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Using ML based Unfolding to reduce error on lattice QCD observables

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In any lattice QCD based study, gauge configurations have to be generated using some form of Monte Carlo simulations. These are then used to compute physical observables. In these measurements, physical observables (like the chiral condensate or baryon number density) can be expressed as a trace of a combination of products of the inverse fermion matrix. These traces are usually estimated stochastically using the random noise method. This method requires making a choice of the number of random sources used in the computation. In principle, only in the limit of infinite such sources one sees the true physics results. Due to the finiteness of the number of sources, a systematic error is introduced in all measurements. We propose making use of an Unfolding algorithm based on a sequential neural network to learn the inverse of the transformation that takes a "true" distribution (using a sufficiently large number of random sources) to a "measured" distribution (small number of sources) in order to attempt reducing errors on measured observables.

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