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Machine Learning Approaches to Hard Exclusive Processes

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Deeply virtual Compton scattering (DVCS) provides one of the most promising avenues to access generalized parton distributions (GPDs), which encode the three-dimensional structure and mechanical properties of hadrons. However, the extraction of GPDs from experimental observables requires solving an ill-posed inverse problem, passing through the intermediate stage of calculating Compton Form Factors (CFFs). In this work, I present recent developments in applying machine learning techniques for a global analysis of DVCS data, which allow for model-independent extraction of CFFs with controlled uncertainties. Applications to JLab data highlight both the successes and limitations of current analyses, while simulated EIC data demonstrate the potential for precision studies of hadron structure at future facilities. I will discuss feasibility tests, systematic uncertainties, and open challenges in bridging machine learning methods with QCD phenomenology. This work paves the way toward a more robust and data-driven tomography of the nucleon.

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