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A REVIEW ON CAUSE OF BLOCKING ARTIFACTS AND THEIR REMOVAL USING SIGNAL ADAPTIVE WEIGHTED SUM TECHNIQUE

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***Abstract**: Many mobile devices compress images excessively to meet limited bandwidth requirements and adopt the Block-based Discrete Cosine Transform (BDCT) coding transformation. When the images are decoded, it produces inevitably the visually annoying noises including blocking artifacts. We present a Signal Adaptive Weighted Sum (SAWS) technique of block boundary pixels to alleviate the blocking artifacts encountered in highly compressed images. The weights are adjusted adaptively according to the directional correlation and activities of local areas. Most artifact reduction techniques blur the details of the images while removing various coding artifacts. So in this technique, in order to avoid blurring the original details, we use a strength parameter that can control the strength of de blocking. Comprehensive experiments demonstrate that the proposed approach achieves excellent visual quality and Peak Signal-To-Noise Ratio (PSNR) compared to a number of de blocking methods in the literature. Moreover, proposed algorithm has low complexity that facilitates the application to mobile devices.*

Keywords: *Blocking Artifacts, De blocking, Signal Adaptive Weighted Sum (SAWS)*

1. INTRODUCTION

Image data compression becomes more important because of the fact that the transfer of uncompressed graphical data requires far more bandwidth and data transfer rate. Most of the coding standards for still images and video sequences, such as JPEG, MPEG adopt the Block-based Discrete Cosine Transform (BDCT) as a main coding tool. After this transformation, the transform coefficients are quantized. This is the step where most of the compression is realized, some quality is sacrificed, and the blocking artifacts are caused, which are discontinuities between adjacent blocks, due to independent quantization of each block without considering inter block correlation. Various methods have been proposed to remove blocking artifacts. They can be derived from two different viewpoints, i.e. image enhancement and image restoration. The image enhancement approaches aim at improving the perceived quality by using low-pass filtering of the blocky images. It reduces the blocking artifacts but the image is blurred and some details are wiped out. Therefore, a number of adaptive spatial filtering techniques have been proposed to solve this blurring problem .For the adaptive filtering, classification is carried out in order to exploit local statistics of image regions and the sensitivity of human perception. Then, different spatial filters are applied to blocking artifacts according to the class information. The image restoration approaches deal with the post-processing as an image recovery problem. Reconstruction is performed with the prior knowledge of the distortion model and the observed data at the decoder. In this paper, we propose a blocking artifacts removal algorithm for BDCT-coded images, based on the Signal Adaptive Weighted Sum (SAWS) technique. Since the blocking artifacts are discontinuities at the block boundaries, the de blocking process can be interpreted as a spatial smoothing process, i.e., weighted averaging process of block boundary pixels.

ISSN 2320-6802

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY

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The proposed approach for the spatial smoothing applies the SAWS technique to the current pixel and boundary pixels. We adjust the weights according to directional correlation and block activities in order to reflect the characteristics of local image areas. Moreover, we employ a Strength Parameter (SP) in order to avoid excessive blurring in the detailed area. That is, the SP makes the de blocking process weak in the detailed area, whereas makes it strong in the smooth area.

2. COMPRESSION ARTIFACTS

The video and image compression artifacts are caused by lossy compression, and manifest themselves as visually annoying errors in the image or video frame. In this work, only artifacts caused by block based encoders are discussed. The artifacts will be classified in three categories, namely: blocking artifacts, ringing artifacts and staircase noise.

2.1THE ORIGIN OF ARTIFACTS

The artifacts described here are artifacts caused by the encoder, in this case Block based Discrete Cosine Transform (BDCT) encoders. Examples of this type of encoder are JPEG and MPEG based encoders. Besides those standards there is Motion-JPEG (which is not a standard), this is a method that records video as sequence of JPEG encoded images, optionally with audio.

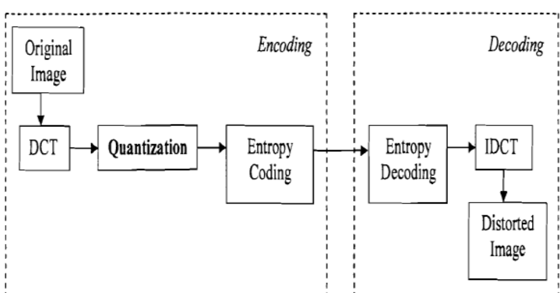

Figure 1: The Encoding-Decoding process of JPEG Compression

As shown in Fig.1, these encoders divide the frame into small blocks, typically of size 8x8 pixels, and transform each block with a 2-D Discrete Cosine Transform (DCT).After this transformation, the transform coefficients are quantized, this is the step where most of the compression is realized, some quality is sacrificed, and the artifacts are caused. Successively, the quantized coefficients are entropy encoded, this step stores the coefficients in an efficient way and there are no losses in this step.

In the decoder, the entropy coded coefficients are decoded and then transformed back with the inverse DCT (IDCT). Because of the possibly coarse quantization of the DCT coefficients, the image is not reconstructed exactly and, therefore, the decompressed image shows artifacts.

Figure 2: (a) Original Boat Image (b) Boat Image After JPEG-Compression

In Figure 2, the undistorted original "Boat" image is shown together with a distorted version. The distorted image was obtained with JPEG compression with a Quality of 10, using the JPEG library of the Independent JPEG Group. The Quality in JPEG compression controls the compression ratio and, consequently, the perceptual quality of the resulting image. The compression strength is controlled totally in the quantization stage of the compression process.

2.2 Blocking Artifacts

The blocking artifact is the most noticeable artifact appearing in both JPEG and MPEG compression. Blocking is a discontinuity of the luminance and the chrominance value across block boundaries. This discontinuity is an effect of the independent quantization of each block's DCT coefficients. As an example, we refer to Figure 3(b). The blocking effect is best seen in the sky, where the smooth gradient is reduced to only three or two lightness levels and blocks are visible and annoying. Discontinuities across block boundaries appear in the high frequency/activity areas as well, but in these areas the effect is less annoying because it is perceptually masked.

www.ijaret.org Vol. 1, Issue III, April 2013
ISSN 2320-6802

INTERNATIONAL JOURNAL FOR ADVANCE RESEARCH IN ENGINEERING AND TECHNOLOGY

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3. REQUIREMENTS FOR DERIVATION OF SAWS EQUATION

In derivation of the proposed SAWS equation, we have following requirements:

- We use as few floating-point operations as possible to reduce the computational complexity.
- For generality of the algorithm, the coding parameters such as the quantization parameter are not used.
- For the real-time applications, the iterative technique such as the POCS-based methods is not included.
- The strength of the de blocking can be altered adaptively according to characteristics of local areas

3.1 DERIVATION OF SAWS EQUATION

Let I and *p(i,j)* be an image of size *R* x *C* and its pixel, respectively, then we have

I = { }i = 0, …, R – 1, j = 0, …, C – 1. (1)

The image is coded with nonoverlapping blocks of N x N size br,c and thus I can be rewritten as

I = { }r = 0, …, (R/N) – 1, c = 0, …, (C/N) – 1 (2)

where the pixels in each block are given by

= { }i, j = 0, …, N – 1

A De blocking block and its sub blocks are shown in the Fig.1. A pixel in De blocking Block (DB) is modified by using three pixels at block boundaries, to remove block discontinuities in this SAWS technique. And these three pixels belongs to three Sub Blocks except for the Sub Block containing the to-be-modified pixel.

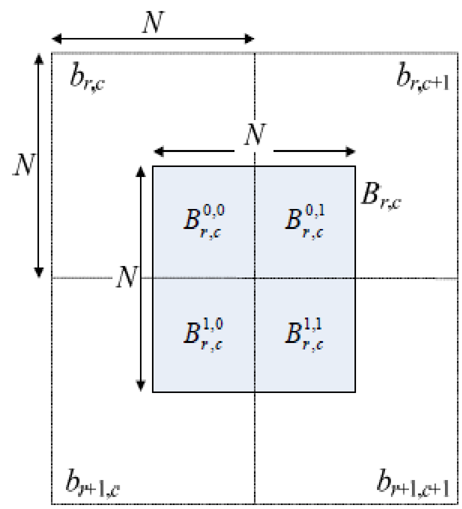

Figure 3: A Deblocking Block (DB) and its SubBlocks.

Let be the modified pixel of in the DB, and the weighted sum equation is given by

= ―――――――――――― (3)

Where m is N/2 if I is less than N/2; otherwise, (N/2)-1, and n is N/2 if j is less than N/2 otherwise, (N/2)-1. In the above equation and are the boundary pixels lying on the 's row and column, respectively, and is a boundary pixel lying on diagonal position.

The weights a, b and c are functions of distance between and its boundary pixel.

The weights , , are determined under the following constraints:

1) **Lower/Upper bounds**: Each weight should be a value in the range [0, 1].

2) **Ordering**: The weights for boundary pixels should be selected with the largest values. The farther from the block boundary the pixel becomes, the smaller the weights become.

3) **Boundary condition**: The weights should be larger than a typical value. Since the effect of averaging is maximized at the block boundary by the second constraint (ordering constraint), the small weights for the boundary pixels can degrade the de blocking performance.

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4. CONCLUSION AND FUTURE SCOPE

The proposed approach can be used in many mobile devices to remove blocking artifacts that have limited storage and bandwidth and therefore suffer from blocking artifacts. Many algorithms exist that remove these artifacts but each of them have some limitations, like they blur the images. In this technique, a strength parameter is used to avoid blurring of images. So the goal will be to achieve better quality of images and peak Signal-To-Noise ratio as compare to other algorithms.

REFERENCES

[1] K. K. V. Toh, H. Ibrahim, and M. N. Mahyuddin, "Salt-and-pepper noise detection and reduction using fuzzy switching median filter," *IEEE Trans. Consumer Electron.*, vol. 54, no. 4, pp. 1956–1961, Nov. 2008

[2] L. Shao and I. Kirenko, "Coding artifact reduction based on local entropy analysis," *IEEE Trans. Consumer Electron.*, vol. 53, no. 2, pp. 691-696, May 2007.

[3] A. Z. Averbuch, A. Schclar, and D. L. Donoho, "Deblocking of blocktransform compressed images using weighted sums of symmetrically aligned pixels," *IEEE Trans. Image Process.*, vol. 14, no. 2, pp. 200-212, Feb. 2005

[4] T. Chen, H. R. Wu, and B. Qiu, "Adaptive postfiltering of transform coefficients for the reduction of blocking artifacts," *IEEE Trans. Circuits Syst. Video Technol.*, vol. 11, no. 5, pp. 594-602, May 2001

[5] S. Kim, J. Yi, H. Kim, and J. Ra, "A deblocking filter with two separate modes in block-based video coding," *IEEE Trans. Circuits Syst. Video Technol.*, vol. 9, no. 1, pp. 156-160, Feb. 1998.

[6] Mei-Yin Shen, and C.-C. Jay Kuo, *"Review of Postprocessing techniques for compression artifact removal"*, Journal of Visual Communication and Image Representation, Volume: 9, No.1, March 1998, Pages: 2-14, Article No. VC970378

[7] Y. Yang, N. P. Galatsanos, and A. K. Katsaggelos, "Regularized reconstruction to reduce blocking artifacts of block discrete cosine transform compressed images," *IEEE Trans. Circuits Syst. Video Technol.*, vol. 3, no. 6, pp. 421-432, Dec. 1993.