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# DNNLikelihood

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We introduce the DNNLikelihood, a novel framework to easily encode, through Deep Neural Networks (DNN), the full experimental information contained in complicated likelihood functions (LFs). We show how to efficiently parametrize the LF, treated as a multivariate function of parameters and nuisance parameters with high dimensionality, as an interpolating function in the form of a DNN predictor. We do not use any Gaussian approximation or dimensionality reduction, such as marginalization or profiling over nuisance parameters, so that the full experimental information is retained. The procedure applies to both binned and unbinned LFs, and allows for an efficient distribution to multiple software platforms, e.g. through the framework independent ONNX model format. The distributed DNNLikelihood could be used for different use cases, such as re-sampling through Markov Chain Monte Carlo techniques, possibly with custom priors, combination with other LFs, when the correlations among parameters are known, and re-interpretation within different statistical approaches, i.e. Bayesian vs frequentist. We discuss the accuracy of our proposal and its relations with alternative approximation techniques and likelihood distribution frameworks. We apply our procedure to a pseudo experiment corresponding to a realistic LHC search for new physics already considered in the literature.

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