

Statistics for Machine Learning Lecture I

Wednesday 3 April 2024 09:15 (1h 30m)

Plan for Lectures I - III:

LHC Physics with its vast amount of data and its precise first-principle simulations is a perfect case for using modern machine learning techniques. This includes data acquisition, analysis, simulations, and inference. I will introduce the main ML-concepts and ML-tools in a physics-specific manner, with a focus on statistics aspects. I will start by introducing Bayesian neural networks and likelihood loss functions and show how we can train classification networks with a probabilistic output. I will then introduce a range of generative networks, which are transforming not only our daily lives but also LHC physics. Finally, I will discuss how these ML-methods enable unfolding or inverse simulations and optimal inference for the LHC and more broadly. While there will be no tutorial for this lecture, all students are encouraged to deepen their understanding using the tutorials which are provided with the lecture notes <https://arxiv.org/abs/2211.01421> Updated lecture notes are here:

https://www.thphys.uni-heidelberg.de/~plehn/pics/modern_ml.pdf

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