

Christian Andersson Naesseth (University of Amsterdam)

SDE Matching: Scalable Variational Inference for Stochastic Differential Equations

The Stochastic Differential Equation (SDE) is a powerful tool for time series, dynamics and sequence modeling. However, learning SDEs typically relies on adjoint sensitivity methods, which depend on simulation, discretization, and backpropagation through approximate SDE solutions, which limit scalability. In this work, we propose SDE Matching, a new simulation- and discretization-free method for learning SDEs. Inspired by modern Score- and Flow Matching algorithms for learning generative dynamics, we extend these ideas to the domain of stochastic dynamics for time series and sequence modeling, eliminating the need for costly numerical simulations. Our results demonstrate that SDE Matching achieves performance comparable to adjoint sensitivity methods while drastically reducing computational complexity.