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Using a mixture density network to interface between experimental observables and QCD theory[1] ELENI TSITINIDI, MEG HOUCK, Davidson College, YASIR ALANAZI, MANAL ALMAEEN, Old Dominion University, MICHELLE KUCHERA, Davidson College, YAOHANG LI, Old Dominion University, WALLY MELNITCHOUK, Jefferson Lab, RAGHU RAMANUJAN, Davidson College, NOBUO SATO, Jefferson Lab, CENTER FOR NUCLEAR FEMTOGRAPHY COLLABORATION — We map experimental high-energy scattering data to quantum probability distributions that characterize nucleon structure and the emergence of hadrons in terms of the quark and gluon degrees of freedom of QCD. We train a mixture density network (MDN) to address the inverse problem of transforming observable space into theoretical parameter space. The output of the network provides a mixture of Gaussians that is processed through a mode-finding algorithm to produce multiple points in parameter space with their probabilities. This approach has been used to accurately predict collinear parton distribution functions, and can be straightforwardly extended to other probability distributions, such as generalized parton distributions and Wigner functions. It will thus allow us to build a new generation of QCD analysis tools that will provide a new paradigm for the analysis of high-energy data and the design of future experiments.

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