Image Restoration from Noisy Incomplete Frequency Data by Alternative Iteration Scheme

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Consider the image restoration from incomplete noisy frequency data with total variation and sparsity regularizing penalty terms. Firstly, we establish an unconstrained optimization model with different smooth approximations on the regularizing terms. Then, to weaken the amount of computations for cost functional with total variation term, the alternating iterative scheme is developed to obtain the exact solution through shrinkage thresholding in inner loop, while the nonlinear Euler equation is appropriately linearized at each iteration in exterior loop, yielding a linear system with diagonal coefficient matrix in frequency domain. Finally the linearized iteration is proven to be convergent in generalized sense for suitable regularizing parameters, and the error between the linearized iterative solution and the one gotten from the nonlinear Euler equation is rigorously estimates, revealing the essence of the proposed alternative iteration scheme. Numerical tests for different configurations show the validity of the proposed scheme, compared with some existing algorithms.