

Data Driven Modeling of Unknown Systems with Deep Neural Networks

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We present a framework of predictive modeling of unknown system from measurement data. The method is designed to discover/approximate the unknown evolution operator, i.e., flow map, behind the data. Deep neural network (DNN) is employed to construct such an approximation. Once an accurate DNN model for the evolution operator is constructed, it serves as a predictive model for the unknown system and enables us to conduct system analysis. We demonstrate that flow map learning (FML) approach is applicable for modeling a wide class of problems, including dynamical systems, systems with missing variables and hidden parameters, as well as partial differential equations (PDEs).