Hello folks,

Here's what you might find interesting today. Slim pickings on the ML-for-HEP front, but a couple of papers are worth a look.

Simulation-Based Inference and Density Ratio Estimation

Mono-Z Dark Matter Search with Neural Spline Flows Using CMS Run 2015D Open Data

This might be interesting for you, Jingjing. The authors apply **Neural Spline Flows** to model both Standard Model background and DM signal densities in a mono-Z search using CMS open data, constructing a per-event test statistic from the log-likelihood ratio between signal and background density estimates. They work in a 37-dimensional feature space across both the mumu and ee channels simultaneously, which is a genuinely **unbinned high-dimensional analysis** -- directly in your wheelhouse for simulation-based inference and density ratio estimation. The approach avoids hard MET thresholds by leveraging the full kinematic phase space, and they perform a simultaneous profile-likelihood fit combining channels. The observed limits are weaker than expected due to a residual high-MET background-modeling discrepancy, which is an honest and useful cautionary tale about the practical challenges of flow-based density estimation in real (open) data. No starred authors, but the methodology is squarely on-topic for your interests in ML techniques for improving density ratio estimation.

Jet Substructure and Jet Physics

Measurement of Xi-/Xi+ production in jets from Z boson decays with the DELPHI open data

This might catch your eye, Aritra. The paper measures **double-strangeness baryon production rates** in energy-ranked jets from Z decays using DELPHI open data, deriving the ratio of Xi production in gluon versus quark jets relative to charged-particle multiplicity. The result, R_g/q = 1.21 +/- 0.18(stat) +/- 0.26(syst), is consistent with JETSET expectations and prior OPAL measurements for K_S and Lambda. While there is no ML component, the quark/gluon jet enrichment via energy ordering in three-jet events and the study of **baryon formation mechanisms in non-perturbative QCD** touches on your interest in understanding the physics of jets. It is a useful experimental baseline for anyone thinking about how quark-versus-gluon jet structure manifests at the particle level.

V/H+Jet Production with the Cambridge/Aachen Algorithm

This one is marginally relevant for you, Aritra. The paper presents fixed-order calculations up to four-loop order for the **invariant-mass distribution of the highest-pT jet** produced in association with a vector boson or Higgs, comparing the Cambridge/Aachen, anti-kT, and kT algorithms in terms of their impact on **non-global logarithms**. They find that the C/A algorithm suppresses large non-global logarithms more effectively than anti-kT at fixed order, while performing comparably to kT at all orders. There is no ML here, but the systematic study of how jet algorithm choice affects the perturbative structure of non-global observables is relevant background for anyone working on jet substructure -- particularly if you are thinking about how algorithmic choices interact with ML-based jet taggers that operate downstream.

That is all for today -- the rest of the arXiv listings were largely outside the ML-for-HEP scope.

Back tomorrow with more!

P.S. In the most recent submission window: hep-ph: 25 papers hep-ex: 9 papers hep-th: 24 papers