29th International Symposium on Lepton Photon Interactions at High Energies

Contribution ID: **346** Type: **Parallel Session talk**

Variational Autoencoders for New Physics Mining at the Large Hadron Collider

Thursday, August 8, 2019 9:00 AM (12 minutes)

Summary

Using deep autoencoders trained on known physics processes, we develop a one-side p-value test to isolate previously unseen event topologies as outlier events. Since the autoencoder training does not depend on any specific new physics signature, the proposed procedure has a weak dependence on underlying assumptions about the nature of new physics. Such a strategy can be exploited to extend the sensitivity of the LHC to new physics. We provide two practical examples: a trigger application that selects otherwise lost anomalous events, stored for visual inspection and to guide future searches; a technique to turn each LHC search to final states including jets into a model-independent and data-driven search for new physics. These studies and future applications of autoencoders to high energy physics will contribute to the robustness of the LHC physics program and could be extended easily beyond collider physics.

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Session Classification: Detectors/Accelerators/Computing (Parallel)

Track Classification: Accelerators, Detectors and Computing for HEP