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RESEARCH ARTICLE

LOSSLESS COLOR IMAGE COMPRESSION BASED ON RCT AND CONTEXT ADAPTIVE CODING

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ABSTRACT: Compression is used to decrease the number of bits required to store and transmit images without any measurable loss of information. Lossless color image compression for an image in RGB color model is done by a Reversible Color Transformation. It converts RGB to YUV color model. *Y* component is encoded by method called Lifting Wavelet Transform (LWT) with Huffman coding. The lifting scheme is a technique for both designing wavelets and performing the Discrete Wavelet Transform. To merge the steps and designed in wavelet filters while performing the wavelet transform. The overall signal variation is suppressed by the color transform and the prediction error is reduced in chrominance channel. The proposed method used for hierarchical scheme to encode the chrominance image. Under this process, the chrominance image is decomposed by even row and odd row image. This decomposed image is compressed using arithmetic coding and decoded to get the original image using color reverse transformation after the image can be reconstructed and performance measure can be calculated.

Keywords: RCT, Arithmetic coding, LWT

I. Introduction

Most of the years have been an increased level of research in image compression. Many applications such as medical imaging, remote sensing require or desire lossless compression. As cameras and display systems are going high quality and as the cost of memory are lowered. Hence efficient lossless compression will become more and more important.

Lossless color image compression algorithm:

A most variety of algorithm used by lossless JPEG [1], LOCO-I [2], CALIC [3], JPEG2000 [4] and JPEG-XR [5].

JPEG:

"JPEG" stands for Joint Photographic Experts Group. JPEG is a commonly used method of lossy compression for digital images. The compression method is lossy, which means few original image data will be lost and cannot be restored.

LOCO-I:

Low complexity lossless compression for images (LOCO-I) is an algorithm for lossless and near-lossless compression of continuous-tone still images and it is based on simple fixed context model. A good prediction of pixel value can be attained by LOCO-I.

CALIC:

Context-based adaptive lossless image codec (CALIC).CALIC puts heavy emphasis on data modeling images. It can be used for large number of modeling contexts to a condition and non-linear prediction of various source statistics. In non-linear prediction to adaptive an error feedback mechanism. It can only estimates the expectations of prediction errors contained a more number of conditional error probabilities. A more number of modeling contexts without suffering form of sparse context problem. CALIC gives as an average lossless bit rate of 2.99 bits/pixel and the 8-bit test images selected by ISO for proposed evaluation an average bit rate of 3.98bits/pixel for lossless compression of JPEG using Huffman codes on the same test images.

JPEG 2000 (Joint Photographic Experts Group 2000):

It is a wavelet image compression standard. It was created by the Joint Photographic Experts Group committee with the intention of superseding their original discrete cosine transform based JPEG standard. JPEG 2000 has higher compression ratios than JPEG.

II. COLOR TRANSFORM

The purpose of this paper is to develop a hierarchical prediction scheme used in lossless compression based on raster scan prediction which is sometimes inefficient in the high frequency region. In this paper we design an edge directed prediction and context adaptive model for this hierarchical scheme. The compression of color images RGB first transformed into YCuCv by an RCT [6].

RCT (Reversible color transform):

In this reversible color transform for hicolor used in picture coding. The work is motivated by increasing needs of multimedia applications such as mobile phones and PDAs. A reversible color transform customized for hicolor system is derived from YCrCb and JPEG2000 Reversible color transformation. The transform proves simple but highly decorrelating and able to reduce the computation time of decoding.

III. ENCODING

Huffman coding:

It is an entropy encoding algorithm used for lossless data compression. It can be refer only a variable length code for encoding a source symbol (such as character in a file).The variable length code has been derived for a particular way based on the estimated probability of occurrence for each symbol. In each symbol to express the common source symbols using string of bits are used for less common source symbol.

Arithmetic coding:

The context based adaptive arithmetic coder also includes low computational complexity method for binary arithmetic coding and probability estimation is well suited for efficient hardware and software implementations. In this entropy coding method of H.264/AVC for the typical area of investigated in target applications. In this arithmetic coding does not use for a discrete number of bits per each symbol to be compress. At last all the symbol of input data to be encoded and transmit the data or information on the sub-range itself is enough for exactly accurate reconstruction of input data at the decoder.

IV. PROGRESSIVE DECOMPOSITION AND PIXEL PREDICTION

The chrominance channels Cu and Cv resulting from the RCT generally have distinctive measurements from Y, furthermore diverse from the first color planes R, G, and B. In the chrominance channels, the general sign variety is stifled by the shade change, yet the variety is still substantial close to the item limits. Subsequently, the prediction errors in chrominance divert are highly decreased in a smooth area, however remain moderately substantial close to the edge or inside a composition area. For the proficient lossless packing, it is critical to precisely gauge the pdf of forecast mistake for better connection demonstrating, alongside the exact forecast.

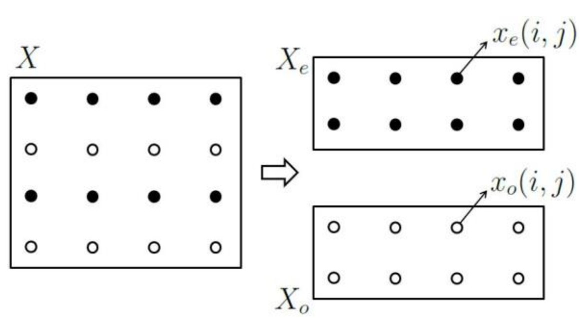

Figure.1 Decomposition of an input image

For this, we propose a various leveled decay plot as delineated in Fig. 1, which demonstrates that pixels in an info image x is differentiated into two sub images: an even sub image Xe and an odd sub image Xo. At that point, Xe is encoded first and is used to foresee the pixels in Xo. Moreover, Xe is additionally used to gauge the insights of forecast mistakes of Xo. In real usage, Xe is decayed afresh as will be clarified later. For the packing of Xo pixels utilizing Xe, directional forecast is utilized to evade expansive expectation lapses close to the edges. For every pixel xo(i, j) in Xo, the flat indicator xˆh (i, j) and vertical indicator xˆv (i, j) are characterized as

$$X^{\wedge}h\ (i.j) = X_o\ (i, j-1)$$

$$X^{\wedge}v(i,j) = \text{round}\left(\frac{xe\ (i,j) + xe\ (i+1,j)}{2}\right) \quad \ldots.(1)$$

what's more one of them is chosen as an indicator for xo(i,j). With these two conceivable indicators, the most widely recognized methodology to encoding is "mode determination," where better indicator for every pixel is chosen and the mode (flat or vertical) is likewise transmitted as side data. On the other hand, the vertical indicator is more regularly right than the even one when the indicators are characterized as (1) on the grounds that upper and lower pixels are utilized for the "vertical" while simply a left pixel is used for the "even." The horizontal indicator is more exact just when there is a solid even edge. For sample, the recurrence of selecting even indicator is just 0.03% ∼ 1.45% for the pictures in Kodak set [7] which is one of the picture sets utilized as a part of the investigations. Subsequently, the vertical indicator is utilized for most pixels, and mode determination is utilized just when the pixel is by all accounts on a solid even edge. For executing this thought, we characterize variable for the heading of edge at every pixel dir (i, j), which is given either H or V . Really, it is given h only when the horizontal edge is solid, and given V for the rest. Choosing dir (i, j) is outlined in Algorithm 1, where it can be seen that the bearing is given H only when |xo(i, j) − xˆh (i, j)| is much littler than |xo(i, j) − xˆv (i, j)| by adding a consistent T1 to the previous when looking at them. In light of the headings of pixels, the overall prediction plan is outlined in Algorithm 2. It can be seen that the mode choice is attempted when more than one of dir (i − 1, j) or dir (i, j − 1) are H , and the vertical expectation is performed for the rest.

V. PROPOSED CODING SCHEME

In this segment, we clarify the general methodology of picture packing, including the new encoding plan. An info RGB shade picture is changed into Y cu cv color space by a RCT. The luminance picture Y is encoded by any of lossless grayscale picture coders, for example, CALIC, JPEG-Ls, or Jpeg 2000 lossless. The chrominance pictures Cu and Cv are encoded utilizing the system depicted as a part of Section II. To be particular, a chrominance picture X(0) ∈ {cu,cv } is deteriorated column by line into an even sub image X(1)e and an odd sub image X(1)o as indicated

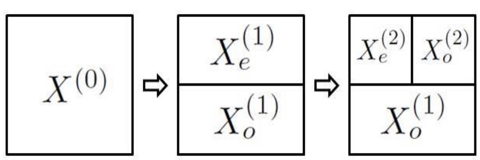

Figure.2 Illustration of hierarchical decomposition

The sub image X(1) o is anticipated and encoded utilizing X(1)e , as portrayed as a part of Section II. The sub image X(1)e can be further deteriorated segment by section into the even sub image X(2)e and the odd sub image X(2)o as indicated in the last figure of Fig. 2, where the sub image X(2)o is layered utilizing X(2)e in the prescient lossless layering, proficient encoding of the expectation lapse $e(i,j) = xo(i,j) - \hat{x}o(i,j)$plays an essential part. Despite the fact that the proposed expectation strategy generally produces little forecast blunders owing to the RC the refined forecast plan, there are still moderately expansive slips close to the edge or surface area, which corrupts the pressure execution. For the productive pressure, the insights of images (forecast lapses) ought to well be depicted by a suitable model and/or parameters. We model the expectation mistake as an arbitrary variable with pdf $P(e|cn)$, where Cn is the coding connection that reflects the size of edges and compositions. Particularly, Cn is the level of quantization steps of pixel action $\sigma(i, j)$ characterized as

$$\sigma (i,j) = | xe (i,j) – xe (i+1,j) | \ldots\ldots\ldots\ldots\ldots \quad (2)$$

Note that the nearby action and its quantization steps are computed with the pixels in Xe, in light of the fact that all the pixels of Xe are accessible and its factual property would be practically the same as that of Xo. The neighborhood movement is quantized into K steps such that Cn speaks to the step

$$qn-1 \leq \sigma(i,j) < qn \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

for n = 1, . . . , K with $q0 = 0$ and $qk = \infty$. The length of quantization steps is dead set such that each one stage incorporates the same number of components (neighborhood exercises). For each setting, a nonexclusive versatile math coder [8] is utilized to encode the forecast lapse. For outline, Fig.3 demonstrates an information picture, the neighborhood action of a sub image (connection), and $P(e|cn)$ for a few Cn. It depicts the factual property of expectation mistake extremely well, in that the slip greatness is vast at the point when the nearby action is solid. Thus the proposed model can be successful for the compression with arithmetic coding.

VI. CONCLUSION

The proposed system uses lossless color image compression method based on the hierarchical prediction scheme and context adaptive arithmetic coding. The image is first transformed into YUV color space using an RCT (Reversible Color Transforms). The modules RCT and decomposition of luminance image using LWT with Huffman coding was completed in this phase. The remaining modules hierarchical predictive arithmetic coding and performance measure will be done as future work.

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