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Machine learning methods for predictions in the future Electron-Ion Collider[1] M.P. KUCHERA, Davidson College, Y. ALANAZI, M. ALMAEEN, Old Dominion University, M. HOUCK, Davidson College, T. LIU, E. MCCLELLAN, W. MELNITCHOUCK, Jefferson Laboratory, E. PRITCHARD, R. RAMANUJAN, M. ROBERTSON, Davidson College, N. SATO, R R. STRAUSS, Jefferson Laboratory, E. TSITINIDI, Davidson College, L. VELASCO, University of Dallas, Y. LI, Old Dominion University — We report on the development of machine learning tools to allow fast and accurate predictions for phenomena at the femtometer scale. There are two primary goals of this work: **(1)** Build a universal Monte Carlo event generator (MCEG). For this we implement generative adversarial networks (GANs). We train on experimental data to develop a model-independent event generator that mimics the full final state for a given reaction. In the first stage, we have trained on synthetic data on electron-proton scattering created by the Pythia MCEG, and have developed a one- and two-stage GAN that provides realistic deep-inelastic scattering spectra. **(2)** Map between experimental observables and theoretical parameters. For this we use a mixture density network (MDN) that allows us to create faithful mappings between experimental data and the underlying quantum probability distributions that describe nucleon structure. This approach represents a new paradigm for QCD global analysis, which will provide valuable tools for theorists as well as for experimentalists in the design of future experiments.

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