A Novel Hybrid technique using Vector Transform and Haar Wavelet for Lossless Image Compression

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Abstract: Image Compression is a very challenging task in the field of image processing. The main purpose is to reduce the size of the image without disturbing the details present inside the image. This reduces size of the image helped when there is a need to transmit the image over network having limited bandwidth capacity. Compression techniques mainly represented either as lossy or lossless compression. The output images in case of lossy compression techniques may loss some of the finer details which previously were present in the original image. In case of lossless compression, the output image produced by decompression stage produce the same image as the original one. Here in this paper, a novel hybrid technique is proposed using Vector transform and Haar Wavelet for lossless Image compression and issues with the existing techniques will also be discuss for the purpose of clarity.

Keywords –: Lossy compression, Lossless compression, Bandwidth, Haar wavelet, Decompression, Vector transform

I. INTRODUCTION

Image processing field produce many challenges in front of computer vision researchers. The challenges may cover different phases like Image acquisition, Pre-processing, Segmentation, Restoration, Compression etc. Image Compression is also one of the hot topic. As the main challenge in case of images is the size of the image. Every process of processing an image have to address each and every pixel present in the image. So more the number of pixels more difficult the task is. To deal with the size issue of images, one of the solution is its compression process. Sometimes one image have to be sent to a remote location for some important tasks. In this case again if the size of the image is huge as compared to the available bandwidth, the system may have to face some problems. So compression is a process in which an image with a large size is given as input, Then a process is executed which play with each pixel present in the image and manipulate their values. At the end an output image is produced with less number of pixels than the original one. And this output image represents the same data as represented by the original image. Number of techniques are used for compressing images in past. And mainly these techniques are classified in two categories as lossy image compression and lossless image compression. In case of lossy image compression, an image is compressed using some of its algorithms and at the time of decompression the output image may loss some of the minute details but these details may not affect the overall purpose of the image. So lossy techniques are applied in those cases where image data is not sensitive and if there is a loss of some small information from the image then its application will tolerate that portion. On the other side, lossless image compression always performed in those cases where image data is sensitive and minute details of the image may affect the overall purpose of the application. Here, after decompression process the produced output image always will be same as that of the input image of compression process. In this paper, the main focus is on lossless image compression technique to deal with the sensitive image processing applications. A technique is proposed to deal with this issue, it is the combination of two different process. Firstly, Iterative Haar-Wavelt technique may be applied to compress the input image then Vector transform method will gave finishing to the compression process. Also it is suggested to compare the results obtained after the implementation of proposed hybrid technique with existing techniques such as Integer to Integer compression and Bandelet compression process. For the comparison purpose the parameters like Signal to Noise Ratio (SNR), Root Mean Square Error (RMSE), Compression percentage (CP) and Compression Ratio (CR) may be considered.

II. RELATED WORK

Marta mrak,SonjaGrgic and MislavGrgic, concluded that the major problem during the compression and decompression process is the degradation of the reconstructed image. All this happed because of the noise which may produced during the compression process. In their paper correlation of subjective with objective measures had been highlighted. Picture quality is measured using 9 different objective measures and subjective measures using mean opinion score. The effect of different compression algorithm, picture content and CR are accessed. Results show some objective measures correlate well with perceived picture quality for given compression algorithm but they are not reliable for evaluating across different algorithm.

Matthew C. Stamm, proposed a set of anti-forensic operations capable of removing compression fingerprints from digital images. They developed a generalized framework for the removal of quantization fingerprints from an image's transform coefficient. To do this they have to estimate about distribution of the image's transform coefficient before compression, they added anti-forensic dither to the compressed image's transform coefficients.

Adnan Khashman and KamilDimililer focused on the concept to transmission and storage of medical images. Ideal image compression systems must yield high quality compressed images with high compression ratio, this can be achieved using wavelet transform based compression, however, the choice of an optimum compression ratio is difficult as it varies depending on the content of the image. Authors trained a neural network to relate medical image contents to their optimum image compression ratio. Once trained, the neural network would choose the optimum compression ratio of a radiograph upon presenting it to the neural network by using its intensity values.

Yu Yanxin, Song Xue, found that overlapping block algorithm estimates the blocking effect that blocking brings and the quality of reconstructed image is much better than direct block compression algorithm. Their algorithm took lifting schemes and overlap blocking techniques has advantage of saving memory and raising calculation speed. Hardware parallel mode was also achievable from the algorithm proposed by them.

Olfa Kanoun, Kachouri, presented that for Angiography images, degradation of the images were more visible on the reconstruct images after compression using JPEG quantification. They proposed that mathematical tools in medical imagery aim at gathering information about properties which are more complex to seen with naked eyes.

III. PROPOSED OBJECTIVES

The problem under consideration is itself a very complex task because here simple data is not considered for the purpose of compression, where few values are involved to compressed data. The proposed system raises a solution for the lossless compression of digital images. Here the data for compression process is present in huge form as the value of each pixel is considered as data for compression process. And there are many number of pixels are there in an image. And this number depends on the size of the image, which the system take as input. In this section some of the objectives of the proposed system are mentioned to make an guess about the step by step procedure which have to be followed to achieve the overall results.

- As the size of the image creates huge data to deal with the compression process. So, the first objective is to apply some pre-processing function to reduce the size of the input image. This can be achieved by calculating the height factor and width factor of image.
- Second objective is to study and implement the existing techniques to show the shortcoming of those present solutions and to compare the results of the proposed system. Here we proposed the implementation to two lossless image compression techniques as Integer to Integer compression technique and Bandelet Compression process.
- Implementation of proposed system by covering the hybrid nature of Haar Wavelet and Vector transform methods.
- After the implementation of compression process at sender side, a decompression process is also required to regenerate the original image. So the next objective is to perform the decompression process for both existing and proposed techniques.
- At the last the comparisons of both existing and proposed techniques can be done by calculating the values of the parameters such as CP, CR, SNR and RMSE.

IV. PROPOSED METHODOLOGY

The proposed system will be implement using C#.Net environment. The main purpose is to perform lossless compression. So, the system require input in the form to digital image. When digital image is provided as input to the system then all the algorithms of procedures which one wants to implement will be applied to the pixel values hold by the input image. Means if one wants to process an image for compression or any other task then they have to consider the value of each pixel at least once. Generally, large number of pixels are contained by the image. It means large number of iterations are required to address each pixel. To deal with this situation the first process we proposed is the resizing of the input image into a standard size of 256 X 256. This can be done by calculating width factor and row factor of original image. width factor can be calculate by dividing the width of the input image by 256 and height factor can be calculated by dividing the height of the input image by 256. The overall proposed method is presented in Figure1. After pre-processing next step is calculate the intensity values of each pixel by converting the input image into a grey scale image. The next step is to implement the existing algorithms for compression. Firstly, the integer to integer compression will be applied by performing two tasks. First is the conversion of integer data to float for further calculations and then in the second phase of the compression update and predict parameters are used to finish the task. This will generate the output image-1 as first compressed image as shown in Figure1.

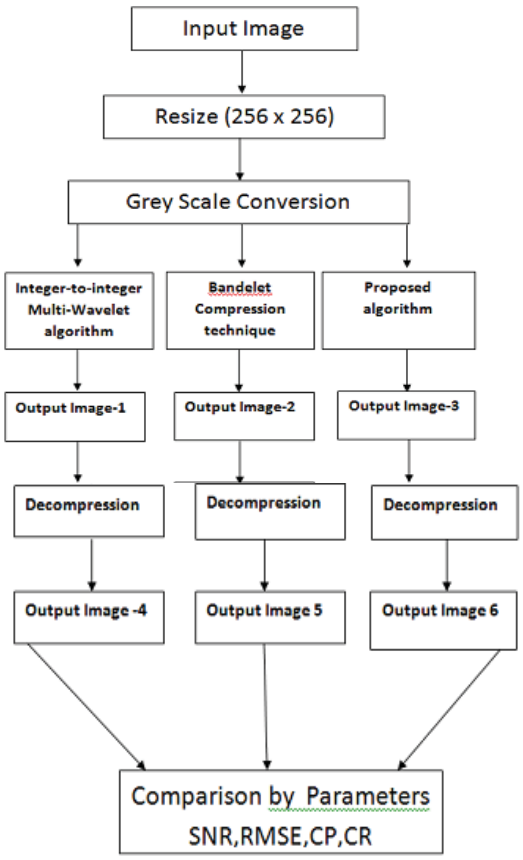

Figure1.: Proposed Methodology

The next existing algorithm for compression is Bandelet technique for compression. It works on the idea of direction of geometric flow in the image and adaptation of image geometry with compact support. The compressed output image generated by this process can be represented as image-2. At the end we proposed a hybrid technique using haar wavelet transform and vector transform to generate image-3 as compressed image. At the next phase decompression step is followed to generate three different images as image-4, image-5 and image-6 for integer to integer compression method, bandelet compression method and proposed technique respectively. After the generation of final images some parameters are calculated on the basis of image data as Signal to Noise Ratio (SNR), Root Mean Square Error (RMSE), Compression Ratio (CR) and Compression Percentage (CP). The higher

value of SNR as compared to existing techniques for the proposed method, the lowest value of RMSE for the proposed technique, High compression ration and high value of CP will show the enhanced performance of the proposed system.

V. CONCLUSION

To transmit an image to a remote location, we have to adjust the size of the image according to the availability of the bandwidth for the purpose of communication. So there is a need to compress the image and to fit the image into a smaller size by not scarifying the details present in the image. To perform the above task a lossless compression technique is required. In this paper, a hybrid technique is proposed to perform this task. The combination of Vector transform and Haar wavelet strengthen the concept of compression and decompression and helps to reproduce the images as such. The proposed method will generate the exact replication of the input image and will produce low values for SNR, High values for RMSE, CP and CR parameters.

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