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BSM models and parameter inference via an n-channel 1D-CNN

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In this study, we focused on inferring BSM models and their parameters from the kinematic distributions of collider signals via an n-channel 1D-Convolutional Neural Network (1D-CNN). As new physics may influence two or more observables, a 2D-CNN approach might not always be the best option. Alternatively, one can use a simple MLP with any number of observables via an event-by-event approach. However, this may not be the best in inferring global parameters that influence the entire dataset. Instead, we opt for an n-channel 1D-CNN that allows simultaneous inference from n observables while still inferring from distributions. To exemplify our approach, we applied our method on a two-component dark matter model using mono-jet and mono-Z signals. It is used to distinguish between different dark matter fields and also to infer their spin and mass. Given the importance of having sufficient training data for ML and also the computational expenses associated with simulations, we introduced a data augmentation technique. This involves modifying our architecture to be multiheaded and also including auxiliary information as additional inputs. Beyond conserving computational resources, this also improves our method's robustness against variations in signal regions.

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