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JPEG Compression Using Machine Learning

"Prof. V.B. Raskar, Pratikkumar Kulkarni, Akash Jojar, Prashant Palange"

'Department of Electronics and Telecommunication'

Savitribai Phule,Pune University.

Abstract:

The traditional compression technique and video coders such as JPEG, H.261, MPEG-1, MPEG-2 suffer from annoying blocking artifacts when they applying low bit rate coding .it can be occur because the inter correlation between the block is lost by block based prediction, quantization, transformation etc

The commonly used JPEG image compression technique have good compression ratio but it also introduce blocking effects, to overcome the blocking artifacts we implement the machine learning technique to predict the DCT coefficient value and the pixel value of the compressed image. The result of our method gives the decreasing of the mean square error between our predicted image and original uncompressed image and it also gives the clear reduction of the blocking artifacts.

Index term:

Image compression, artifact removal, feed-forward neural network, JPEG, DCT compression algorithm.

I. INTRODUCTION

The lossy compression technique like JPEG, MPEG etc, methods that uses inexact approximations for representing the encoded content. This commonly used compression technique introduce the blocking artifacts. These artifacts affect the image quality and it introduces the problem while recovering the image. All these artifacts not only decrease perceptual visual quality, but also adversely affect various low-level image processing routines that take compressed images as input, e.g. contrast enhancement super-resolution and edge detection. However, under such a huge demand, effective compression artifacts reduction remains an open problem.

To separate the color component at the time of compression RGB image is transferred into Y'CbCr color format. This conversion technique gives the color component in different channel. it can be done because of the human visual system has proper frequency response to color than luminance ,color component are subsample greatly reducing an images files size with minimal perceivable effects[1].the DCT domain is useful for reducing the luminance component by using the quantization[2]the blocking artifacts is created when the image is heavily compressed. The DCT technique is a simple 8 x 8 blocking technique [3]

The proposed system the wavelet based system is used to compress the image [3],to detect and smooth the blocks in uniform background region we make the exploiting and the correlation among the wavelet coefficient[4].the other commonly used compression technique having the common drawbacks like high computational cost and some technique may lost the information of the image etc.

The basic aim of the proposed system is to preserve the original information of the image as possible while removing the block like discontinuities in the compressed image. To implement this method we use feed forward neural network method. This method helps to predict the value of discarded DCT coefficient for each 8 x8 block as well as approximate the pixel intensities for all pixels at the block boundaries [4].

II. ARCHITECTURE OF ARTIFICIAL NEURAL NETWORK

The artificial neural network has three layers such as input layer, hidden and output layers. The hidden layer simulation in order to determine the optimal number of hidden nodes. The input layer is used to select the parameter to the training data and it take the values from highest range value. Once the input layer process completed, then the process moved to the hidden layer. The hidden layer range value varied based on the validation data. If the hidden layer process is completed, then the process is moved to the output layer. The weights in the hidden node need to test using training data. The training data is used to find the neural networks input and output of the weights of the hidden nodes.

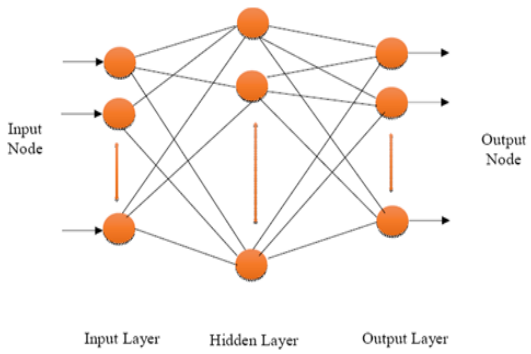


Fig. 2 Architecture of Artificial Neural Network

III. IMAGE QUALITY ENHANCEMENT TECHNIQUE

When the image is heavily compressed the more number of frequency component are degraded, resulting in loss of the information. we want an image processing framework that allows for the file size reduction benefits of JPEG while ridding the image of blocking artifacts and noise. we study the more number of image deblocking algorithm used today are computationally expensive and can increase

the MSE and decrease the PSNR and noise. The proposed system or method is more suitable for compressed the image effectively and recover back without noise and recover back the signal value. The predictor takes large number of time to predict the coefficient values because of the complex algorithm of neural networks, if once we done the prediction the values are stored in the database and we can use these values in any instance.

IV. LEARNING OF DCT COEFFICIENT

The big problems occur in JPEG compression technique when the DCT coefficients are quantized. To recover such loss of the information by approximates the value of original non quantized DCT values into the corresponding image prior. We approach this method by using a trained neural network as the true DCT coefficient value and the predicted DCT coefficient value. The neural networks receive the input as 8 x 8 pixel block and predict a DCT coefficient corresponding to its index position in the pixel block, after completion of prediction of all coefficients we perform the inverse DCT to recover back the original information of the image.

V. LEARNING OF PIXEL VALUES

The pixel intensities are change accordingly the boundaries between two adjacent 8 x 8 pixel blocks, by decreasing these intensities different artifacts become less evident. To avoid the variation of pixel intensities we implement the idea of approximation of pixel intensities located at the boundary. To approximate the boundary value we trained the neural networks to predict the luminance intensity value at image block boundary, the luminance intensities of the block boundaries indexes (mod 8==0, mod 8==1), using pixel neighborhood as instance attribute. A pixel predicting neural network takes as input a pixel neighborhood and predicts the target pixel values. After prediction of the all pixel values replace the boundary block pixel values by target pixel values.

VI. IMAGE SMOOTHING

When the image is heavily compressed using JPEG certain amount of information is lossed and the high-frequency components are removed. The loss of high frequency component introduce the aliasing and ringing effects to remove this effects we use the Gaussian filter

$$G(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}} \qquad [2]$$

Also we convolved the Gaussian kernel into the compressed image to remove the noise and the artifacts introduced in compression,
Also we measure the decreasing the noise and increasing the image quality of the image.

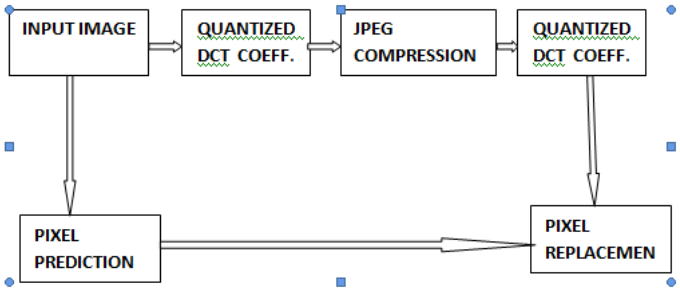
VII. PROCESSING METHODS

To implement this method by collecting the n number of images compressed with the same quality parameter q, then we proceed smooth the entire image using the Gaussian filter with the predicted value.
Thus we describe our new set of smoothing images as Thus, we describe our new set of smoothed images as ;

Spkq _ Ipkq _ G for k _ 1; 2; : : : ; n; (3)

Where
S = new set of smoothed images,
I = original set of compressed images,
G= our Gaussian filter,
_ =convolution operator.
Then we implement the feed-forward neural network to predict the DCT coefficient values and predict the pixel intensities values at 8 x 8 block boundary

Processing:

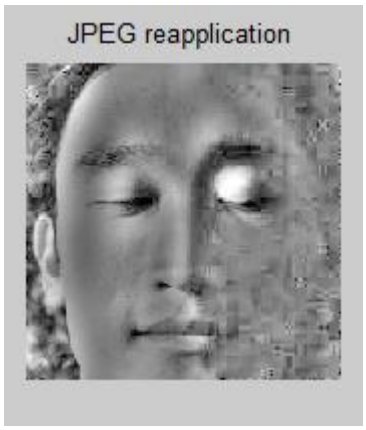


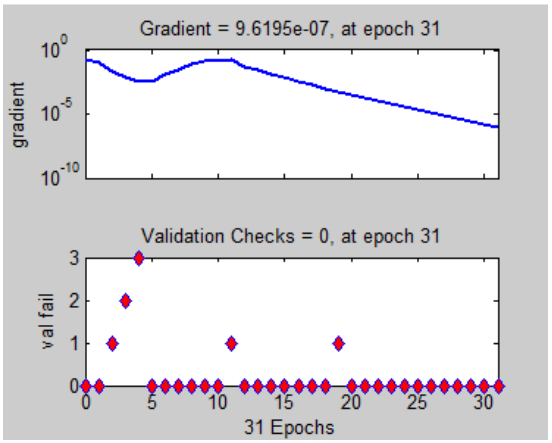
Our method lock diagram

The input DCT coefficients predict the value of input image and transform back into pixel space. This prediction is call DCTPRED combining the both pixel value and replacing inside of the compressed pixel value.

VIII. RESULTS

We implement and our proposed system and calculate the results in two images, compare our results with blocking and deblocking image and also observe replication and unblocking of the JPEG compression[5], we calculate the MSE and PSNR of the both images and plotting the histogram.





IX. CONCLUSION

We presented a machine learning method that allows processing images affected with blocking artifacts and noise and improving image quality. Our method yields a reduction in MSE and increase in PSNR, as well as an evident reduction of blocking artifacts. Processing is fast, and no user-input is necessary.

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AUTHER DETAILS:-
Prof. V.B. Raskar, Department of Electronics and Telecommunication, Savitribai Phule,Pune University, *Pune, India, 9881595966.*
Pratikkumar Kulkarni, Department of Electronics and Telecommunication, Savitribai Phule,Pune University, *Pune, India,940408486.*
Akash Jojar, Department of Electronics and Telecommunication, Savitribai Phule,Pune University, *Pune, India, 982835653.*
Prashant Palange, Department of Electronics and Telecommunication, Savitribai Phule,Pune University, *Pune, India, 9404601732.*