RECASTING OF THE IMAGE DEBLOCKING PROBLEM INTO THE DOMAIN OF IMAGE DENOISING

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A new approach is proposed to solve the blocking artifact problem that results from block transform-based image compression at very low bit-rates. In our approach, we attempt to recover from the quantization noise for the transform coefficients by adding uniform random noise to them. This results in a decompressed image that is corrupted by noise of the AGWN type, rather than a blocky image. This recasting of the blocking artifact problem into the domain of AGWN reduction allows any algorithm that has been developed for image denoising to now be a candidate solution for the blocky image problem. In this research we present initial experiments for this novel approach.

After experimenting with several denoising algorithms, we have found that a recently reported Wavelet-based denoising algorithm serves well to restore the noisy image created by the noise injection stage of our proposed algorithm. This denoising algorithm uses Hidden Markov Trees (HMTs) to estimate the original image from the image corrupted by AGWN. Experimental results that we report are based on incorporate this Wavelet-based image denoising technique. Experiments were performed on the 512x512 versions of the Lena and Barbara images compressed, using JPEG, to bit-rates of less than 0.2 bps, where blocking artifacts are visible. The experimental approach was to first inject an appropriate level of uniform random noise into the quantized DCT coefficients, then to perform the inverse-DCT on these modified coefficients (resulting in an AGWN corrupted image), and finally to apply the novel Wavelet-based denoising technique to the corrupted image in order to obtain image free of AGWN and blocking artifacts.

Results were positive for both smooth (Lena) and non-smooth (Barbara) images, from objective and subjective standpoints. A PSNR improvement of 0.82 dB was achieved for the Lena image, and one of 0.53 dB was achieved for the Barbara image. There was no visible blockiness either case. Also worth noting is that the level of noise that needed to be injected into the compressed Barbara (non-smooth) image was slightly less than that needed in compressed Lena (smooth) image.

In conclusion, the proposed algorithm has the advantages of (1) being conceptually simple, (2) being general enough to apply to other transform domain artifacts, (3) expanding the scope of algorithms that can be applied to the blocking artifact reduction problem, and (4) being non-iterative. Future research will involve investigating the algorithm’s performance using other denoising techniques, comparing the algorithm to other popular image deblocking techniques, as well as applying the algorithm to other image artifact problems.