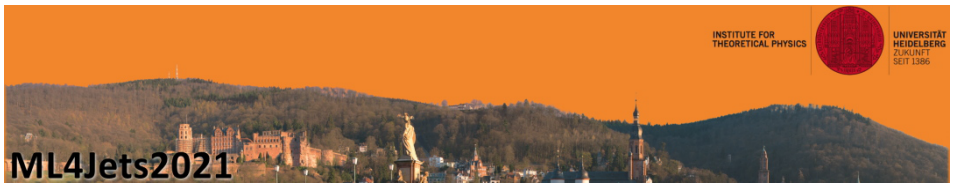

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Learning Uncertainties the Frequentist Way: Calibration and Correlation in High Energy Physics

Wednesday, July 7, 2021 2:40 PM (20 minutes)

A common problem that appears in collider physics is the inference of a random variable Y given a measurement of another random variable X, and the estimation of the uncertainty on Y. Additionally, one would like to quantify the extent to which X and Y are related. We present a machine learning framework for performing frequentist maximum likelihood inference with uncertainty estimation and measuring the mutual information between random variables. By using the Donsker-Varadhan representation of the KL divergence, the framework learns the likelihood ratio $p(x|y)/p(x)$. This can be used to calculate the mutual information between X and Y. The framework is parameterized using a Gaussian ansatz, which enables a manifest extraction of the maximum likelihood values and uncertainties. All of this can be accomplished in a single training of the model. We then demonstrate our framework for a simple Gaussian example, apply it to a realistic calibration task by calculating jet energy correction (JEC) and jet energy resolution (JER) factors for CMS open data.

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Session Classification: Regression, Calibration, and Fast Inference