Sparse optimization for super-resolution in fluorescence microscopy

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Abstract

Fluorescence microscopy is ubiquitous on biology platforms to image biological structures at the cellular and intracellular levels on living tissues. However, the resolution is limited by the diffraction of light. Many super-resolution techniques combining specific illumination/acquisition systems or specific fluorophores with image reconstruction algorithms allow to bypass the diffraction barrier. The Single Molecule Localization Microscopy approach requires the reconstruction of images of isolated fluorophores. This reconstruction is modeled by an inverse problem under the constraint of sparsity. I will give some approaches that we have developed for penalized and constrained optimization using semi-norm L0 to enforce sparsity. In a last part I will present another approach of super-resolution by fluctuations of molecules with a method of reconstruction using a generative adversarial network (GAN).