Research

Colloquium

Phase retrieval algorithms with random masks

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摘　要：

Phase retrieval aims to recover one unknown vector from its magnitude measurements, e.g., coherent diffractive imaging, where phase information is missing. The recovery of phase information can be formulated as one minimization problem subject to a non convex highdimensional torus set. Uniqueness of solutions can be obtained under random masks. The introduction of random masks actually breaks the symmetry of Fourier matrices and creates spectral gap for the local convergence of many phase retrieval algorithms, including alternative projection methods and Fourier Douglas-Rachford algorithms. Actually, local convergence rate depends on spectral gap of the system. In this talk, we shall present the convergence analysis as well as their fixed point property.

Empirically, the alternative projection could fail to generate the global solution effectively due to possible stagnations. To alleviate the stagnations, we propose one null vector method to produce good initializations.The method is motivated by the following observation: Gaussian random vectors in high dimensional space are always nearly orthogonal to each other. With aid of magnitude data, we can construct one sub-matrix assembled from the sensing vectors nearly orthogonal to the unknown vector. One candidate for the initialization vector is given by the singular vector of the sub-matrix corresponding to the least singular value. Empirical studies (non-ptychography and ptychography) indicate that its incredible closeness to the unknown vector, compared with other existing methods. In this talk, we present one nonasymptotic error bound in the case of random complex Gaussian matrices, which sheds some light on its superior performance in the Fourier coherent diffractive case with random masks.