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A Data-Directed Paradigm for Resonance Detection at the LHC

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The 'Data-Directed Paradigm'(DDP) is a search methodology that efficiently explores possibilities for new physics within a vast number of spectra featuring smooth-falling Standard Model backgrounds. DDP deviates from the traditional analytical approach by sidestepping the requirement for a simulated or functional-form-based background estimate. Instead, it uses a neural network trained to predict the log-likelihood-based significance such that, when used on data, should be able to identify histograms that present an anomalous bump. The adoption of the DDP approach results in a significant reduction in time requirements and has the potential to enhance the ATLAS data discovery reach by enabling the prompt investigation of numerous unexplored regions.

Currently, the DDP is trained on samples that have analytical functions as background with injected artificial gaussian signals. These background functions are obtained either from smoothly falling shapes or from fitting data-like histograms, such as the Dark Machines samples. The training of the model is currently being optimized in a series of tests, in the hope of eventually using it with ATLAS data in the context of anomaly detection.

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