Bayesian Approach of Image Denoise in the Wavelet Threshold

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1. The Bayesian algorithm

Wavelet thresholding is a method for the reduction of noise in image. It assumes that the original can be represented in a sparse way by a small number of large wavelet coefficients. In the case of an orthogonal transform, i.i.d. noise is spread out equally over all coefficients. Selecting the coefficients with the largest magnitude therefore removes most of noise, while preserving the essential image information. A number of authors have observed that wavelet coefficients have non-Gaussian distribution. The intuitive explanation for this is that images typically have spatial structure consisting of smooth areas interspersed with edges. The smooth regions lead to near-zero coefficients, and the structures give large amplitude coefficients.

The spatial structure of a wavelet representation follows from the decorrelating properties of this orthogonal transform. But this decorrelating is not complete, a wavelet transform is also a multiscale data representation and the coefficients at subsequent resolution levels tend to be correlated. Jansen and Bultheel(1999) developed the Empirical Bayes Approach to improve the classical threshold algorithm using local characterization in Markov random field. Even though the above method has dealt with clustering of significant Wavelet coefficients to consider decorrelating properties within the subband, it didn't take account of a realistic model. We also developed wavelet thresholding algorithm using Laplacian distribution which is more realistic model. This distribution has been used as a marginal statistical model to Bayesian image restoration by Simoncelli(1999).

We have described two empirical thresholding models for visual images. These procedures are deigned for application in image noise reduction. Jansen and Bultheel(1999) developed the Empirical Bayes Approach to improve the classical threshold algorithm using local characterization in Markov random field. Even though the above method has dealt with clustering of significant Wavelet coefficients, it was to consider the prior model taking these line singularities into account, it didn't take account of a realistic model. We also developed wavelet thresholding algorithm using Laplacian distribution which is more realistic model. This distribution has been developed a marginal Statistical model to Bayesian image restoration by Simoncelli(1999). We used this distribution for the wavelet threshold to improve denoising.

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