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Novel Machine Learning techniques for high-dimensional density estimation and photon shower calibration

Tuesday 8 April 2025 14:00 (15 minutes)

A large part of High Energy Physics is dedicated to correcting wrong distributions due to detector mismodelling, experimental measurement limitations and an insufficient theoretical understanding of non-perturbative processes. This often results in deviations between MC and data distributions, that require a lot of time to correct - especially in very high-dimensional, highly correlated feature spaces. As a result, I will present novel Machine Learning techniques that simultaneously correct the deviations across the entire feature space with first-order gradient boosting and Wasserstein-based regression. The ML models presented allow an improved probability density estimation of the underlying distributions, and are used to enhance the calibration of photon showers in the electromagnetic calorimeter (ECAL) of CMS. These new approaches can be used to generally minimise analysis uncertainties and increase the sensitivity to New Physics at the LHC in Run 3 and beyond.

Author: KRUPER, Paul Felix (Imperial College (GB))

Presenter: KRUPER, Paul Felix (Imperial College (GB))

Session Classification: Analysis and Reconstruction Methods

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