Contribution ID: **85** Type: **Talk**

Surrogate Regressors for a Surrogate generators

Thursday 15 September 2022 09:50 (20 minutes)

High energy physics experiments essentially rely on the simulation data used for physics analyses. However, running detailed simulation models requires a tremendous amount of computation resources. New approaches to speed up detector simulation are therefore needed.
t has been shown that deep learning techniques especially Generative Adversarial Networks may be used to reproduce detector responses. However, those applications are challenging, as the generated responses need evaluation not only in terms of image consistency, but different physics-based quality metrics should be taken into consideration as well.
In our work, we develop a multitask GAN-based framework with the goal to speed up the response generation of the Electromagnetic Calorimeter. We introduce the Auxiliary Regressor as a second task to evaluate a proxy metric of the given input that is used by the Discriminator of the GAN. We show that this approach improves the stability of GAN and the model produces samples with the physics metrics distributions closer to the original ones than the same architecture without additional loss.

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Session Classification: Applications in Particle Physics

Track Classification: Particle Physics