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A SPATIO-CHROMATIC ICA BASED NOISE REDUCTION IN COLOR IMAGES

Xian-Hua Han[1], Yen-Wei Chen[2] and Jian-Mei Lei[3]

[1]Electronics and Information Engineering School
Central South University of Forestry and Technology
changsha, Hunan 410004, P. R. China
hanxhua@yahoo.com.cn

[2]College of Information Science and Engineering
Ritsumeikan University
Kasatsu-shi 525-8577, Japan
chen@is.ritsumei.ac.jp

[3]College of Communication Engineering
ChongQing University
ChongQing 400044, P. R. China

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Abstract. *In this paper, a spatio-chromatic ICA based noise reduction in color images is presented. We use RGB color images with a regular arrangement RGB channels into spatio-chromatic space, and ICA performs decorrelation of these signals. We show that spatio-chromatic components of images contain spatial information and color information, and that ICA spatio-chromatic analysis is able to help the reconstruction of images. We propose an efficient noise reduction method for color images based on the observation. In the proposed method, the image is first transformed to spatio-chromatic ICA domain and then the noise components are removed by soft thresholding (Shrinkage). Experimental results show that the denoised images based spatio-chromatic ICA domain shrinkage are dramatically improved in comparison to that with conventional filtering.*
Keywords: Noisy color images, Independent component analysis, Spatio-chromatic space, Shrinkage function

1. **Introduction.** While much computer vision and image processing research focuses exclusively on the luminance domain, the analysis of color images has gained increasing interest in recent years. An important problem in the processing of color images is that of enhancement and denoising. Following early attempts to denoise color images through independent smoothing of the RGB channels, practically all contemporary approaches focus on a variety of filtering processes applied appropriately to the color vectorial data. While some studies explore vector median and directional filters [1,2], most color image denoising approaches are based on some form of anisotropic diffusion [3-5], either on an explicit vectorial representation of the color or on differential geometrical properties of a manifold representation in a higher dimensional space. However, the conventional denoising method did not consider imaging procedure (nonorthogonal coding scheme) of the chromatic structure in natural images that may be more appropriate for chromatic encoding by cortical cells. In this paper, we attempt a unification of these tasks by exploiting the localized, oriented and color feature in the spatio-chromatic color domain.

The statistical analysis of natural scenes, as viewed by human observers, has given a new insight into the processing and functionality of the human visual system. Pioneering work by Field (1987) and Barlow (1989) has established the relationship between redundancy