

Large Covariance Regression for Spatial Data

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Abstract: Data assimilation plays an important role in geoscientific research, which can be viewed as inference in nonlinear, non-Gaussian state-space models with very high-dimensional state vectors. A Monte Carlo variant of the Kalman filter, known as the ensemble Kalman filter (EnKF), has been extremely successful in such applications but far from being well understood. A mystery in understanding the behavior of EnKF is the covariance inflation and localization that is often required in the EnKF updates. We cast this problem in the framework of large covariance regression for spatial data, and investigate the consistency and optimality of several estimators for the inflation factors. The methodology and theory are illustrated on simulated and real air pollution data.