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Learning a Representation of New Physics Models

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In the world of particle physics experiments, we often deal with data lying in high-dimensional spaces. Tasks like navigating and comparing these data points become challenging, but can be simplified with dimensionality reduction methods. In this work, we develop a method for mapping data originating from both Standard Model processes and various theories Beyond the Standard Model into a unified representation space while conserving information about the relationship between the underlying processes. We show that such mapping techniques can be learned by a neural network and that the arrangement of processes within this representation space is stable and based on the physical properties of the processes. These results were achieved by applying neural embedding and contrastive learning to decay data by either conserving a pairwise distance or by learning similarities and differences between the signals. The resulting arrangements are easy to interpret and show interesting relationships between the data sets.

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