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Accelerated Image Inpainting via a Globally Convergent Stabilized Fixed-Point Method

Communication Info

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Abstract

In our foundational work, we formulated image inpainting as the search for a unique fixed point of a nonexpansive neighborhood-reconstruction operator and proved the strong convergence of the standard Picard iteration. While theoretically sound, the practical utility of this baseline method is limited by a slow convergence rate. This paper addresses this critical efficiency gap by integrating a powerful, globally convergent acceleration scheme. We employ a stabilized variant of Type-I Anderson Acceleration specifically designed for nonsmooth, nonexpansive fixed-point problems. The core contribution is a formal proof that our inpainting operator satisfies the key hypotheses of the global convergence theorem for this acceleration method, thus ensuring its theoretical guarantees are preserved. Comprehensive experiments validate our approach, demonstrating that the accelerated method achieves dramatic speed-ups reducing iteration counts by an order of magnitude and wall-clock time by over 10x while maintaining the same high reconstruction fidelity as the baseline. This work successfully transforms a theoretical model into a robust and high-performance tool.

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