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Digital Image Compression using Super-Resolution Scheme: A Review

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ABSTRACT: In this paper we can observe the idea of image compression and have a look at approximately the various technologies implemented on the image compression. Also highlight the sanctifications of the image compression. In image compression the inappropriate information is eliminated from the image maintaining in thoughts that the data is stored in an adequate form. By doing this the data from the unique image is occasionally lost. Based on this, inside the review paper the desires, its precept and numerous report formats of image compression are mentioned. The paper additionally focuses on algorithms of image compression the use of super resolution that is used to provide higher resolution and it prevents image distortion while zooming process.

KEYWORDS: Super resolution, compression ratio, Lossless compression, Lossy compression

I. INTRODUCTION

Super-resolution (SR) algorithms try and generate a single high resolution (HR) image from one or more low-resolution (LR) images of the equal scene. The predominant assignment is to recover the high-frequency information that become misplaced in the system of producing the low-resolution inputs. If the low-resolution images were directly captured by using a camera, for instance, this information changed into eliminated by way of the band-limiting filter of the image system due to imperfections in the optics and integration over the pixels of the sensor. If the low-resolution images had been the result of software program down sampling, these data become misplaced through the filtering process of anti-aliasing. The aim of the SR algorithms is to get better this lacking statistics in a manner that approximates the unique high-resolution image as intently as possible. This is a critical trouble in numerous communities and has applications which encompass object reputation, video transmission, image compression, and so forth. Traditionally, SR approaches have used a fixed low-resolution images that have been captured with sub-pixel accuracy to try to resolve for the missing excessive-frequency data [1]. Recently, however, there was developing interest in recuperating these facts from a single, low-resolution photo, a place of studies additionally called image hallucination [2] or image up sampling [3]. The "single-image amazing-resolution" problem is mainly important due to the fact there are numerous systems in which most effective a single, low-resolution image is available and the up sampling need to be carried out as a post process.

II. RELATED WORK

In overview paper [1], authors Sapan Naik, Nikunj Patel have proven that in wavelet and spatial domain with powerful PSNR ratio and visible exceptional. Also deliver faster algorithm for fantastic decision. In evaluation paper [2], authors Sapan Naik and Viral Borisagar, have reached to end that technique use have advantage easy to enforce and require less Memory the prevailing technique for exceptional resolution & Interpolation technique that we have taken is likewise gives suitable end result because it works on edges as nicely. In assessment paper [3], authors Mathew .K. And Dr. S. Shibu have shown that PSNR is high & it is used to degree pleasant measure. A method for Reconstruction of notable decision image the usage of low decision natural colour image has been advanced. In overview paper [4], authors Deepa K Davis and Rajesh Cherian Roy display that our approach has were given high PSNR compared to Curvelet Transform based top notch decision. Also, it's miles proven that there's no need of filter out to avoid interpolation errors. This approach has the benefits of higher PSNR with out using any filter out, in comparison to the existing strategies of outstanding decision.

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However, the computational burden has expanded, in evaluation paper [5], K. J. Kothari, Dr. D. D. Vyas, Dr. D. R. Bhojani show that the quantitative and visual outcomes are displaying the superiority of the proposed method over the conventional and kingdom-of-artwork image decision enhancement techniques. The computational complexity may be progressed by using parallel implementation to increase response time. Finally conclude that this approach can be prolonged to brilliant resolution of color films. In evaluate paper [6], Mrs. Preet Kaur, Geetu lalit show that image compression is a technique through which we can reduce the storage space of photographs, motion images in order to beneficial to increase storage and transmission method's performance. In image compression, we do not simply concentrate on reducing size but additionally focus on doing it without dropping first-rate and facts of image.

In assessment paper [7], Michael Elad and Arie Feuer conclude that in the notable resolution recovery problem, an improved decision photo is restored from several geometrically warped, blurred, and noisy and down sampled measured images. Hybrid approach is used for boom the speed. In this context, the ML, the MAP, and the POCS techniques are all proven to be without delay and in reality applicable to terrific decision recuperation with equivalencies among those methods. In overview paper [8], Hasan Demirel and Gholamreza Anbarjafari say that an image decision enhancement approach based totally on interpolation of the high frequency subband images obtained through discrete wavelet rework (DWT) and the enter image. The edges are enhanced by introducing an intermediate degree through using stationary wavelet rework (SWT). This technique improves that generate IDWT. In evaluation paper [9], Neeraj Kumar Atul Kumar finish that Peak signal to Noise ratio (PSNR) and Mean Square Error (MSE) are the 2 elements for measuring the first-rate of various denoising strategies. Main goal of the denoising algorithms is to dispose of noise even as preserving as a lot as possible the crucial image functions.

In evaluation paper [10], Mr. G.M. Khaire, Prof. R.P. Shelkikar says that method involves calculation of DWT sub bands. High frequency sub bands are interpolated to double their length. DWT loses a few data within the method of interpolation; it's far corrected with the assist of SWT. IDWT with unique image and high frequency additives provide terrific resolution image.

III. NEED OF IMAGE COMPRESSION

In general, data compression is the process of reducing the data needed to represent a given quantity of information. The goal of image compression is to diminish the data required to represent a digital image. When a digital image is saved as a file on a web browser, it is basically saving it as a sequence of bits. Each pixel in the image consists of one byte and each byte is made from eight bits. If the image measures $M \times N$ pixels, then MN bytes is needed to accumulate the image. There are 256 different bytes each of which has its own base 2 representation. So for a web browser to display a stored image, it must have the sequence of bits that describes the bit representation of each byte.



(a)

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(b)

Fig 1 Comparison of (a) original image and (b) compressed image

Table.1 Results showing variations in dimensions of original image to compressed image having 99.7% savings in file size

PARAMETERS	Original	Compressed
Width	2448 pixels	400 pixels
Height	3264 pixels	533 pixels
File Size	2,196.8 kb	5.9 kb

The purpose of image compression is to lessen the size of digital images to save storage space or transmission time. The image with dimensions $512 \times 512 \times 3 = 786,431$ pixels requires only 41,909 bytes when compressed in JPEG format. The question that arises is how the space can be saved while maintaining most of the content. The ratio of sizes tells us about the effectiveness of the image. The term defining this is known as the compression ratio.

$$\text{Compression ratio} = (\text{Size of an original image}) / (\text{Size of the compressed image})$$

A. Lossless compression

Lossless compression [1] is a compression algorithm in which the original image can be reconstructed from the compressed image i.e. after compression, reconstructed image is numerically identical to the original image. Some of the image file formats use lossless compressions are PNG or GIF.

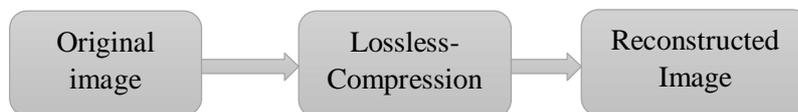


Fig 2 Lossless Compression

There are the following techniques included in lossless compression.

- Run length encoding
- Huffman coding
- LZW coding
- Area coding

Run length encoding: - The run length compression technique is useful in case of repetitive data. In this technique the sequence of identical symbols or pixels is replaced and it is known as a run by a shorter symbol. The run length code for a grayscale image is represented by a sequence (V_i, R_i) , where V_i is the intensity of the pixel and R_i is the number of consecutive pixels with intensity as shown in Fig.

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 4, Issue 12, December 2015

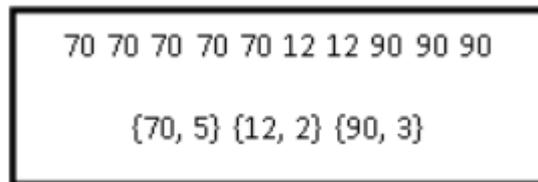


Fig3 Run length encoding

Huffman coding: - Huffman coding is based on the probabilities or statistical occurrence frequencies. In the Huffman encoding each pixel are treated as a symbol. The symbols which have frequency are assigned a smaller number of bits while the symbol which has less frequency is assigned a relative large number of bits. While the symbol which has less frequencies are assigned a relative large no of bits.

Lempel-Ziv-Welch (LZW): - It is a very useful coding. It is used in computer industries, and implemented as a computer on UNIX. It is dictionary base coding. LZW is basically of two type, Static and dynamic. In static dictionary coding, when the code is assigned (encoding) and in decoding process. Dictionary is not change. Dictionary is fixed in both processes. But in the dynamic dictionary coding updated on fly.

Area Coding: - Area coding is enhanced form of run length coding of lossless compression. The significant of lossless method is that this technique over the other, it reflecting two dimension character of images. This coding uses an array of sequence building up a two dimension object. The algorithms for this coding try to find rectangular region with the same characteristics and these regions are coding in a descriptive form as an element with two points and a certain structure. The problem with this coding is that, it cannot be implemented in hardware because of non-linear method.

B. Lossy compression:

In lossy compression, redundant information is permanently removed. When an image is uncompressed, only a part of the original image exists and the rest is permanently removed which is unnoticeable to the user. Most commonly used image file formats include JPEG image file.



Fig 4 Lossy Compression

There are the following Lossy compression technique include following scheme

- Transformation coding
- Vector quantization
- Fractal coding
- Block truncation coding
- Sub band coding

Transformation coding: - transformation coding is lossy compression technique resulting in a lower quality copy of original signal. This scheme is used for „natural“ data like audio signal or biomedical image. In transformation coding less bandwidth is required. In this coding scheme transform such as DFT (discrete Fourier transform) and DCT (discrete coding transform) are used to change the pixel in the original image into

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frequency domain coefficients. These coefficients have several desirable properties; one is the energy compression property that results in most of the energy of the original data being concentrated in only a few of the significant transform coefficient. This is the basic of achieving the compression only few significant coefficients are selected and remaining are discarded. The selected coefficient are further quantization and entropy encoding. DCT coding has been the most common approach to transform coding and also adopted in the JPEG image compression standard

Vector Quantization:- In vector quantization a dictionary of fixed-size vectors, is to be developed, called code vectors. A vector is usually a block of pixel values. So image is then partitioned into non-overlapping blocks (vectors) called image vectors. Then for each in the dictionary is determined and its index in the dictionary is used as the encoding of the original image vector. Thus, each image is represented by a sequence of indices that can be further entropy coded.

Fractal Coding: - In Fractal Coding decompose the image into segments by using standard image processing techniques such as edge detection, color separation, and spectrum and texture analysis. Then each segment is looked up in a library of fractals. The library actually contains codes called iterated function system (IFS) codes, which are compact sets of numbers. Using a systematic procedure, a set of codes for a given image are determined, such that when the IFS codes are applied to a suitable set of image blocks yield an image that is a very close approximation of the original. This scheme is highly effective for compressing images that have good regularity and self-similarity.

Block truncation coding:- In this scheme, the image is divided into non-overlapping blocks of pixels. For each block, threshold and reconstruction values are determined. The threshold is usually the mean of the pixel values in the block. Then a bitmap of the block is derived by replacing all pixels whose values are greater than or equal (less than) to the threshold by a 1 (0). Then for each segment (group of 1s and 0s) in the bitmap, the reconstruction value is determined. This is the average of the values of the corresponding pixels in the original block.

Sub band coding:- In this scheme, the image is analyzed to produce the components containing frequencies in well-defined bands, the sub bands. Subsequently, quantization and coding is applied to each of the bands. The advantage of this scheme is that the quantization and coding well suited for each of the sub bands can be designed separately.

V. CONCLUSION

This paper represents the idea of image compression and various technologies used inside the image compression evaluating the overall performance of compression techniques same data units and overall performance measure are used. In this paper we studied image compression based on a fast decision technique, need and precept. We also focused on numerous imaging report codecs and compression strategies of lossy and lossless image compression. We thereby concluded that super resolution technique is the maximum efficient approach of photograph compression because it combines multiple low decision images to form an excessive resolution picture. The prime benefit of the usage of super resolution approach is that it could fees much less and the present low decision image may be nevertheless being applied.

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BIOGRAPHY

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