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Automatizing the search for mass resonances using BumpNet

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The search for resonant mass bumps in invariant-mass distributions remains a cornerstone strategy for uncovering Beyond the Standard Model (BSM) physics at the Large Hadron Collider (LHC). Traditional methods often rely on predefined functional forms and exhaustive computational and human resources, limiting the scope of tested final states and selections.

This poster presents BumpNet, a Convolutional Neural Network to predict log-likelihood significance values in each bin of smoothly falling invariant-mass histograms. Thereby a model-agnostic search of many final states at once can be performed without the need for traditional background-estimation. The method allows for an exploration of the many unsearched areas of the phase space within the time frame of a traditional analysis of one final state. Training the network on realistic simulated data and smoothly falling functions has led to promising results, such as predicting the correct significance of the Higgs boson discovery, agreement with a previous ATLAS dilepton search, and success in predicting the excess in significance in simulated BSM scenarios. These results highlight the potential for BumpNet to accelerate the discovery of New Physics and motivate current work on implementing this technique in an ATLAS analysis.

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