

Inverse problems arising in biomedical imaging

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Modern techniques of biomedical imaging, such as MRI or CT scan, are indispensable in diagnosing a wide variety of medical conditions. Many other useful imaging modalities exist, and new ones are being actively developed currently. Common to all these techniques is that the images are not measured directly but are reconstructed from measurable parameters by solving the so-called "inverse problems". A typical inverse problem consists of finding the spatially-varying coefficient(s) of a partial differential equation (PDE) within some domain, from the knowledge of the solutions to this equation on the boundary of the domain.

The set of mathematical techniques required to understand and solve such problems is extremely rich. In addition to theory and algorithms for PDE's it includes integral geometry, theory of integral equations, spectral theory, Fourier analysis, linear and abstract algebra, numerical methods, data science, etc.

In the beginning of the talk, the better known classical inverse problems will be introduced and discussed. After that I will outline the emerging modalities that are of interest to my research group, and will present the theoretical, numerical and experimental techniques used to study and solve the arising inverse problems.

The talk is aimed at the first and second year graduate students.