Bayesian Multiscale Analysis of Images

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Abstract

Two novel multiscale methods for digital images are proposed. The first method detects differences between two images obtained from the same object at two different instants of time. It detects both small scale, sharp changes and large scale, average changes. The second method extracts features that differ in intensity from their surroundings and produces a multiresolution analysis of an image as a sum of scale-dependent components.
As images are usually noisy, Bayesian inference is used to separate real differences and features from artefacts caused by random noise. The use of the Bayesian paradigm allows the use of various noise types, incorporation of expert knowledge about the images at hand and facilitates analysis of non-linear transformation of images.
The methods are instants of SiZer (Significant zero crossings of derivatives) methodology that was originally considered for one-dimensional nonparametric probability density estimation and curve fitting [1, 2]. The new methods, iBSiZer (Bayesian SiZer for images) and MRBSiZer (Multiresolution Bayesian SiZer), were originally proposed in [3] and [4], respectively.

Keywords: Bayesian methods, Scale space, Image analysis, SiZer
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