



Color image compression algorithm based on the DCT transform combined to an adaptive block scanning

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ABSTRACT

This paper considers the design of a lossy image compression algorithm dedicated to color still images. After a preprocessing step (mean removing and RGB to YCbCr transformation), the DCT transform is applied and followed by an iterative phase (using the bisection method) including the thresholding, the quantization, dequantization, the inverse DCT, YCbCr to RGB transform and the mean recovering. This is done in order to guarantee that a desired quality (fixed in advance using the well known *PSNR* metric) is checked. For the aim to obtain the best possible compression ratio *CR*, the next step is the application of a proposed adaptive scanning providing, for each (n, n) DCT block a corresponding $(n \times n)$ vector containing the maximum possible run of zeros at its end. The last step is the application of a modified systematic lossless encoder. The efficiency of the proposed scheme is demonstrated by results, especially, when faced to the method presented in the recently published paper based on the block truncation coding using pattern fitting principle.

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1. Introduction

Compression is any method reducing the original amount of data to another less quantity. One can categorize already elaborated algorithms to lossless or lossy techniques:

- In the first case: the quality is totally preserved and we converse about storage or transmission reduction.
- In the counter part, lossy algorithms look for the check of the well-known tradeoff rate-distortion. It means that the quality of the decompressed data must be in the tolerable bounds defined by each specific application according to the maximum possible compression ratio reachable [1].

The deployment of such algorithms is evidently, of great importance. The massive exchange of large amount of different types of data (sounds, images, videos...) in Internet/Intranet or in mobile phone networks is the best example.

When focusing the attention on the elaborated methods dedicated to color image lossy compression, we can enumerate:

- The direct methods acting by the direct processing of image samples such as those based on block truncation (BT) [2–4], the others techniques built around the vector quantization [5,6].
- The transform based techniques using transforms such as the DCT [7–9], wavelets [10–12] and PCA [13]. Their use is, implicitly, in

order to concentrate the whole energy, contained initially in the original signal, in a few number of the transformed coefficients.

As an important preprocessing step, several decorrelating transforms are used to reduce the correlation between the R, G and B planes. The principle is to move from the original primary space RGB to more suitable decorrelated space such as: YCbCr [11], YUV, KLT [14], YIQ [15] and O1O2O3 [4]. In this optic, it is preferable to use one of these colors space transforms before the application of DCT or wavelet coding transforms.

The elaborated method includes many steps that are: The YCbCr transform reducing the correlation between the R, G, B spaces; a guaranteed quality-control, based on the *PSNR* measure, achieved using the bisection algorithm; the new proposed adaptive scanning; the two-role encoder (TRE) associated to a another simple and effective proposed lossless encoder applied on the resulting quantized DCT coefficients.

The rest of this paper is organized in four sections. Section 2 describes the proposed algorithm. Section 3 presents the experimental results obtained in this paper. Section 4 draws the conclusion of this work and possible future works.

2. Method presentation

As reported previously, the elaborated method is dedicated to lossy color image compression. It is RGB to YCbCr and DCT transforms based and the two phases of compression/decompression are shown in Fig. 1.

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