ENHANCING IMAGE COMPRESSION TECHNIQUES USING THRESHOLDING HAAR TRANSFORM FOR MEDICAL IMAGING

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ABSTRACT:

The idea of data compression is increasingly important for minimizing data redundancy in order to save more hardware space and transmission bandwidth when it comes to picture compression. Lossless and lossy picture compression are the two main varieties. It is difficult to minimize the size of medical images in Image Enhancement. X-ray imaging was the focus of the planned study in medical imaging. X-ray imaging employs a unique technique known as the Haar transform. High frequency information may be extracted more successfully using Haar transforms, which are used to deconstruct the high frequency subimages of wavelets. In order to minimise the size of medical pictures, Haar Compression Key (HCK)-based Thresholding Haar Transform (THT) was developed. A high PSNR and low running time may be achieved for varied haar compression key values with a decent compressed picture quality by employing the compression ratio, PSNR. For the purpose of supplying more practical compression of photos, the Image Furior Transform (IFT) method is a classifier set that assigns a splendour label to each pixel in the image. Local Map View (LMV) is a suggested strategy that emphasises the importance of a neighborhood's uniqueness in terms of its comparative resemblance to other factors in a given time period.

KEYWORDS: Haar Transform, LMV, IFT, PSNR, Image compression.

1. Introduction

Radiology images such as magnetic resonance imaging (MRI), computed tomography (CT), and mammography are among the most often used images in the medical field today. Compression and enhancement procedures are used progressively to the medical photos in this study. Redundancy reduction is really the goal of data compression. There are several ways to reduce the amount of information needed for a particular quantity to be represented. The same quantity of data may be sent using multiple levels of expertise. Also, JPEG decoders may use rapid but imperfect approximations to the intended computations to trade off decoding speed versus picture quality. Between 10:1 and 20:1 are the common JPEG compression ratios that are useful. An excessively single block's quantization leads the reconstructed picture to vary from the original image by a blunder image proportionate to the related basis function. In terms of image data segmentation, thresholding is the most practical approach. Thresholding may be used to convert grayscale photos into binary images.

2. Literature Survey

Using Haar wavelet and Vector remodel approaches, Neha Sikka et. al. (2016) have investigated and presented a lossless image compression solution. In this system, compression percentages of up to 97 percent are used, and high SNR levels and excessive root mean square errors (RMSE) values are computed. The suggested technique uses a hybrid approach for lossless image compression, which results in higher SNR, lower RMSE, higher compression percentage, and higher compression ratio. For lossless image compression, a hybrid technique was devised the compression ratio is set at 96.64 percent.

Two-dimensional clinical images are used by D. Ravichandran et al. (2016) to evaluate the performance of three-dimensional clinical images that are based only on the Discrete Wavelet Transform (DWT). Photo-sensible three-dimensional picture models are useful for Image Guided Surgery not only for visualisation and illustration but also for intelligent motion and substance delivery (IGS). In order to access, exchange, and share these healing pictures for the intelligent E-fitness services, fitness care facilities face a number of problems, including limited data transfer speed. Three-dimensional medical images have a high rate of occurrence. It is common for wavelet compression to have a greater PSNR cost even if the compression ratio of a 2-dimensional picture is better. For the purposes of image analysis, analysis, and clinical therapy, high-frequency additives may be extracted using the methods outlined below. The compression ratio costs 33.55 cents when using this method.

Telagarapu, P., et al. Image compression has been the subject of a great deal of study. A wide range of compression standards are in effect. However, there is room for over compression with high-quality reconstruction in this case. When it comes to compressing images, JPEG employs Discrete Cosine Transform (DCT). With the development of wavelets, compression now has a new level of precision. The goal of this work is to evaluate compression utilising DCT and Wavelet remodel and to get greater PSNR end results by applying the proper threshold approach. To get at this result, a great deal of testing was done. In this study, we'll discuss how DCT and DWT may be used to compress and decompress photographs. DWT-based compression has a lower MSE and a higher PSNR than DCT-based compression, based on nine different images as inputs.

Using Rasika N Khatke's wavelet image compression approach, Rasika N Khatke [12] presented a way to minimise data storage capacity or transmission bandwidth. An image input is transformed using a wavelet transform technique to produce transform coefficients. It also creates and decodes an efficient tree structure using the acquired transform coefficients. To obtain quantized transform coefficients, the transform coefficients are quantized depending on the quantizing interval. There is an arithmetic coding of the changed tree list and quantized transform coefficients. A signal's timing and scale may be examined using the Wavelet transform. It allows for multiple resolutions and greater compression ratios without sacrificing image quality.

3. Methodology

For more than a century, the JPEG picture format has been in use. To reduce picture file size while maintaining acceptable quality, JPEG compression has progressed greatly over the years. Compressing and transferring images via the network using the Thresholding Haar Transform (THT) approach has been suggested. It is possible to create binary images from a grayscale picture using the threshhold approach. High-frequency information may be extracted using Haar transforms, which are particularly effective. Using the Haar transform, the estimate time is quite quick. As a result, it takes just a few seconds to calculate the final output. As a result, the Thresholding Haar Transform (THT) model was created for medical photographs in order to reduce the amount of data that must be sent over an internet connection.

Proposed Algorithm : Thresholding Haar Transform (THT) Method Using Haar Compression Key (HCK) Value

Images across the network are compressed using the Haar Compression Key (HCK) approach in the Thresholding Haar Transform (THT) introduced in this study. HCK levels are used to breakdown pictures that are picked from an uiget file. Using the HCK matrix, a hard threshold of 3 was given to this compressed picture. A final image reconstruction results in a reduced memory footprint, PSNR value, compression ratio, and elapsed time in seconds for the final output picture, but not for the original image.

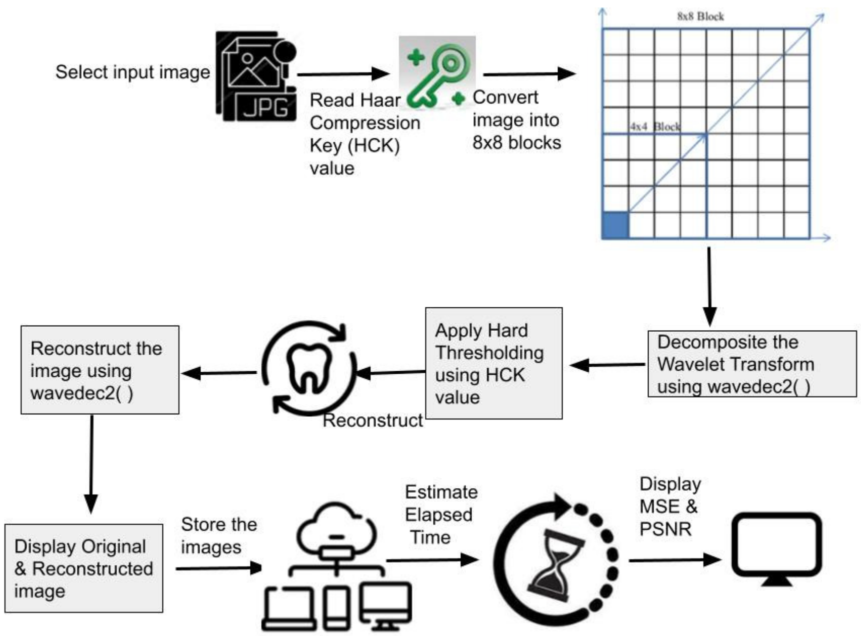


Figure 3.1. Proposed Architecture Diagram

Proposed Algorithm Process:

JPEG images are read and used to several wavelet algorithms, such as Threshold transform and Haar transforms, for decomposition, denoising, and reconstruction. HCK levels are deconstructed from the original picture. At the HCK level, the picture has been compressed and denoised. HCK matrix value is used to apply a Hard Threshold of 3. Finally, a high-quality output picture is generated and shown. Additionally, the compression ratio, PSNR, and running duration were shown.

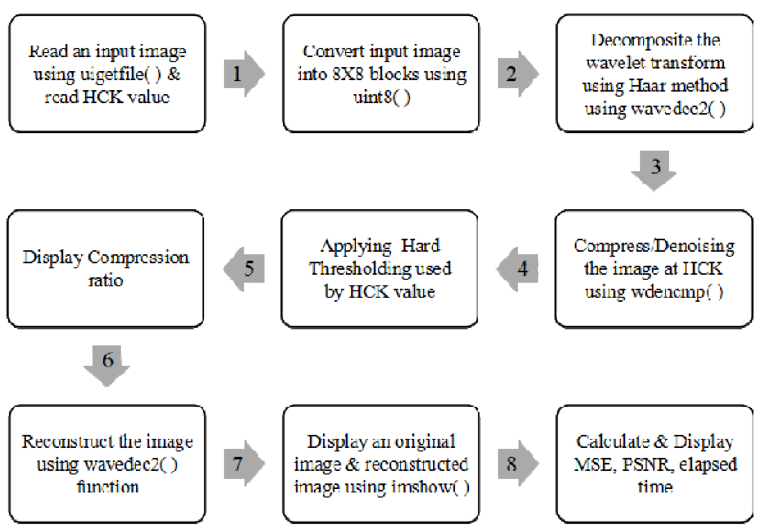


Figure 3.2. Proposed Algorithm Process

Image Compression by IFT Technique:

It is possible to achieve a more realistic compression of images using the Image Furior Transform compression technique, which is a classifier algorithm that assigns a class label to each pixel in the image. Any probability or vitality limiting image division computation may be used as a classifier, despite the fact that probabilistic calculations are often preferred since they convey vulnerability in the results. The ability of the classifier to highlight unlabeled picture pixels increases as preparation information increases. In most cases, the data is insufficient for the classifier to provide accurate labelling and assess the degree of uncertainty associated with the arrangement's outcomes. Whenever the precariousness remains over a certain threshold, or the customer deems the division to be of poor quality, a FL bunch query is derived from all together.

Methodology: Local Map View

There have been different methodologies proposed to the undertaking of dividing the breast profile area in mammograms. Let $\mathbf{M = \{M_1,..,M_i ,\dots, M_N\}}$ be a matrix of size $\mathbf{K \times N}$, where K and N are respectively the **[10]** values of image and the principle of voxels. In this matrix, $\mathbf{M_i = [M_{i1},\dots, M_{ij},\dots, M_{iJ}]'}$ and $\mathbf{M_{ij}}$ is the label of the template j at voxel i. The goal here is to estimate the output image compression $\mathbf{K= \{K_1,\dots, K_i ,\dots, K_N\}}$ and the performance parameters $\boldsymbol{\theta = \{\theta_1,\dots, \theta_j ,\dots, \theta_J\}}$ where θj is the matrix of size $\mathbf{S \times S}$, $\mathbf{\theta_{js}'s = f(M_{ij} = s'|K_i = s)}$, and S is the number of Image compression labels. Here's an LMV method that shows how different image compression and clustering options work with pictures to be reached in the mapping and how they are consistent with different indices and edges with the unique specification of images.

4. Analysis and Implementation

IFT Description:

Pictures may be learned with different compression sensibilities using the contigent stroller method, which displays its usefulness in terms of its border and its given area, as well as the image's compatibility with the definition of images.

Implementation Overview:

A variety of image results from the image furior transform compression technique are shown in the following pictures.

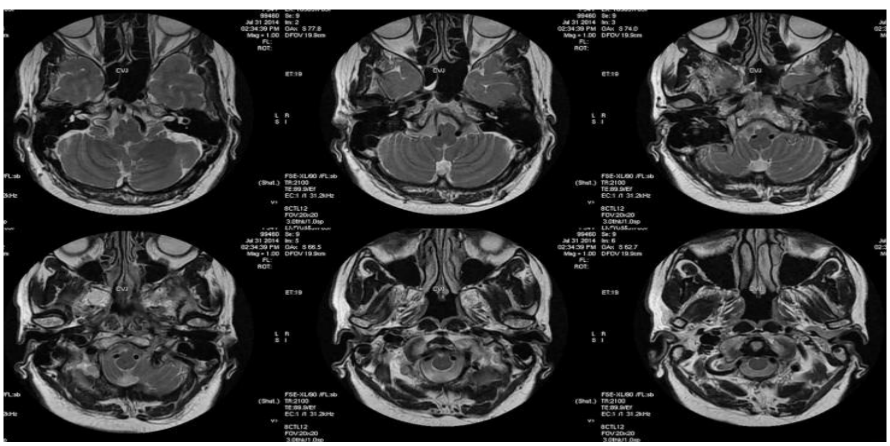


Figure 4.1 Functionality of the Image

The picture view shown above illustrates the many functionalists found around the image's border, where the perspective shifts in response to the image's boundaries. In medical image analysis, picture compression is a critical and ubiquitous task. The "vulnerability field" we offer to develop over the picture subjects, based on our four suggested functions, is how our system proposes to value image compression.

Efficiency view of images: The following figure displays how images with varying visibilities may be used to teach efficient functioning, and it identifies the image in every location.

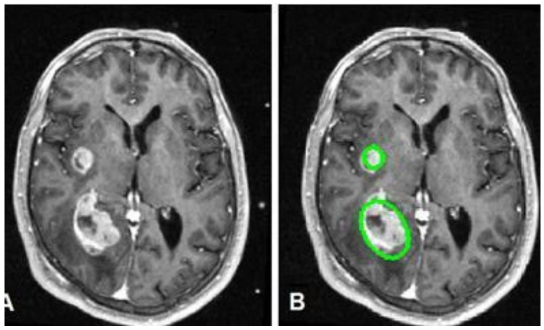


Figure 4.2 Image compression after the active queries were labeled

Efficiency Throughput:

Table 4.1. Comparison of Image View

"Techniques"	**"DSM Compression"**	**"Active Contour"**	**"IFT Compression"**
"Regional View"	**4.3**	**2.4**	**6**
"Boundary View"	**2.5**	**4.4**	**7**
"SmoothView"	**3.5**	**1.8**	**7.8**
"Entropy View"	**4.5**	**2.8**	**8.5**

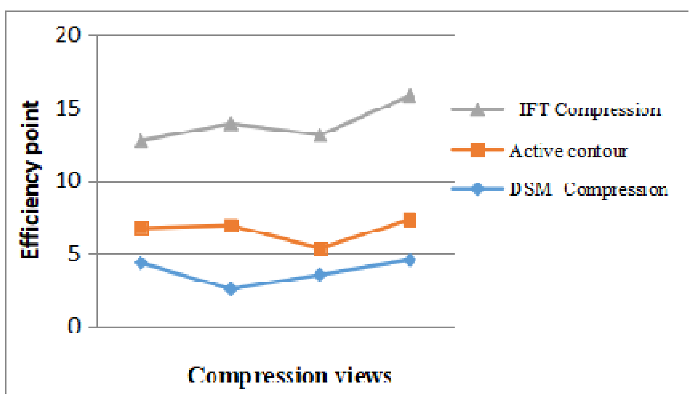


Figure 4.3 Efficiency comparison of the image view

The graph above compares the picture's efficiency to other methods of image compression. As a result of their great efficiency, it's difficult to determine a particular throughput for these operations. However, the throughput shown by our approach is really high.

The graph shows the percentage of photos that can be used in other processes. Compared to previous compression methods, our suggested method is more efficient than any of the others. Images may be compressed using these ratios, which are presented across all perspectives.

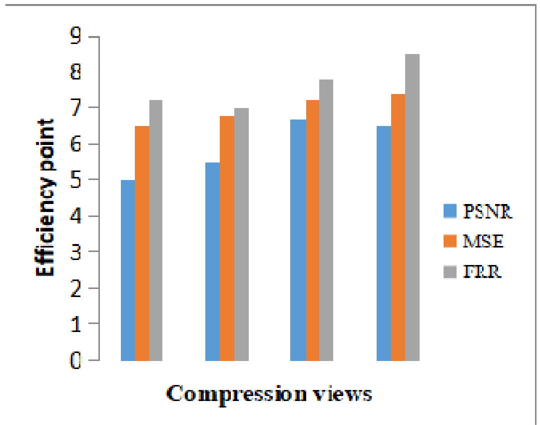
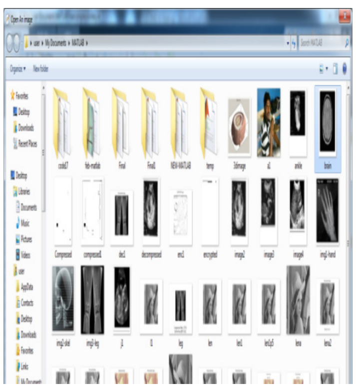


Figure 4.4 The false Rejection Ratio, MSE, PSNR for the image compression

5. Result and Discussions

5.1. Results of X-ray image:

The uigetfile() method is used to choose an image, and the imread function is used to read the picture. High-level coefficients may be decomposed from the Haar Compression Key value. Under different HCK values, the chest.jpg picture is tested. This is the final picture, as well as the CR, PSNR, and elapsed time.



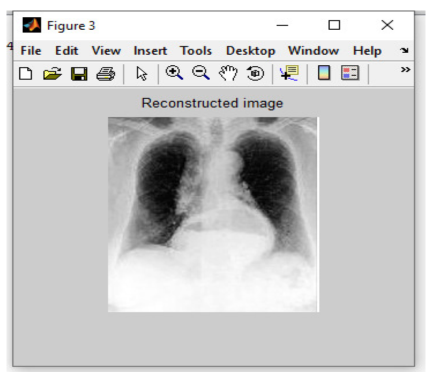


Figure 5.1 a) Input Image select **5.1 b) Reconstructed image**

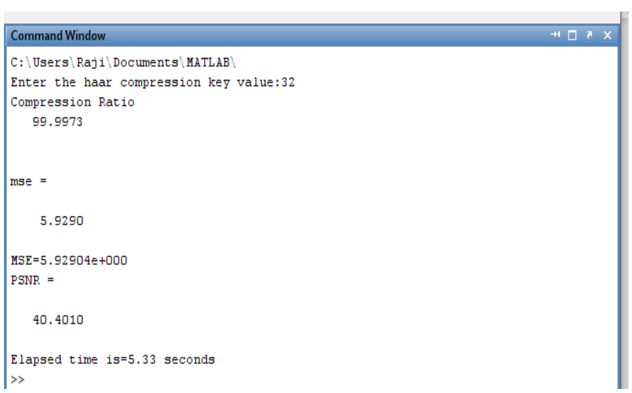


Figure 5.1 c) PSNR value and elapsed time

A variety of Haar Compression Key values are tried on the chest.jpg picture. Table 5.1 displays the following results for PSNR, MSE, Compression ratio, and elapsed time:

Table 5.1 Results of output from various HCK value

"IMAGE"	"HCK VALUE"	"PSNR (dB)"	"MSE (*10 e+04)"	"CR"	"ELAPSED TIME (seconds)"
1.chest.jpg	2	40.4010	5.91	84.5413	7.15
2.chest.jpg	4	40.4010	5.92	98.7327	9.49
3.chest.jpg	8	29.5350	3.29	99.9840	15.92
4.chest.jpg	16	29.5350	3.29	99.9973	18.79
5.chest.jpg	32	29.5350	3.29	99.9973	20.80

Various Haar Compression Key (HCK) values are tried on the input photos using the proposed technique on different types of images. In terms of the PSNR, compression ratio, and operating time, it was superior. Figure 5.2 shows the outcomes of the output:

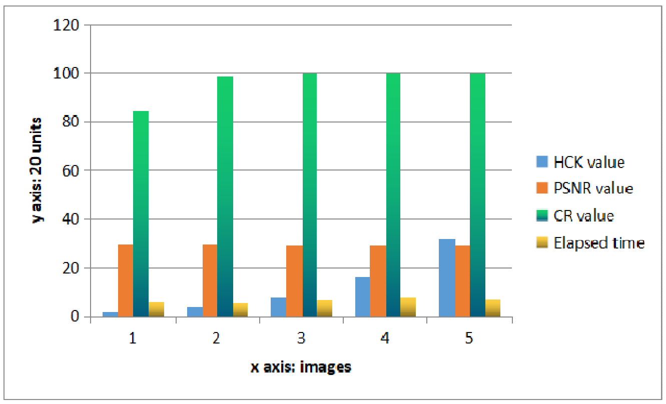


Figure 5.2 PSNR, CR, Elapsed time of different HCK value

Discussion:

Thresholding Haar Transform (THT) using Haar Compression Key (HCK) offers high output picture quality while requiring less memory space, according to Matlab findings. In addition, the PSNR value is high, and the running duration is short. The suggested approach outperformed current findings in terms of compression %. The output quality factor improves whenever the HCK value increases.

HCK X-ray pictures are employed in THT's proposed study, which results in the following:

- Compression ratio is good.
- Less room in the memory.
- It has a high PSNR value.
- It takes less time to do the task.
- High quality images

6. Conclusion

Using Matlab, the suggested technique has a good compression ratio, a good PSNR value, and a decent picture quality compared to earlier studies. X-ray pictures, for example, benefit greatly from this. With this new approach, photos may be transferred or stored more efficiently on a digital computer with less available memory. The Haar Compression Key (HCK) value technique of Thresholding Haar Transform (THT) is the best way to send X-ray pictures across the network. The Huffman encoder and the Wavelet-based Image-Coding have been discussed in detail in this article on image compression. The zero-tree wavelet-coefficient architecture at decomposition level 8 with the Huffman encoder is a highly effectively employed approach that demonstrated a greater compression ratio and a superior PSNR. This method. This study also aids in the development of new software for compressing any picture as a lossless real image using the Huffman encoding process, which is outlined in this paper. The easier it is to compress any picture in terms of both size and time after it has built its own framework.

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