Class Announcement
Winter Semester 2013/14

Mathematical signal processing for biophysical applications

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The lecture will cover various mathematical models and methods for signal processing in biophysical applications. In particular, we will discuss magnetic resonance imaging (MRI), flourescence microscopy, coded apertures, computed tomography (CT) and variants such as SPECT. A great challenge for signal processing is to recover the maximal amount of information from the usually noisy and incomplete data arising in each of these applications. The mathematical theory of signal processing has made great advances allowing for steadily improving reconstruction guarantees. The goals of this lecture are to understand the imaging processes, to derive mathematical models for the resulting signals and to develop corresponding methods for signal recovery and enhancement. Specifically, we will study the following topics:

- Physical derivation of mathematical descriptions of the imaging processes
- Imaging models: wavelets, sparsity, Besov spaces, Markov random fields, bounded variation
- Bayesian inference
- Noise models, denoising, deblurring
- Compressed sensing: random Fourier measurements, variable density compressive imaging, reconstruction algorithms

Requirements: Analysis, linear algebra; introductory physics is helpful.

Time: Monday+Thursday, 10.15–11.45 **Room:** MN 55