Contribution ID: **72** Type: **not specified**

Looking at overfitting within semi-supervision with Generative Adversarial Networks for physics searches at the LHC

The technique of semi-supervision can be used in searches for new physics where the signal plus background regions are not labelled. We employ semi-supervision but this technique has over-fitting issues. We resort to GANs to mimic a Monte Carlo (MC) simulation which is very expensive computationally in order to perform toy MC studies. We propose Generative Adversarial Networks (GANs) as our main framework. GANs are powerful, but often suffer from number of issues including training instability or failure to converge. We henceforth go beyond vanilla GANs, by implementing a wasserstein GAN with gradient penalty (WGAN-GP) to achieve performance stability. We demonstrate the effectiveness of WGAN-GP on MC generated data and show that WGAN-GP achieves a better performance and is capable of generating perfect fakes with a good accuracy on a single GPU.

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