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Implementation of Image Compression Algorithm using MATLAB

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ABSTRACT

In current scenario, Internet becomes a handy tool to everyone and everyone wants lot things in a very compact form so-that less amount of data can be stored or captured in a very small space. As Internet is act as medium of transportation of documents (such as multimedia documents). In this paper, a compression technique is being representated to compress the on form of multimedia document such as image using MatLab. Since, image contains a lot of information in dot form and required a huge space on hard disk. The Image compression technique used discrete cosine transform to deal with the real value during the compression of an image. Using DCT in compression leads to easy calculation of image data in frequency domain.

Keywords: Image compression, JPEG, DCT.

I. INTRODUCTION

Video and image contains a lot of information and consumes huge storage space. Generally internet applications have less or very limited space. To overcome the space requirement image compression is must. This paper introduces the basic concept of data compression using Matlab. Which could be applied to modern image and video compression techniques. Basically, compression is done to reduce the data similarity. Discrete Cosine Transform is frequency domain technique. By applying DCT, the data in time (spatial) domain can be transformed into frequency domain.

In this paper an image compression algorithms are being used in Matlab. The necessary bandwidth is required to digitally represent the data in the form of signals. There are many existing applications in video and audio that made it inexpensive because its ability to deal with compressed signals. Compression technology can result in reduced transmission time. In this regard there is less data to be transmitted and decrease the storage requirements, again because there is less data.

There are two types of compression as follows:

1. Lossy compression: This is the technique in which higher compression ratios is achieved. Luckily, the majority of video and image processing applications do not require higher compression ratios. In these applications, lossy compression schemes can be used, achieving higher compression ratios.

2. Lossless compression: In many fields like medical systems, image losses can translate into costly medical mistakes; therefore lossless compression methods are used.

DCT Compression: DCT is a lossy compression scheme in which a MxN image block is transformed from the spatial domain to the Discrete Cosine Transform domain. DCT decomposes the signal into spatial frequencies components called DCT coefficients. The lower frequency DCT coefficients appear toward the upper left-hand corner of the DCT matrix and the higher frequency coefficients are in the lower right-hand corner of the DCT matrix. The Human Visual System (HVS) is tolerant to errors in high frequency coefficients. HVS is not tolerant to lower frequency coefficients. So that the higher frequency components can be changed or quantized. This is done by the quantization technique.

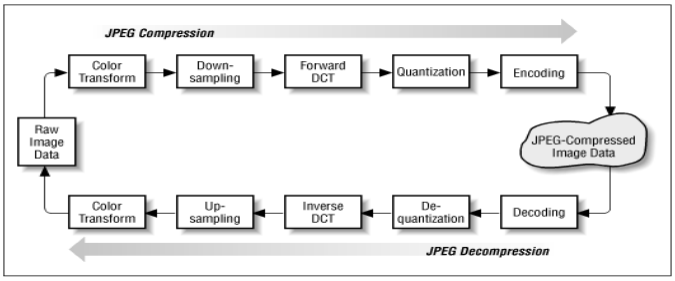

Figure1: JPEG compression and decompression [1]

II. METHODS AND MATERIAL

JPEG (Joint Picture Expert Group): It is lossy a compression method for digital images. The images taken by particularly digital photography needs lossy compression. The amount of compression can be adjusted according to application. In this regard one factor could be allowing a selectable tradeoff between storage size and image quality. JPEG typically achieves 10:1 compression ratio. In this process, little perceptible loss in image quality.

The JPEG compression scheme could be understand by dividing it into the following stages:

1. Transform the image into RGB to gray scale.
2. Down sample the image.
3. Convert image in multiple of 8 and apply a Discrete Cosine Transform (DCT) to blocks of pixels of 8×8.This the way for removing redundant image data.
4. Quantize each block of DCT coefficient found in step 3, using weighting functions optimized for the human eye.
5. Encode the resulting coefficient

The discrete cosine transform (DCT) is very much related to the discrete Fourier transform.

2-D Discrete cosine transforms

One disadvantage of the DFT for some applications is that the transform is complex valued, even for real information. A related transform, the discrete cosine transform (DCT), does not have complex value problem. It is widely used in image and video compression applications, e.g., JPEG and MPEG.

Principles behind Compression

Number of bits required to represent the information in an image or in video can be minimized by removing the similarity present in it. There are three types of redundancies:

(i) spatial redundancy, which is due to the similarity or dependence between neighboring pixel values;
(ii) spectral redundancy, which is due to the similarity between different color planes or spectral bands; [4]
(iii) temporal redundancy, which is present because of similarity between different frames of the image or different images. Image compression work aims to reduce the number of bits required to represent an image. This work can be completed by removing the redundancies as much as possible.

Data redundancy is the main issue of digital image compression. If L1 and L2 denote the number of information carrying units in original and compressed image respectively, then the compression ratio CR can be defined as

CR=L1/L2;

And data redundancy RD of the original image can be defined as

RD=1-1/CR;
Three possibilities arise here:
(1) If L1=L2,then CR=1 and hence RD=0 which implies that original image do not contain any redundancy between the pixels.
(2) If L1>>L2,then CR→∞ and hence RD>1 which implies considerable amount of redundancy in the original image.[5]
(3) If L1<<L2, then CR>0 which indicates that the compressed mage contains more data than original image.

DCT Advantages:

Compared to other transforms, DCT has many advantages
(1) It could be implemented in single integrated circuit;
(2) It has the ability to pack most information in lesser number of coefficients;
(3) It minimizes the block like appearance called blocking artifact that results when boundaries between sub-images become visible

Matlab Codes - Functions

There are few Mat lab functions which are used used to read an image and perform dct as follows:

- imread(file); %reads file into a matrix
- dct2(temp); %perform 2-D cosine transfer function[2]

III. CONCLUSION

There are two methods for image steganography. The least significant-bit (LSB) based techniques are very popular and simplex method for steganography in spatial domain. The simplest LSB technique simply replaces the LSB in the cover image with the bits from secret information. Further advanced techniques like DCT and DWT, use some criteria to identify the pixels in which LSB(s) can be replaced with the bits of secret information. In DCT based technique insertion of secret information in carrier depends on the DCT coefficients. Any DCT coefficient value above proper threshold is a potential place for insertion of secret information because this pixel value have very little effect on image quality.[3]

IV. REFERENCES

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