Contribution ID: **60** Type: **not specified**

Generate parton-level events from reconstructed events with Conditional Normalizing Flows

Tuesday 7 November 2023 14:45 (15 minutes)

In High Energy Physics, generating physically meaningful parton configurations from a collision reconstructed within a detector is a critical step for many complex analysis tasks such as the Matrix Element Method computation and Bayesian inference on parameters of interest. This contribution introduces a novel approach that employs generative machine learning architectures, Transformers combined with Normalizing Flows, to accomplish this complex task.

Traditionally, regressing parton level quantities, such as the transverse momentum of single particles, is a common task in High Energy Physics. However, performing this task on the full event description at the parton level poses significant challenges. Furthermore, attempts to draw samples from a parton level probability density function are rare.

We propose to tackle this problem from a new perspective by using a Transformer network to analyze the full event description at the reconstruction level (including jets and leptons). This approach extracts a latent information vector, which is then used to condition a Normalizing Flow network. The Normalizing Flow learns the conditional probability at the parton level directly and is trained to generate probable sets of partons that are compatible with the observed objects. Our strategy is applicable to events with multiple jets multiplicity and can be scaled to model additional radiation at the parton level.

We will present the performance of the first version of this architecture applied to a complex final state, such as the ttH(bb) semileptonic channel. Additionally, we will discuss possible applications of the method.

Authors: VALSECCHI, Davide (ETH Zurich (CH)); LIAO, Hongbo (Chinese Academy of Sciences (CN))

Presenter: VALSECCHI, Davide (ETH Zurich (CH))

Session Classification: Generative: Partons and Phase Space