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State-space Optimized Dynamic Mode Decomposition for Noisy Data[1] TAKU NONOMURA, Tohoku University, Presto, JST, KAZUYUKI NAKAMURA, Meiji University, Presto, JST, NAOTO NAKANO, Kyoto University, STEVEN L. BRUNTUN, J. NATHAN KUTZ, University of Washington — This presentation proposes several new formulations of dynamic mode decomposition (DMD) for full-state measurements of a linear dynamical system with process and measurement noise. First, we develop two methods to denoise and reconstruct the true state of the approximated linear system from noisy experimental data: the DMD-based state variable reconstruction (DMDsvr) and the DMD-based state space reconstruction (DMDssr). DMDsvr estimates the state variable as a solution of a least square problem, when the system coefficients and the noise variances are known. DMDssr simultaneously estimates the noise variance and the state variables by the expectationmaximization (EM) algorithm in a Bayesian framework. The final method, state-space optimized DMD (ssoDMD), simultaneously estimates the DMD coefficients together with the noise variances and the state variable. The proposed ssoDMD can estimate the system coefficients, noise variance and true state variables from noisy data. Estimation of system coefficients and noise variances can be used for data-assimilation using Kalman filter. Numerical tests show an improvement of the proposed methods over conventional DMD for linear systems with process noise.

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Taku Nonomura
Tohoku University, Presto, JST

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