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Generating particle-clouds with discrete features using Markov jump processes

Tuesday 5 November 2024 14:30 (20 minutes)

In many real-world scenarios, data is hybrid —i.e. described by both continuous and discrete features. At high-energy accelerators like the LHC, jet constituents exhibit discrete properties such as electric charge or particle-id. In this talk, we introduce a novel generative model for discrete features based on continuous-time Markov jump processes. By combining our approach with well-known models for continuous features, such as diffusion or flow-matching, we can effectively model hybrid data within a unified framework. We apply our method to generate particle-clouds that incorporate kinematic data, particle identities, and charge information. We demonstrate the effectiveness of our approach on the JetClass dataset.

Track

Detector simulation & event generation

Author: Dr FAROUGHY, Darius (Rutgers University)

Presenter: Dr FAROUGHY, Darius (Rutgers University)

Session Classification: Event generation