Leslie F Greengard*, Flatiron Institute, 162 Fifth Avenue, New York, NY 10010. Linear and nonlinear inverse problems in imaging.

We will begin with a brief review of linear inverse problems that arise in medical imaging. Following that, we turn to inverse acoustic scattering and protein structure determination from cryo-electron microscopy data (cryo-EM). These are computationally intensive tasks that are typically formulated as non-convex optimization problems. In cryo-EM, the raw data is extremely noisy and existing methods are generally based on some version of maximum likelihood estimation, with a low resolution starting guess. In inverse acoustic scattering, the underlying physical problem is ill-posed and requires both regularization and high-order methods to solve a sequence of forward scattering problems.

We will present some algorithms for accelerating image reconstruction in all these settings, illustrate their performance with several examples, and discuss open problems in the field. (Received July 26, 2018)