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Dongbin Xiu. *On generalized residue network for deep learning of unknown dynamical systems.*

We present a general numerical approach for learning unknown dynamical systems using deep neural networks (DNNs). Our method is built upon recent studies that identified residue network (ResNet) as an effective neural network structure. In this paper, we present a generalized ResNet framework and broadly define "residue" as the discrepancy between observation data and prediction made by another model, which can be an existing coarse model or reduced order model. In this case, the generalized ResNet serves as a model correction to the existing model and recovers the unresolved dynamics. When an existing coarse model is not available, we present numerical strategies for fast creation of coarse models, to be used in conjunction with the generalized ResNet. These coarse models are constructed using the same data set and thus do not require additional resource. The generalized ResNet is capable of learning the underlying unknown equations and producing predictions with accuracy higher than the standard ResNet structure. This is demonstrated via several numerical examples, including long-term prediction of a chaotic system. (Received January 30, 2020)