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Symmetries, Safety, and Self-Supervision

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Collider searches face the challenge of defining a representation of high-dimensional data such that physical symmetries are manifest, the discriminating features are retained, and the choice of representation is new-physics agnostic. We introduce JetCLR to solve the mapping from low-level data to optimized observables though self-supervised contrastive learning. As an example, we construct a data representation for top and QCD jets using a permutation-invariant transformer-encoder network and visualize its symmetry properties. We compare the JetCLR representations with alternative representations using linear classifier tests and demonstrate its performance on an anomaly detection task.

Primary authors: Dr DILLON, Barry (University of Heidelberg); KASIECZKA, Gregor (Hamburg University (DE)); Mr VOGEL, Lorenz (Heidelberg University); SORRENSON, Peter Rangi (Universität Heidelberg); PLEHN, Tilman

Presenter: SORRENSON, Peter Rangi (Universität Heidelberg)

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