As the nature of data changes so the mathematics needed to study that data changes. The success of wavelets, for instance, has increased awareness of the notion of time-scale in addition to the familiar ideas from frequency. But many applications have been made also of ideas from geometry and algebraic structures as well as non-linear and probabilistic approximation theory. In this course we shall present some of these mathematical ideas.

Likely topics to be covered as time permits:

1) Hilbert Spaces, Fourier transform theory (emphasizing mathematical structure), Related transforms - Hilbert transform and Radon Transform. Filter banks.

2) Frames and Multi-Resolution; wavelets and curvelets; redundancy, sparcity and direction. Thresholding and non-linear approximation.

3) Analysis and geometry: Grassmanian manifolds and frames.

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The graphics are an ECG corrupted by muscle noise and a schematic representation of MIMO antennas. But what’s the associated math?