Perceptual Image Coding by Exploiting Internal Generative Mechanism

Authors : Kuo-Cheng Liu

Abstract : In the perceptual image coding, the objective is to shape the coding distortion such that the amplitude of distortion does not exceed the error visibility threshold, or to remove perceptually redundant signals from the image. While most researches focus on color image coding, the perceptual-based quantizer developed for luminance signals are always directly applied to chrominance signals such that the color image compression methods are inefficient. In this paper, the internal generative mechanism is integrated into the design of a color image compression method. The internal generative mechanism working model based on the structure-based spatial masking is used to assess the subjective distortion visibility thresholds that are visually consistent to human eyes better. The estimation method of structure-based distortion visibility thresholds for color components is further presented in a locally adaptive way to design quantization process in the wavelet color image compression scheme. Since the lowest subband coefficient matrix of images in the wavelet domain preserves the local property of images in the spatial domain, the error visibility threshold inherent in each coefficient of the lowest subband for each color component is estimated by using the proposed spatial error visibility threshold assessment. The threshold inherent in each coefficient of other subbands for each color component is then estimated in a local adaptive fashion based on the distortion energy allocation. By considering that the error visibility thresholds are estimated using predicting and reconstructed signals of the color image, the coding scheme incorporated with locally adaptive perceptual color quantizer does not require side information. Experimental results show that the entropies of three color components obtained by using proposed IGM-based color image compression scheme are lower than that obtained by using the existing color image compression method at perceptually lossless visual quality.

Keywords : internal generative mechanism, structure-based spatial masking, visibility threshold, wavelet domain