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Enhancing Parameter Exclusion and Extrapolation in Physics Applications with Advanced Machine Learning Techniques: A Phenomenological Perspective

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The burgeoning field of machine learning in physics has proven to be an indispensable tool for constraining parameters and augmenting sensitivities across a range of applications. In this study, we present a modern comparison of diverse methodologies for eliminating parameter space regions within a representative toy model. We further introduce a novel machine learning technique, the Attention Parametric Graph Neural Network model, which demonstrates exceptional performance in both parameter exclusion and extrapolation via sensitivity estimation. Our findings offer valuable insights into the potential of advanced machine-learning approaches for bolstering the efficacy of phenomenological studies which can be applied to constrain dark matter and enhance searches.

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