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Deep Generative Models for detector simulation

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The High Energy Physics (HEP) community has a long tradition of using Machine Learning methods to solve tasks related, mostly, to the selection of interesting events over the overwhelming background produced at colliders. In recent years, several studies, in different fields of science, industry and society, have demonstrated the benefit of using Deep Learning (DL) to solve typical tasks related to data analysis. Building on these examples, many HEP experiments are now working on integrating DL into their workflows for different applications: from data quality monitoring, to real-time selection, to simulation.

In particular, Monte Carlo simulation is expected to represent one of the major challenges, in terms of computing resources, for the High Luminosity LHC upgrade and alternative fast simulation solutions will be required. In this talk, I will present several studies on the use of Generative Models as potential alternatives to classical simulation. Initial results are very promising: different levels of agreement to Monte Carlo have been reached. Most studies are now beyond the initial prototyping stage, and face new challenges related to detailed performance assessment, optimisation, computing resources and integration in the simulation framework.

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