Image Blocking Artifacts Reduction via Patch Clustering and Low-Rank Minimization

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Block-based Discrete Cosine Transform (BDCT) has been widely used in image and video compression due to its energy compacting property and relative ease of implementation [1]. However, BDCT has a major drawback, which is usually referred to as blocking artifacts. Blocking artifacts appear as grid noise along the block boundaries because each block is transformed and quantized independently.

Image deblocking techniques can reduce these distortions and alleviate the conflict between bit rate reduction and visual quality preservation. Many state-of-the-art image deblocking algorithms treated the blocking artifacts reduction of the compressed image as an inverse restoration problem. Natural image prior models are well utilized into the blocking artifacts reduction processing, such as the local sparsity prior model [2] and non-local similarity property of natural images [3]. These two local and non-local models characterize the image prior information in two complementary perspectives. Therefore, it is necessary to combine these two models in a unified framework.

In this paper, we propose a novel method to reduce the blocking artifacts of block-coded images via patch clustering and low-rank minimization, which simultaneously exploits the local and non-local sparse representations in a unified framework. First, the whole compressed image are divided into small patches. For each patch, we perform patch clustering to collect similar patches into a group. Then the whole group are simultaneously reconstructed by a low-rank minimization approach. Singular value thresholding (SVT) algorithm is employed to solve the low-rank minimization problem. To further improve the performance of the proposed algorithm, we adopt an iterative procedure to utilize the newly output data in each iteration and update the noise and signal variance adaptively. Experimental results show that the proposed method achieves higher PSNR and SSIM than the state-of-the-art methods. Comparing to the state-of-the-art algorithms [2] and [3], the proposed algorithm achieves about 0.37dB and 0.11dB improvement on average. For visual quality assessment, the deblocking images produced by the proposed algorithm reveal much more sharp edge structures and richer textures.

References

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This work was supported by National Natural Science Foundation of China under contract No. 61071082, National Basic Research Program (973 Program) of China under contract No. 2009CB320907 and Doctoral Fund of Ministry of Education of China under contract No. 20110001120117.

1068-0314/13 $26.00 © 2013 IEEE
DOI 10.1109/DCC.2013.95