ON SPATIAL PRIORS IN MULTIRESOLUTION IMAGE DENOISING : FROM LOCAL SPATIAL ACTIVITY INDICATORS TO MRF AND MPGSM MODELS

Aleksandra Pižurica and Bart Goossens

Ghent University
Department Telecommunications and Information Processing
Image Processing and Interpretation group

Recent studies in image denoising show the importance of using (i) multiresolution transformations with improved orientation selectivity and (ii) the appropriate spatial context models. Regarding the first point, a number of the so-called "geometrical representations" have been introduced (e.g., curvelets, contourlets, shearlets,...) that represent image discontinuities better than the classical wavelets, which also results in better noise reduction results. It has been also proved that using better models for the statistical dependencies of the transform coefficients improves the estimation of the noise free data. A number of different contextual models have been proposed in this respect starting from the simple bivariate parent-child models or local spatial indicators to the more complex Markov Random Field (MRF) models, Gaussian Scale Mixture (GSM) models and recently mixtures of the GSM (MGSM), the mixtures of the projected GSM (MPGSM), Field of Experts (FoE) models and Gaussian Conditional Random Field (GCRF) models.

In this talk, we wish to discuss these developments from the perspective of our own research and to identify possible directions for future developments in this field. In particular, we will discuss detection and estimation of a signal of interest in the noisy image using a local spatial activity indicator, a MRF model and a GSM model. We will then compare this approach with a state-of-the art estimator using MPGSM model and link it to some other most recent developments in this field. We will also show some practical applications to different types of images with natural noise, including some medical imaging modalities and digital camera images.