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Mixture density networks as a machine learning technique for QCD analysis[1] MEG HOUCK, ELENI TSITINIDI, Davidson College, MANAL ALMAEEN, YASIR AWADH ALANAZI, Old Dominion University, MICHELLE KUCHERA, Davidson College, YAOHANG LI, Old Dominion University, WALLY MELNITCHOUK, Jeffersion Lab, RAGHU RAMANUJAN, Davidson College, NOBUO SATO, Jeffersion Lab, CENTER FOR NUCLEAR FEMTOGRAPHY COLLABORATION — The use of machine learning in QCD analysis is an example of how learning techniques can facilitate the interaction between experimental data and QCD theory. In this project a mixture density network (MDN) was developed as a tool for QCD data analysis, providing one solution to the inverse problem using machine learning. The MDN is used to generate maps between experimental observables and theoretical parameters, taking experimental cross sections as inputs and generating parameters that describe the data in terms of the underlying parton distribution functions. To accommodate the possibility of multiple solutions in the theoretical parameter space when experimental data have large uncertainties, the MDN predicts a probability distribution function representing the multiple solutions and their likelihood. The results for the "up" and "down" quark distributions for the case of a 10-dimensional toy problem will be presented.

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