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MadNIS: Neural networks for multi-channel integration

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High-precision theory predictions require the numerical integration of high-dimensional phase-space integrals and the simultaneous generation of unweighted events to feed the full simulation chain and subsequent analyses. While current methods are based on first principles and are mathematically guaranteed to converge to the correct answer, the computational cost to decrease the numerical error to a sub-percent level is enormous. Therefore, we combine current methods with fast and flexible machine-learning algorithms. In detail, we use a conditional normalizing flow that extends and generalizes the idea of i-flow, as well as machine-learned multi-channel weights to reduce the Monte Carlo error. Additionally, we employ a two-stage training procedure that reuses previously generated samples to reduce the number of potentially expensive integrand evaluations.

Primary authors: BUTTER, Anja; Dr KRAUSE, Claudius (Rutgers University); Prof. MALTONI, Fabio (Universite Catholique de Louvain (UCL) (BE) and Università di Bologna); ISAACSON, Joshua; MATTELAER, Olivier (UCLouvain); WINTERHALDER, Ramon (UC Louvain); HEIMEL, Theo (Heidelberg University); PLEHN, Tilman

Presenter: WINTERHALDER, Ramon (UC Louvain)

Session Classification: Generative Models – Particle Level