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["Data-driven Modeling of Stochastic Systems using Physics-aware Deep Learning."](#)

Abstract: We present a probabilistic deep learning methodology that enables the construction of predictive data-driven surrogates for stochastic systems. Leveraging recent advances in variational inference, we put forth a scalable computational framework for discovering surrogate models from paired input-output observations of a system that may be stochastic in nature, originate from different information sources of variable fidelity, or be corrupted by complex noise processes. We also show how physical constraints can be employed as informative priors that introduce a regularization mechanism for effectively constructing robust deep learning models in cases where the cost of data acquisition is high and training data-sets are typically small. The effectiveness of the proposed methods is demonstrated through a series of canonical studies involving stochastic dynamical systems and nonlinear conservation laws.