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OmniFoldHI: Advanced ML Unfolding for Heavy-Ion Data

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To compare collider experiments, measured data must be corrected for detector distortions through a process known as unfolding. As measurements become more sophisticated, the need for higher-dimensional unfolding increases, but traditional techniques have limitations. To address this, machine learning-based unfolding methods were recently introduced. In this work, we introduce OmniFoldHI, an improved version of the well-known algorithm [1], tailored for heavy-ion analyses. OmniFoldHI incorporates background counts, detector acceptances, efficiency, and uncertainties for real-analysis applications, and it works for an arbitrary number of observables. Besides removing detector effects, we demonstrate that unfolding can be used to subtract the high-multiplicity underlying event, which is crucial for jet-quenching analyses and phenomenology. With these enhancements, OmniFoldHI functions effectively even without additional background subtraction. To illustrate its capabilities, we apply OmniFoldHI to unfold up to a 7-dimensional jet-substructure observable, comparing it to traditional techniques and quantifying uncertainties. We present model-independent results, with training and testing performed using different event generators.

[1] Andreassen et. al, Phys. Rev. Lett. 124, 182001 (2020)

Track

Unfolding

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