Generative modeling for time series via Schrödinger bridge

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We propose a novel generative model for time series based on Schrödinger bridge (SB) approach. This consists in the entropic interpolation via optimal transport between a reference probability measure on path space and a target measure consistent with the joint data distribution of the time series. The resulting solution is described by a stochastic differential equation over a finite horizon with a path-dependent drift function, which accurately captures the temporal dynamics of the time series distribution. We can estimate the drift function from data samples either by kernel regression methods or with LSTM neural networks, and the simulation of the SB diffusion yields new synthetic data samples of the time series.

The performance of our generative model is evaluated through a series of numerical experiments. First, we test with a toy autoregressive model, a GARCH Model, and the example of fractional Brownian motion, and measure the accuracy of our algorithm with marginal and temporal dependencies metrics. Next, we use our SB generated synthetic samples for the application to deep hedging on real-data sets. Finally, we illustrate the SB approach for generating sequence of images.

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