Linear System Identification via Atomic Norm Regularization

Parikshit Shah, Badri Narayan Bhaskar, Gongguo Tang, Benjamin Recht

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This paper proposes a new algorithm for linear system identification from noisy measurements. The proposed algorithm balances a data fidelity term with a norm induced by the set of single pole filters. We pose a convex optimization problem that approximately solves the atomic norm minimization problem and identifies the unknown system from noisy linear measurements. This problem can be solved efficiently with standard, freely available software. We provide rigorous statistical guarantees that explicitly bound the estimation error (in the H_2-norm) in terms of the stability radius, the Hankel singular values of the true system and the number of measurements. These results in turn yield complexity bounds and asymptotic consistency. We provide numerical experiments demonstrating the efficacy of our method for estimating linear systems from a variety of linear measurements.

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