Hello folks,

Here's what you might find interesting today. Fair warning: it's a fairly thin day for our specific topics, but a couple of papers are worth a look.

ML Uncertainty Quantification and Statistical Validation

VERaiPHY -- Validation & Evaluation for Robust AI in PHYsics -- This might be interesting for you, Jingjing. The VERaiPHY initiative, developed within the PHYSTAT programme, aims to establish statistical standards for ML development, evaluation, and deployment in fundamental physics. The opening article lays out probabilistic and statistical foundations for robustness assessment and uncertainty quantification of ML techniques -- directly in your wheelhouse of ML uncertainty quantification. It is framed as the first in a series, with later contributions promised to focus on specific methodological domains, so this is one to watch as a framework paper. **Tilman Plehn** is among the authors, which gives it additional credibility in the physics-ML intersection. The emphasis on separating statistical validation from the ML model itself is a point that should resonate with your simulation-based inference concerns, where uncertainty quantification is often the bottleneck.

Multi-Higgs Phenomenology at the LHC

Quadruple-Higgs boson production at the high-luminosity LHC -- This one is adjacent to your interests, Jingjing, though not exactly di-Higgs. The paper studies four-Higgs production via gluon fusion at the HL-LHC, deriving projected simultaneous constraints on triple and quartic Higgs self-coupling modifications using a multivariate analysis on the eight-b-jet final state. They also explore BSM scalar extensions with resonant and cascade pathways to hhhh. The ML component is a standard multivariate analysis rather than anything novel, so the appeal here is more on the phenomenology side -- understanding how far the HL-LHC can probe the Higgs self-interaction landscape beyond HH. If you are thinking about projected sensitivity studies for multi-Higgs final states, the projected constraints (c3 range of -10.3 to 11.2) give a useful baseline.

Jet Substructure and Energy Correlators

Entanglement of back-to-back gluon pair -- This might catch your eye, Aritra. The paper computes the density matrix of back-to-back gluon pairs in unpolarized pp collisions and finds that the q-qbar annihilation channel produces a maximally entangled Bell state in certain kinematic configurations, while the gg-to-gg channel yields a separable state. What makes this relevant to your interests is the use of energy correlators and their anisotropy to extract the linear polarization correlation of gluon pairs via a cos(2 Delta-Phi) modulation. This connects to your interest in understanding the physics of jets using statistical and information-theoretic tools -- the entanglement structure of parton-level states is a relatively unexplored angle that could inform how we think about information content in jet substructure observables.

That's all for today -- the rest of the arXiv listings were largely outside our scope. Back tomorrow with more!

P.S. In the most recent submission window: hep-ph: 29 papers hep-ex: 5 papers hep-th: 23 papers