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Self-supervision for data-driven anomaly detection at the LHC

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Anomaly detection at the LHC broadens the search for BSM effects by making no assumptions about the signal hypothesis. We employ ML to perform density estimation on raw data and use the density estimate for anomaly detection. A neural network can learn the physics content of the raw data. However, the gain in sensitivity to features of interest can be hindered by redundant information already explainable in terms of known physics. This poses the question of constructing a representation space where known symmetries are manifest and discriminative features are retained. We use contrastive learning to define a representation space invariant under pre-defined transformations and test the learned representations with an autoencoder-based OOD detection task. I will present results on tagging dark jets from jet constituents and the detection of anomalies in reconstructed events using our CLR framework.

Primary authors: DILLON, Barry; FEIDEN, Friedrich; RUESCHKAMP, Jan; FAVARO, Luigi (University of Heidelberg - ITP); KRAEMER, Michael; MODAK, Tanmoy; PLEHN, Tilman (Universität Heidelberg, ITP)

Presenter: FAVARO, Luigi (University of Heidelberg - ITP)

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