Extracting the Most from Collider Data with Deep Learning

Wednesday, June 30, 2021 • noon -1 p.m.

Abstract:"Precise scientific analysis in collider-based particle physics is possible because of complex simulations that connect fundamental theories to observable quantities. These simulations have been paired with multivariate methods for many years in search of the smallest distance scales in nature. Deep learning tools hold great promise to qualitatively change this paradigm by allowing for holistic analysis of data in its natural hyperdimensionality with thousands or millions of features instead of up to tens of features. These tools are not yet broadly used for all areas of data analysis because of the traditional dependence on simulations. In this talk, I will discuss how we can change this paradigm in order to exploit the new features of deep learning to explore nature at sub-nuclear distance scales. In particular, I will show how neural networks can be used to (1) overcome the challenge of intractable hypervariate probability density modeling and (2) learn directly from (unlabeled) data to perform hypothesis tests that go beyond any existing analysis methods. The example for (1) will be full phase space unfolding and the example for (2) will be anomaly detection. The talk will include a discussion of uncertainties associated with deep learning-based analyses."

Link: https://bluejeans.com/451415148/8427   Contact: tennant@jlab.org

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Dr. Ben Nachman received his bachelor's degree from Cornell University in 2012, Churchill Scholar at the University of Cambridge in 2012-2013, Ph.D. in Physics / Ph.D. minor in Statistics from Stanford University in 2016. He was a Chamberlain Fellow at Berkeley Lab from 2016-2020 and is currently a Staff Scientist at Berkeley Lab and the Group leader of Machine Learning for Fundamental Physics.