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Generating high-level physics variables based on Monte Carlo simulated ttH events using Wasserstein GANs

Developing and building an analysis in high energy particle physics requires a large amount of simulated events. Simulations at the LHC are usually complex and computationally intensive due to sophisticated detector architectures. In this context, Generative Adversarial Networks (GANs) have recently caught a wide interest. GANs can learn to generate complex data distributions and produce samples up to 5 orders of magnitude faster than well-established simulations.
The recently introduced Wasserstein GAN (WGAN) further improves and stabilizes the training process of generative models. In this talk we present the results of a WGAN trained to produce a set of high-level physics variables in the context of top-quark pair associated Higgs boson production (ttH). In contrast to other GAN applications presented in the literature this high-dimensional data has no simple visual representation. We demonstrate how the quality of our generated data can be evaluated using the already trained WGAN model itself as well as a correlation score based on the Fisher transformation.
For benchmarking purposes we introduce a simple discrimination task between ttH and its primary irreducible background. In this setup we train two separate WGANs, one for the signal and one for background events. The performance of a discriminator based on these generated samples is compared to a network trained on the original simulated events.

Intended contribution length

20 minutes

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