FIM Nachdiplomvorlesung

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Applied Harmonic Analysis meets Compressed Sensing

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HG G 43, ETH Zürich, Rämistrasse 101

Abstract

Many important multivariate problem classes are governed by anisotropic features such as singularities on lower dimensional embedded manifolds. Prominent examples are edges in natural images or shock fronts in the solutions of transport equations. It is well known that wavelets -- although perfectly suited for isotropic features and nowadays indispensable as a multiscale encoding system for a wide range of more theoretically to more practically oriented problems -- do not perform equally well when dealing with anisotropic features. The last years have seen many suggestions for directional representation systems, and today shearlet theory might be considered the most versatile and successful methodology to efficiently represent anisotropic features.
Compressed sensing is a novel research area, which was introduced in 2006, and since then has already become a key concept in various areas of applied mathematics, computer science, and electrical engineering. It surprisingly predicts that high-dimensional signals, which allow a sparse representation by a suitable basis or, more generally, a frame, can be recovered from what was previously considered highly incomplete linear measurements by using efficient algorithms.
In this lecture, we will first give an introduction to applied harmonic analysis, in particular to shearlet theory, as well as to compressed sensing. One main focus will then be on the interplay between these areas, with a particular emphasis on novel methodologies to solve inverse problems such as recovery of missing data or feature extraction.

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