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Effect of Soft Decision Quantization in Compression Technique

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Abstract: Image compression is technique that addresses the problem of reducing the amount of data required to represent a digital image. In this paper instead of normal DCT (Discrete Cosine Transform) we used block 8X8 DCT for image compression. Although the standard blocks size, which is 8 pixels by 8 pixels is usually the most well rounded choice, the different block size is suited for a particular image. To improve the quality of decompressed image with low image size here also Soft Decision Quantization (SDQ) algorithm proposed. Due to the SDQ, it improves rate distortion (RD) performance of image coding system. For some application size of image required very small but quality of that image want to be a better. This is the main objective of the paper.

Index Terms — Image Compression, Discrete Cosine Transform, Block Transform, Rate Distortion, Soft Decision Quantization

I.INTRODUCTION

This research paper about improving image quality of decompressed image at the output side. Here, first we discuss the compression technique and then quantization method for to get the better quality image at the output.

The objective of image compression is to reduce irrelevance and redundancy of the image data in order to be able to store and transmit data in an efficient form. Basic types of image compression are lossy and lossless image compression. Various methods are generated for both type of image compression [1]. Lossy image compression uses the transform techniques like Discrete Fourier Transform (DFT), Discrete Cosine Transform (DCT) etc. In this paper we used block 8X8 DCT technique [2] [3]. In block transform image is dividing into 8 pixels by 8 pixels block, and then we take DCT of each block. Taking the DCT of a each block, matrix multiply the block by a mask that will zero out certain values from the DCT matrix. DCT uses only cosine function, therefore not interacting with complex number at all. Humans are unable to see the aspects of an image at high frequency. Since taking the DCT allows us to isolate where these high frequencies are, so we can take advantage of this in choosing which values we want to preserve. By multiplying the DCT matrix by some mask, we can zero out elements of the matrix, thereby freeing the memory that had been representing those values. Due to block DCT also we can save memory space [3].

The image consist inliers and outliers part. Inliers are the content which present inside an image, whereas outliers are the edges of the image. Outliers and inliers are two statistical different regions, in that probability of occurrence of outlier is small as compared to inliers. Soft decision quantization algorithm, we only consider for inlier part of the image.

II.RELATED WORK

Many researchers develop different encoding algorithm for DCT coefficient and also the techniques which improve the rate distortion present into an image. Variable rate trellis encoding, Huffman coding, run length coding, context based entropy coding, intra frame coding these are all methods are developed earlier. Z.Zhang proposed in their paper variable rate trellis algorithm for encoding. They tell us that the developed code is useful for low region. It gives low rate output, so such low rate the coders perform poorly [4].

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En-Hui Yang proposed intra frame coding. They designed general framework in which motion estimation, quantization, and entropy coding in the hybrid coding structure for the current frame can be jointly designed to minimize a true RD cost given previously coded reference frames. But more challenge that designed algorithm is to extend optimization framework to the joint optimization of a group of frames [5]. Also Xiang Yu developed algorithm for near optimal SDQ with conjunction CABAC (Context Adaptive Binary Arithmetic Coding) by developing graph structured to capture the additive inherent in length of CABAC codeword's[6]-[9] .

Longji Wang proposed paper, In that they presented a graph-based R-D optimal algorithm for JPEG run-length coding. It finds the optimal run size pairs in the R-D sense among all possible candidates. Based on this algorithm, we have proposed an iterative algorithm to optimize run-length coding, Huffman coding and quantization table jointly [10] [11].

All of this researcher produce their method for improving SDQ method. But SDQ problem is still open. So in our paper also we research the solution to overcome the problem related to SDQ.

III. SOFT DECISION QUANTIZATION.

In this section we present our approach. First we take input image. Then we perform compression method on it that is block 8X8 DCT. Taking the DCT of each block then we perform soft decision quantization as illustrated below figure:

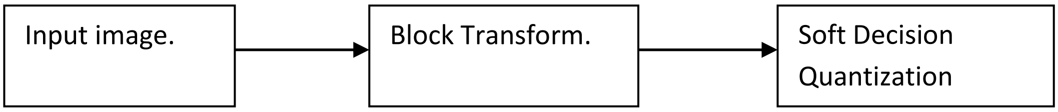

Fig.1.Soft decision quantization

To improve the rate distortion performance,we used SDQ method. SDQ only consider inliers part of image because outliers are large in magnitude and apply SDQ to it is limited. In SDQ all levels can be consider for quantization it depend upon us. Using soft decision quantization (SDQ) instead of hard decision quantization, we discover that the quantized residual itself is a free parameter that can be optimized in order to improve compression performance. Algorithm for SDQ is illustrated below-

Step 1: Initialize scanning position s=1 and constrained optimization $J^{\theta}(t)$ to 0
Where it lies within 0<t<4
Step 2: while
Scanning layer s< number of AC frequencies N_{lyr}
Do
Step 3: if t<4,
Calculate
$$J^{\theta}=min1 < t^{'} < 4(J^{\bullet}(s-1)(t.) + J^{\bullet}(t/t'))$$
And label optimal incoming state to t'^{θ}
Step 4: else
Calculate $J^{\theta}=min1 < t^{'} < 4(J^{\bullet}(s-1)t^{'} + \min 2 < |cs| < L)$
Step 5: end if
Step 6: s=s+1.
Step 7: end while
Step 8: back track optimal index sequence for current SL until S=1 as per labels

IV. EXPERIMENTS AND RESULTS

The proposed algorithm is implemented using MATLAB. According to our block diagram of, first input image is taken then compress it by using block 8X8 Discrete Cosine Transform instead of normal DCT.

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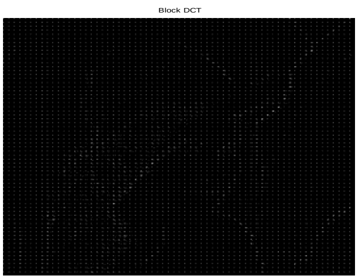
Now compressed image is given to quantization unit, here image is quantizing by soft decision quantization method.

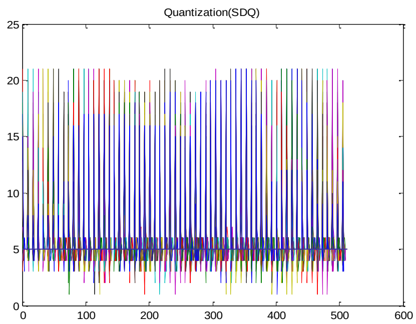
Following steps are performed:-

Step1:- we take input image that is "lena.bmp".

Step 2:-To the input image we apply coefficient extraction technique. Block (8X8) DCT is applied to image to obtain better image quality when image is decompressed. Image is broken into 8x8 block pixel. 8x8 based DCT coefficient extraction leads to selection of maximum points for quantization compared to entire DCT at a time which selects points having less details region wise.



Step 3:- Now we quantize image by using soft decision quantization. Here we take multi threshold point for quantization using "multithresh" inbuilt function of MATLAB. Then we have done quantization. Figure shows the graph of SDQ.



Step 4:- After that we reconstruct the image by using inverse DCT then calculate PSNR value of that image. Result is shown below figure.

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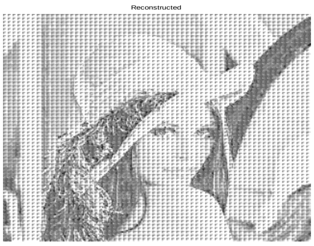
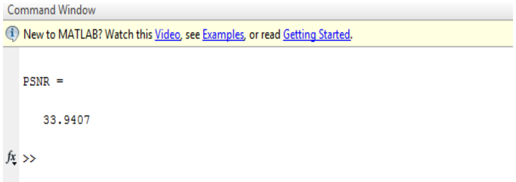
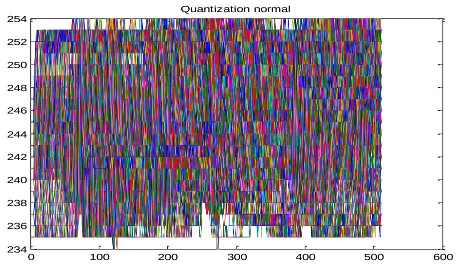
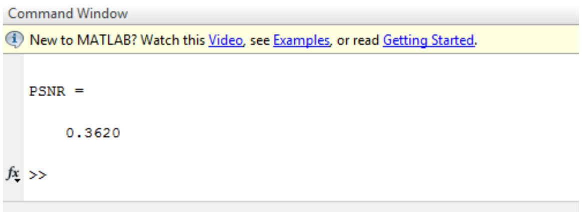




Due to the SDQ reconstructed image quality is better as compared to normal quantization which result is shown below:-



After normal quantization reconstructed image and PSNR value is shown below:-



V .CONCLUSION

Images consist lot of features into it that cannot seen by the human. Now a day's images are used in every application. For transmit and storage purpose image is compressed without harming the features of it. To enhance the quality of decompressed image, here we suggest SDQ algorithm. From the result we get PSNR value 33.9407. Also the reconstructed image is compared with normal quantization. The PSNR of normal quantization is 0.3620. By observing the parameters, the visual quality and PSNR based loss estimation, our proposed method is better as compared to normal quantization. In future we can further improve PSNR value and quality of image by changing the thresholding level.

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