Fractional graph Laplacian for image reconstruction

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A popular approach for regularization involves replacing the original problem with an optimization problem that minimizes the sum of two terms: an ℓ^2 term and an ℓ^q term with $0 < q \leq 1$. The first penalizes the distance between the measured and reconstructed data, while the second imposes sparsity on certain coefficients of the computed solution.

In [1], we propose to use the fractional Laplacian of a properly constructed graph in the ℓ^q term to compute extremely accurate reconstructions of the desired images. Furthermore, we propose automatic approaches to determine the involved parameters so that the proposed method is completely plug-and-play. We show that the algorithm, under some reasonable assumptions, is a regularization method. Some selected numerical examples show the performances of our proposal.

References

[1] S. Aleotti, A. Buccini, M. Donatelli, *Fractional graph Laplacian for image reconstruction*, Applied Numerical Mathematics 200 (2024), 43-57.