**Analytic continuation via “domain-knowledge free” machine learning**

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We present a machine-learning (ML) approach to a long-standing issue in quantum many-body physics, namely, analytic continuation. This notorious ill-conditioned problem of obtaining spectral function from Matsubara Green's function has been a focus of new method developments for past decades. Therefore, many crafty approaches exist; such as maximum entropy method [1,2], stochastic method [3], Pade’s approximation [4]. These approaches require a deep understanding of the details of the problem. We call this detail as ‘domain-knowledge’; such as physical/mathematical approximations and assumptions. Here we show that the ML-based kernel can be realized without ‘domain-knowledge’, using modern ML techniques [5], e.g. convolutional neural network (CNN) and Adam optimizers [6]. Furthermore, the ML-based kernel is more robust to noise from Green’s function. We will also examine the possibility of extending the ML-based analytic continuation to the matrix-valued continuation problem, which recently been tackled by maximum quantum entropy method (MQEM) [7]. Our results illustrate that the ML approach can be a new direction to solved ill-posed physical problem.

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