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Lattice Determination of Parton Distributions Through Neural Network

We propose a framework for the reconstruction of parton distribution functions (PDFs) and generalized parton distributions (GPDs) from lattice QCD, utilizing artificial neural networks (ANNs). Our approach combines two complementary methodologies: the Large Momentum Effective Theory (LaMET) and the short-distance operator expansion (SDE). To determine ANN-based PDFs and GPDs, we achieve a joint reconstruction that incorporates quasi-matrix elements from LaMET and matched Ioffe-time distributions derived from SDE. Our framework successfully recovers PDFs and GPDs from mock data and is applied for actual lattice QCD data. It mitigates the individual limitations inherent in LaMET and SDE, while leveraging the ANN architecture to enable a robust reconstruction.

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