

Conventional compressed sensing theory assumes signals have sparse representations in a known dictionary. Nevertheless, in many practical applications such as line spectral estimation, the sparsifying dictionary is usually characterized by a set of unknown parameters in a continuous domain. To apply the conventional compressed sensing technique to such applications, the continuous parameter space has to be discretized to a finite set of grid points, based on which a “nominal dictionary” is constructed for sparse signal recovery. Discretization, however, inevitably incurs errors since the true parameters do not necessarily lie on the discretized grid. This error, also referred to as grid mismatch, leads to deteriorated recovery performance. In this paper, we consider the line spectral estimation problem and propose an iterative reweighted method which jointly estimates the sparse signals and the unknown parameters associated with the true dictionary. The proposed algorithm is developed by iteratively decreasing a surrogate function majorizing a given log-sum objective function, leading to a gradual and interweaved iterative process to refine the unknown parameters and the sparse signal. A simple yet effective scheme is developed for adaptively updating the regularization parameter that controls the tradeoff between the sparsity of the solution and the data fitting error. Theoretical analysis is conducted to justify the proposed method. Simulation results show that the proposed algorithm achieves super resolution and outperforms other state-of-the-art methods in many cases of practical interest.