Compression of a filtered Image using DCT-Technique

1Ms. Deepti Mehta  2Ms. Kavita Chauhan

1M. Tech Scholar, Department of ECE, N.G.F College of Engineering and Technology
2Asst Prof., Department of ECE, N.G.F College of Engineering and Technology
d.mehta@ymail.com, kavita_chau@rediffmail.com

Abstract: This paper provides compression of a filtered Image using DISCRETE COSINE TRANSFORM (DCT) and the comparison of PSNR-value between an original Image and noisy Image. Parameters of a given image are Compression Ratio, Number of pixels, Quantization bits per pixel, Frame rate and Correlation between adjacent samples (Φ). These parameters defines the Quality of an image. DCT is better technique as it transforms coefficients relatively uncorrelated. Energy of DCT is highly compacted. It is reasonable robust relative to channel errors. DCT operates on Intraframe Redundancy which results 6bpp is compressed into 1.2 bits per pixel while other techniques operate on point to point redundancy which results 6bpp is compressed into 2bpp.

Keywords: Image Compression, DCT, PSNR, Coefficient, Coding technique, Filter, Decompression, Simulink, Color Conversion, Noise in image, pixels, JPEG, transmission, MATLAB

I. INTRODUCTION

Image compression has become an essential requirement for storage, transfer and manipulation of digital images. An image file from digital cameras occupies large memory. Image compression reduces storage spaces by efficient utilization of bandwidth. The main goal of image compression is to represent an image in which pixels are less correlated. There are two fundamental principles for image compression: Redundancy and Irrelevancy. Redundancy is used to remove redundant data from the signal source and Irrelevancy is used to omit pixel values which are not noticeable by human eye. Compression technique is of two types: Lossy and Lossless. Lossy compression techniques are able to achieve much higher compression than lossless technique. The two important image standard based on Lossy compression technique are JPEG and JPEG 2000. JPEG is based on Discrete Cosine Transform (DCT) and JPEG 2000 is based on Discrete Wavelet Transform (DWT). Transform coding techniques use a reversible and linear mathematical transform to map the pixel values onto a set of coefficients which are then quantized and encoded.

II. DISCRETE COSINE TRANSFORM

This technique works on different frequency by separating an image. From all of frequencies, it has been observed that at low frequency we can obtain maximum information. With the help of DCT, Image of higher size is divided into sub-images or blocks of small size. Through these sub-blocks, coefficients are calculated which provides the maximum and minimum value. These values represents information about the image. So at the top-most corner (having Low frequency), high value of the coefficient is obtained. Therefore this corner needs to be quantize and encoding techniques in order to obtain bit-stream at the transmitter-side. The reverse process is done through IDCT in order to obtain reconstructed image. DCT have many advantages:

(1) It has been implemented in single integrated circuit;
(2) It has the ability to pack most information in fewest coefficients;
(3) It minimizes the block like appearance called blocking artifact that results when boundaries between sub-images become visible. This block diagram shows an internal diagram for transmitting a compressed image using DCT technique. See Fig 2.1
III IMAGE COMPRESSION ON SIMULINK

Simulink is an environment on which various blocks can be placed using Drag & Drop facility and a model can be drawn. With the help of Simulink, we can draw the block diagram of Image Compression. Image is compressed by DCT and it is reconstructed by IDCT. PSNR is one of the parameters of Image Compression. It defines the quality of the Image. The given flowchart shows the basic idea of the project. The step by step description of image compression, decompression and computation of PSNR is given below:
Flowchart for an Image Compression using DCT and Decompression using IDCT

PSNR is an acronym of peak signal to noise ratio. It defines the quality of the Image. PSNR is one of the parameters of Image Compression. It measures the quality of the Image. PSNR can be measured after applying decompression technique. It measures the value in decibels. Comparison of Quality between Original Image and Noisy Image is evaluated with the help of PSNR. Higher the value of PSNR, quality of an Image will be better. The flowchart is given as:

Flowchart for Analyzing PSNR-Output

Compression of colored image can be obtained easily by converting it into non-colored image, which means 3-D signal is converted into 2-D signal. This 3-D to 2-D conversion should be done before applying DCT because DCT works on 2-D signal.
IV. RESULTS

Colored image can be compressed with the help of DCT. So, by taking a colored image from the MATLAB workspace and put some noise in the same image and represent it by another name. Both images are called in the Simulink environment. Here the original image is shown as in fig 4.1.

Noisy image is an image which have noise in terms of salt and pepper. The maximum intensity of the noise in Image is 1. Here, noisy image is shown with the intensity of 0.02. This image is also called from MATLAB – workspace. See Fig 4.2

For the transmission and storage of an image, compression becomes necessary. Before compression and transmitting an image, noise should be filtered out this is done to obtain an original image. By considering all these issues, color space conversion become necessary. It converts 3-D signal into 2-D signal. As colored image is 3-dimensional signal and all the operations such as Filtering, DCT and IDCT is performed on 2-dimensional Image. The 2-D image of the original image is shown as in Fig.4.3
After obtaining 2-D Image Median Filter can be applied over noisy image in order to obtain Filtered Image. This filter performs Median filtering of input matrix which comes from the input image. It uses the Neighborhood size parameter to specify the size of the neighborhood over which the block computes the median. Noise intensity gets almost reduced. See Fig.4.4
Compression of a filtered Image using DCT-Technique

Now, filtered Image is ready to compress by DCT algorithm so that compression should be done over filtered image. DCT is an image compression technique which is used for compressing an image at low compression ratio. See Fig 4.5.

In order to obtain an original image at the receiver, decompression technique is needed. Here, IDCT is a corresponding decompression technique to the DCT. Reconstructed image is shown in Fig.4.6.
At the receiver side, image is reconstructed with the help of IDCT technique. From the above observation we can check the quality of the image with the parameter known as PSNR. It uses two inputs in which one is reconstructed - image and another one is noisy-Image. Comparison of PSNR value is shown in table 4.1. See table 4.1

The bar graph represents the comparison of PSNR value with Image component such as R,G and B. The different values of PSNR is shown as in Fig 4.7

![Fig 4.7 PSNR verses True Color Image Component](image)

V. CONCLUSION

When an image is transmitted from transmitter then during the transmission some noise gets introduced in terms of salt and pepper. This noise is filtered through median filter after converting image in 2-D and then it is compressed. Image is reconstructed at the receiver side in 3-D. From this paper, it is concluded from the comparison between filtered Image and noisy Image that higher the value of PSNR gives better quality of the image. As we increase the Compression-Ratio, value of PSNR will decreases. This will degrade the Quality of the Image. DCT will provide better compression results at low compression ratio. So, at higher compression-ratio, we use another technique for Image Compression known as Discrete Wavelet Transform (DWT).
Compression of a filtered Image using DCT-Technique

REFERENCES


