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Neural Simulation Based Inference for Constraining Higgs self-coupling with HH->bbyy at ATLAS experiment

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The ATLAS experiment has published measurement of Higgs trilinear self-coupling with LHC Run 2 + partial Run 3 data, reaching a range of -1.7 < κ_λ < 6.6 ; but the core algorithm for statictical inference is a $m_{\gamma\gamma}$ histogram-based fit, which is not optimal given the κ_λ is non-linear to the signal strength. Motivated by the drawback of histogram analysis, we present an improved algorithm – Neural Simulation Based Inference (NSBI) to study the constraint on κ_λ. The NSBI method depends on multi-dimentional, minimal-biased estimation of the likelihood ratio for signal and background components, by training a set of classificational neural networks. This works can serve as input to an analysis with full Run 2 + Run 3 LHC data.

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