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Detecting New Physics as data anomalies at the LHC: Transitioning from small-scale toy datasets to millions of complex proton collisions

Tuesday 10 September 2024 16:45 (25 minutes)

Anomaly detection has emerged as a promising technique for identifying subtle New Physics signals amidst a dominant Standard Model background. Due to the novelty of these techniques, they are often proposed and demonstrated on toy datasets that mimic real LHC data before being deployed in actual experiments. In this talk, we will discuss the challenges encountered during the transition from research and development to practical implementation in experiments, highlighting lessons learned and future prospects. Various techniques will be compared, including outlier detection versus over-density detection, along with different levels of supervision, ranging from weakly supervised to semi-supervised and unsupervised methods. We will address the statistical challenges involved in applying these methods for data analysis and ultra-fast event filtering in the CMS Experiment at CERN. The discussion will focus on the robustness of these methods and the challenges associated with validating them.

Presenter: AARRESTAD, Thea (ETH Zurich (CH))

Session Classification: Talks