

Off-the-grid and continuous methods for optimization and inverse problems in imaging

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Safe screening for total variation norm

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Total variation regularized optimization problems over the space of Radon measures have gained a lot of interest in the last decade. One element underlying this success is the ‘discrete’ property of their solutions, which consist of a finite number of (weighted) Dirac masses. However, a bottleneck of standard algorithmic solutions is the need for extensive (and iterative) exploration of the parameter space. In this study, we show that the rationale behind “safe screening”—a celebrated acceleration technique for sparsity promoting optimization problems— can be extended to the context of radon measures.

More precisely, we describe practical procedures that allow to test whether any solution contains Dirac masses that lie in a given subset of the parameter space. If the test is passed, one can thus safely discard the corresponding subset of parameters, that is, without affecting the solutions. Finally, we show on numerical examples that our procedures allow to accelerate several existing algorithms.

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