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NFLikelihood: Unsupervised Machine Learning LHC likelihoods with Normalizing Flows.

Full statistical models encapsulate the complete information of an experimental result, including the likelihood function given observed data. Their proper publication is of vital importance for a long lasting legacy of the LHC. Major steps have been taken towards this goal; a notable example being ATLAS release of statistical models with the pyhf framework. However, even the likelihoods are often high-dimensional complex functions that are not straightforward to parametrize. Thus, we propose to describe them with Normalizing Flows, a modern type of generative networks that explicitly learn the probability density distribution. As a proof of concept we focused on two likelihoods from global fits to SM observables and a likelihood of a NP-like search, obtaining great results for all of them. As a plus, we showcase that Normalizing Flows can generally scale well to very high dimensions by testing them against generic multi-modal functions.

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