DATA DRIVEN MODELING OF UNKNOWN SYSTEMS WITH DEEP NEURAL NETWORKS

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ABSTRACT

We present a framework of predictive modeling of unknown system from measurement data. The method is designed to discover/approximate the unknown evolution operator behind the data. Deep neural network (DNN) is employed to construct such an approximation. Once an accurate DNN model for evolution operator is constructed, it serves as a predictive model for the unknown system and enables us to conduct system analysis. We demonstrate that residual network (ResNet) is particularly suitable for modeling autonomous dynamical systems. Extensions to other types of systems will be discussed, including non-autonomous systems, systems with uncertain parameters, and more importantly, systems with missing variables, as well as partial differential equations (PDEs).