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An Anomaly Detection strategy for new physics searches at the LHC

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We introduce a strategy based on unsupervised learning to identify new physics contributions in Vector Boson Scattering events at the LHC.

New physics contributions are modeled within the Standard Model Effective Field Theory (SMEFT) framework. Our anomaly detection strategy relies on Variational AutoEncoders (VAEs), which operate a dimensionality reduction and then map the lower dimensional representation back to the input space. The model is trained on a SM process, thereby learning to accurately reproduce its features. However, notable deviations in the output of the model are observed for instances generated through SMEFT. The reconstruction loss can thus be used to identify an anomaly-enriched region. As the model is solely trained on known physics, the strategy is independent of the specific nature of the chosen new physics process.

We demonstrate this strategy using parton-level generations of same-sign WW scattering events at the LHC, assuming an integrated luminosity of 350/fb.

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