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Using Adversarial Networks to Generate Realistic Structure Function Surfaces ANDREW HOYLE, MICHELLE KUCHERA, RAGHU RAMANUJAN, Davidson College, NOBUO SATO, PAWEL AMBROZEWICZ, WALLY MELNITCHOUK, Jefferson Lab, ZACH NUSSBAUM, Davidson College
— The purpose of this project was to develop a Generative Adversarial Network (GAN) architecture which would generate surfaces of nuclear structure functions as a function of Bjorken x and Q^2. The architecture is based on a modified version of a Wasserstein GAN (wGAN) where the generator produces the structure function surfaces and the discriminator calculates a cross section surface from the structure function and evaluates its validity. Therefore, this model differs from a traditional wGAN in that it is semi-supervised, meaning we are not supervising on the quantity of interest. The model was trained on both theoretical and mock experimental data of both inclusive and semi-inclusive deep inelastic scattering events. The theoretical data were produced by a script which calculates the structure function and cross section values within a specified grid of kinematic variable values. The mock experimental data were generated by Pythia, but transformed into binned experimental-like data. Preliminary results indicate that GANs can be used to generate the structure functions. We explore the most effective architecture and tuning parameters to give the desired results. Results will be presented alongside metrics showing how accurate the generated surfaces are to their true values.

Andrew Hoyle
Davidson College

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