Statistics > Computation

Infinite-dimensional Bayesian filtering for detection of quasi-periodic phenomena in spatio-temporal data

Arno Solin, Simo Särkkä

(Submitted on 11 Mar 2013)

This paper introduces a spatio-temporal resonator model and an inference method for detection and estimation of nearly periodic temporal phenomena in spatio-temporal data. The model is derived as a spatial extension of a stochastic harmonic resonator model, which can be formulated in terms of a stochastic differential equation (SDE). The spatial structure is included by introducing linear operators, which affect both the oscillations and damping, and by choosing the appropriate spatial covariance structure of the driving time-white noise process. With the choice of the linear operators as partial differential operators, the resonator model becomes a stochastic partial differential equation (SPDE), which is compatible with infinite-dimensional Kalman filtering. The resulting infinite-dimensional Kalman filtering problem allows for a computationally efficient solution as the computational cost scales linearly with measurements in the temporal dimension. This framework is applied to weather prediction and to physiological noise elimination in fMRI brain data.

Comments: 8 pages, 5 figures
Subjects: **Computation (stat.CO)**
Cite as: **arXiv:1303.2530 [stat.CO]**
(or **arXiv:1303.2530v1 [stat.CO]** for this version)

Submission history

From: Arno Solin [view email]
[v1] Mon, 11 Mar 2013 14:16:54 GMT (1501kb,D)

Which authors of this paper are endorsers?