An l_1-minimizing Kalman-Filter with Aitken-based convergence acceleration

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Abstract

In many problems high-dimension discrete signals need to be reconstructed from noisy and often undersampled data, raising the issue of solving nominally underdetermined noise contaminated systems of equations. The theory of compressed sensing states (and proves) that such signals can in fact uniquely be reconstructed if they possess a sparse or compressible representation in some basis and some further conditions concerning the incoherence of the measurement domain with the representation domain are met. Especially the so called nullspace property of the overall sensing matrix ensures that the sparse or compressible representation can be recovered just by l_1 minimization, which can in fact be realized either by convex optimization approaches which is the classical way, or alternatively by estimation theoretic approaches, e.g. by extended linearized Kalman filters [1, 2], which is the approach analyzed. In this work, we establish new results on sparse signal recovery via l_1 minimization using such a Kalman filter. The main constribution is a convergence acceleration schema. The results show that the "l_1-minimizing Kalman-Filter with Aitken-based convergence acceleration" yields the same convergence rate than the primal-dual algorithm for l_1 minimization of A. Chambolle and T. Pock [3].

References

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