# DATA DRIVEN MODELING OF STOCHASTIC SYSTEMS

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# ABSTRACT

We present a numerical framework for learning unknown stochastic dynamical systems using measurement data. Termed stochastic flow map learning (sFML), the framework seeks to approximate the unknown flow map of the underlying system, via a generative model such as Generative Adversarial networks (GANs), Autoencoders, or Normalizing Flows. Once a sFML model is trained, it serves as a predictive stochastic evolution model that approximates the unknown true system in distribution. The trained sFML models then allows one to analyze the long-term system behavior of the system under arbitrary initial conditions. A comprehensive set of numerical examples are presented to demonstrate the flexibility and effectiveness of the proposed sFML method for various types of stochastic systems. It is capable of learning systems driven by both Gaussian and non-Gaussian noises, and for jump processes such as chemical reaction systems.

## REFERENCES

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