Preconditioning of the fluorescence diffuse optical tomography sensing matrix based on compressive sensing.

Image reconstruction in fluorescence diffuse optical tomography (FDOT) is a highly ill-posed inverse problem due to a large number of unknowns and limited measurements. In FDOT, the fluorophore distribution is often sparse in the imaging domain, since most fluorophores are designed to accumulate in relatively small regions. Compressive sensing theory has shown that sparse signals can be recovered exactly from only a small number of measurements when the forward sensing matrix is sufficiently incoherent. In this Letter, we present a method of preconditioning the FDOT forward matrix to reduce its coherence. The reconstruction results using real data obtained from a phantom experiment show visual and quantitative improvements due to preconditioning in conjunction with convex relaxation and greedy-type sparse signal recovery algorithms.