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Towards a Deep Learning Model for Hadronization

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Hadronization is a complex quantum process whereby quarks and gluons become hadrons. The widely-used models of hadronization in event generators are based on physically-inspired phenomenological models with many free parameters. We propose an alternative approach whereby neural networks are used instead. Deep generative models are highly flexible, differentiable, and compatible with Graphical Processing Unit (GPUs). We make the first step towards a data-driven machine learning-based hadronization model by replacing a compont of the hadronization model within the Herwig event generator (cluster model) with a Generative Adversarial Network (GAN). We show that a GAN is capable of reproducing the kinematic properties of cluster decays. Furthermore, we integrate this model into Herwig to generate entire events that can be compared with the output of the public Herwig simulator as well as with e+e− data.

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