improve current detector simulations including: improving phenomenological studies by using a better detector representation, increasing the speed of creating event samples that more accurately resemble the output from Geant4-based detector simulation programs, or even speeding up fast simulations based on parametric description of LHC detector responses.

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