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Can contrastive learning de-bias my model?

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Deep learning models have become ubiquitous in high-energy physics and have been successfully applied to a wide variety of tasks. Models for reconstruction are usually trained from scratch on a nominal set of simulation parameters, not taking into account variations of detector systematic uncertainties.

Following advances in contrastive learning, we present a method of pre-training a general model, that is de-biased from detector systematic uncertainties. During the pre-training phase, the model learns a representation that is invariant to simulation shifts and symmetries, by contrasting between different simulated views of the same event. Freezing the weights of the contrastive model, the extracted representation is general enough that it can be used for a variety of prediction tasks. We showcase the flexibility and efficacy of this method by training with sparse 3D neutrino liquid argon time projection chamber (LArTPC) data.

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