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A Review Paper on Image Compression Techniques

Ritika Batra[1], Indu Khatri[2]
[1,2] *Department of Computer Science Gateway Institute of Engineering & Technology (GIET), Deenbandhu Chhotu Ram University of Science & Technology (DCRUST), Sonepat*

Abstract*:** ***Image compression is the process of converting original image into reduced modified image that occupies less number of bytes on the disk and transmits quickly from one place to another. The image compression not only decreases the size of image but also ensures that quality of image is degraded. There are multiple techniques available for compressing the multimedia data such as Discrete Cosine Transform, Discrete Wavelet Transform, Huffman Coding etc. In this paper we provide review of various image compression techniques.
Keywords: Image Compression, DCT, DWT, OCR, Run length Encoding

I. INTRODUCTION

Image compression is the application of data compression on digital images. Image compression is the technique through which we can reduce amount of data required to represent a digital image It is also used for reducing the redundancy that is nothing but avoiding the duplicate data, which will helpful to increase storage and transmission process's performance. The image compression not only decreases the size of image but also ensures that quality of image is degraded.

There are many applications that requires large numbers of images for processing. All these images must be stored on disk for future references. The images take more spaces as compared to text therefore image compression is important for such applications. The images reduce the size of images stored on the disk and it also takes less time for loading and processing. Hence image compression [1] is need that reduces the amount of data required to represent a digital image. Image compression is the process of converting original image into reduced modified image that occupies less number of bytes on the disk and transmits quickly from one place to another.

Image compression system requires two components: a. The component that converts uncompressed (original) image into compressed (reduced) image called Encoding System Component of Image Compression.

b. The component that converts compressed image into uncompressed (original) image called Decoding System Component of Image Compression.

Image compression, consist of three main steps: Transform, quantizing and coding, as illustrated in figure 1below.

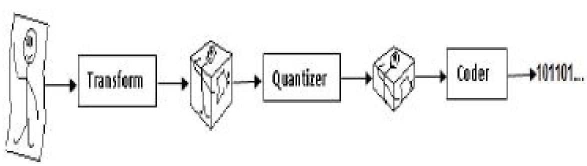

Figure 1: The three steps of digital image compression system

Image compression consists of two transform techniques which are based on frequency. First is Discrete Cosine Transform (DCT) and second is Discrete Wavelet Transform (DWT). Both techniques have its' own pros and cons. DWT gives better compression ratio [1] without losing more information of image but it need more processing power. While DCT is fast, it can be quickly calculated but it has blocks artifacts means loss of some information. In this paper we provide a review about various image compression techniques.

II. IMAGE COMPRESSION

Image compression addresses the problem of reducing the amount of information required to represent a digital image. It is a process intended to yield a compact representation of an image, thereby reducing the image storage transmission requirements. Every image will have redundant data. Redundancy means the duplication of data in the image. Either it may be repeating pixel across the image or pattern, which is repeated more frequently in the image. The image compression occurs by taking benefit of redundant information of in the image. Reduction of redundancy provides helps to achieve a saving of storage space of an image.

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Image compression is achieved when one or more of these redundancies are reduced or eliminated. In image compression, three basic data redundancies can be identified and exploited. Compression is achieved by the removal of one or more of the three basic data redundancies.

A. Inter Pixel Redundancy

In image neighbouring pixels are not statistically independent. It is due to the correlation between the neighboring pixels of an image. This type of redundancy is called Inter-pixel redundancy. This type of redundancy is sometime also called spatial redundancy. This redundancy can be explored in several ways, one of which is by predicting a pixel value based on the values of its neighboring pixels. In order to do so, the original 2-D array of pixels is usually mapped into a different format, e.g., an array of differences between adjacent pixels. If the original image [2] pixels can be reconstructed from the transformed data set the mapping is said to be reversible.

B. Coding Redundancy

Consists in using variable length code words selected as to match the statistics of the original source, in this case, the image itself or a processed version of its pixel values. This type of coding is always reversible and usually implemented using lookup tables (LUTs). Examples of image coding schemes that explore coding redundancy are the Huffman codes and the arithmetic coding technique.

C. Psycho Visual Redundancy

Many experiments on the psycho physical aspects of human vision have proven that the human eye does not respond with equal sensitivity to all incoming visual information; some pieces of information are more important than others. Most of the image coding algorithms in use today exploit this type of redundancy, such as the Discrete Cosine Transform (DCT) based algorithm at the heart of the JPEG encoding standard.

III. IMAGE COMPRESSION TECHNIQUES

In lossless compression schemes, the reconstructed image, after compression, is numerically identical to the original image. However lossless compression can only a achieve a modest amount of compression. An image reconstructed following lossy compression contains degradation relative to the original. Often this is because the compression scheme completely discards redundant information. However, lossy schemes are capable of achieving much higher compression.

A. Types of Image Compression

On the bases of our requirements image compression techniques are broadly bifurcated in following two major categories.

1) Lossless Compression Techniques: Lossless compression compresses the image by encoding all the information from the original file, so when the image is decompressed, it will be exactly identical to the original image. Examples of lossless [2] image compression are PNG and GIF. When to use a certain image compression format really depends on what is being compressed.

a) Run Length Encoding: Run-length encoding (RLE) is a very simple form of image compression in which runs of data are stored as a single data value and count, rather than as the original run. It is used for sequential [19] data and it is helpful for repetitive data. In this technique replaces sequences of identical symbol (pixel), called runs. The Run length code for a grayscale image is represented by a sequence $\{V_i, R_i\}$ where V_i is the intensity of pixel and R_i refers to the number of consecutive pixels with the intensity Vi as shown in the figure. This is most useful on data that contains many such runs for example, simple graphic images such as icons, line drawings, and animations. It is not useful with files that don't have many runs as it could greatly increase the file size. Run-length encoding performs lossless image compression [3]. Run-length encoding is used in fax machines.

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b) Entropy Encoding: In information theory an entropy encoding is a lossless data compression scheme that is independent of the specific characteristics of the medium. One of the main types of entropy coding creates and assigns a unique prefix-free code for each unique symbol that occurs in the input. These entropy encoders then compress the image by replacing each fixed-length input symbol with the corresponding variable-length prefix free output codeword.

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c) Huffman Encoding: In computer science and information theory, Huffman coding is an entropy encoding algorithm used for lossless data compression. It was developed by Huffman. Huffman coding [4] today is often used as a "back-end" to some other compression methods. The term refers to the use of a variable-length code table for encoding a source symbol where the variable-length code table has been derived in a particular way based on the estimated probability of occurrence for each possible value of the source symbol. The pixels in the image are treated as symbols. The symbols which occur more frequently are assigned a smaller number of bits, while the symbols that occur less frequently are assigned a relatively larger number of bits. Huffman code is a prefix code. This means that the (binary) code of any symbol is not the prefix of the code of any other symbol.

d) Arithmetic Coding: Arithmetic coding is a form of entropy encoding used in lossless data compression. Normally, a string of characters such as the words "hello there" is represented using a fixed number of bits per character, as in the ASCII code. When a string is converted to arithmetic encoding, frequently used characters will be stored with little bits and not-so-frequently occurring characters will be stored with more bits, resulting in fewer bits used in total. Arithmetic coding differs from other forms of entropy encoding such as Huffman coding [5] in that rather than separating the input into component symbols and replacing each with a code, arithmetic coding encodes the entire message into a single number.

e) Lempel–Ziv–Welch Coding: Lempel–Ziv–Welch (LZW) is a universal lossless data compression algorithm created by Abraham Lempel, Jacob Ziv, and Terry Welch. It was published by Welch in 1984 as an improved implementation of the LZ78 algorithm published by Lempel and Ziv in 1978. LZW is a dictionary based coding. Dictionary based coding can be static or dynamic. In static dictionary coding, dictionary is fixed when the encoding and decoding processes. In dynamic dictionary coding, dictionary is updated on fly. The algorithm is simple to implement, and has the potential for very high throughput in hardware implementations. It was the algorithm of the widely used UNIX file compression utility compress, and is used in the GIF image format. LZW compression became the first widely used universal image compression method on computers. A large English text file can typically be compressed via LZW to about half its original size.

2) Lossy Compression Techniques: Lossy compression as the name implies leads to loss of some information. The compressed image is similar to the original uncompressed image but not just like the previous as in the process of compression [6] some information concerning the image has been lost. They are typically suited to images. The most common example of lossy compression is JPEG. An algorithm that restores the presentation to be the same as the original image are known as lossy techniques. Reconstruction of the image is an approximation of the original image, therefore the need of measuring of the quality of the image for lossy compression technique. Lossy compression technique provides a higher compression ratio than lossless compression. Major performance considerations of a lossy compression scheme include:

a) Compression ratio
b) Signal to noise ratio
c) Speed of encoding & decoding

3) *Lossy image compression techniques include following schemes:*

a) Scalar Quantization: The most common type of quantization is known as scalar quantization. Scalar quantization, typically denoted as Y=Q (x), is the process of using a quantization function Q to map a scalar (one-dimensional) input value x to a scalar output value Y. Scalar quantization can be as simple and intuitive as rounding high-precision numbers to the nearest integer, or to the nearest multiple of some other unit of precision.

b) Vector Quantization: Vector quantization (VQ) is a classical quantization technique from signal processing which allows the modeling of probability density functions by the distribution of prototype vectors. It was originally used for image compression. It works by dividing a large set of points (vectors) into groups having approximately the same number of points closest to them. The density matching property of vector quantization is powerful, especially for identifying the density of large and high-dimensioned data. Since data points are represented by the index of their closest centroid, commonly occurring data have low error, and rare data high error. This is why VQ is suitable for lossy data compression. It can also be used for lossy data correction and density estimation.

IV. LITERATURE REVIEW

Various types of image compression techniques are available. Also images may be of different type like RGB image, Grey Scale Image etc. In this section, we are going to present the literature work done in this field.

In 2012, Firas A. Jassim, et al [7] presents a novel method for image compression which is called five module method (FMM). In

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this method converting each pixel value in 8x8 blocks into a multiple of 5 for each of RGB array. After that the value could be divided by 5 to get new values which are bit length for each pixel and it is less in storage space than the original values which is 8 bits. This paper demonstrates the potential of the FMM based image compression techniques. The advantage of their method is it provided high PSNR (peak signal to noise ratio) although it is low CR (compression ratio). This method is appropriate for bi-level like black and white medical images where the pixel in such images is presented by one byte (8 bit). As a recommendation, a variable module method (X) MM, where X can be any number, may be constructed in latter research.

In 2012, Ashutosh Dwivedi, et al [8] presents a novel hybrid image compression technique. This technique inherits the properties of localizing the global spatial and frequency correlation from wavelets and classification and function approximation tasks from modified forward-only counter propagation neural network (MFOCPN) for image compression. In this scheme several tests are used to investigate the usefulness of the proposed scheme. In this paper, they explore the use of MFO-CPN networks to predict wavelet coefficients for image compression. In this method, they combined the classical wavelet based method with MFO-CPN. The performance of the proposed network is tested for three discrete wavelet transform functions. In this they analysis that Haar wavelet results in higher compression ratio but the quality of the reconstructed image is not good. On the other hand db6 with the same number of wavelet coefficients leads to higher compression ratio with good quality. Overall they found that the application of db6 wavelet in image compression out performs other two.

In 2012, Yi-Fei Tan, et al [9] presents image compression technique based on utilizing reference points coding with threshold values. This paper intends to bring forward an image compression method which is capable to perform both lossy and lossless compression. A threshold value is associated in the compression process, different compression ratios can be achieved by varying the threshold values and lossless compression is performed if the threshold value is set to zero. The proposed method allows the quality of the decompressed image to be determined during the compression process. In this method If the threshold value of a parameter in the proposed method is set to 0, then lossless compression is performed. Lossy compression is achieved when the threshold value of a parameter assumes positive values. Further study can be performed to calculate the optimal threshold value T that should be used.

In 2012, S.Sahami, et al [10] presents a bi-level image compression techniques using neural networks‖. It is the lossy image compression technique. In this method, the locations of pixels of the image are applied to the input of a multilayer perceptron neural network. The output the network denotes the pixel intensity 0 or 1. The final weights of the trained neural-network are quantized, represented by few bites, Huffman encoded and then stored as the compressed image. Huffman encoded and then stored as the compressed image. In the decompression phase, by applying the pixel locations to the trained network, the output determines the intensity. The results of experiments on more than 4000 different images indicate higher compression rate of the proposed structure compared with the commonly used methods such as comite consultatif international telephonique of telegraphique graphique (CCITT) G4 and joint bi-level image expert group (JBIG2) standards. The results of this technique provide High compression ratios as well as high PSNRs were obtained using the proposed method. In the future they will use activity, pattern based criteria and some complexity measures to adaptively obtain high compression rate.

In 2013, C. Rengarajaswamy, et al [11] presents a novel technique in which done encryption and compression of an image. In this method stream cipher is used for encryption of an image after that SPIHT [14] is used for image compression. In this paper stream cipher encryption is carried out to provide better encryption used. SPIHT compression provides better compression as the size of the larger images can be chosen and can be decompressed with the minimal or no loss in the original image. Thus high and confidential encryption and the best compression rate has been energized to provide better security the main scope or aspiration of this paper is achieved.

In 2013, S. Srikanth, et al [12] presents a technique for image compression which is use different embedded Wavelet based image coding with Huffman-encoder for further compression. In this paper they implemented the SPIHT and EZW algorithms with Huffman encoding using different wavelet families and after that compare the PSNRs and bit rates of these families. These algorithms were tested on different images, and it is seen that the results obtained by these algorithms have good quality and it provides high compression ratio as compared to the previous exist lossless image compression techniques.

In 2013, Pralhadrao V Shantagiri, et al [13] presents a new spatial domain of lossless image compression algorithm for synthetic color image of 24 bits. This proposed algorithm use reduction of size of pixels for the compression of an image. In this the size of pixels is reduced by representing pixel using the only required number of bits instead of 8 bits per color. This proposed algorithm has been applied on asset of test images and the result obtained after applying algorithm is encouraging. In this paper they also

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compared to Huffman, TIFF, PPM-tree, and GPPM. In this paper, they introduce the principles of PSR (Pixel Size Reduction) lossless image compression algorithm. They also had shows the procedures of compression and decompression of their proposed algorithm. Future work of this paper uses the other tree based lossless image compression algorithm.

In 2013, K. Rajkumar, et al [14] presents an implementation of multiwavelet transform coding for lossless image compression. In this paper the performance of the IMWT (Integer Multiwavelet Transform) for lossless studied. The IMWT provides good result with the image reconstructed. In this paper the performance of the IMWT for lossless compression of images with magnitude set coding have been obtained. In this proposed technique the transform coefficient is coded with a magnitude set of coding & run length encoding technique. The performance of the integer multiwavelet transform for the lossless compression of images was analyzed. It was found that the IMWT can be used for the lossless image compression. The bit rate obtained using the MS-VLI (Magnitude Set-Variable Length Integer Representation) with RLE scheme is about 2.1 bpp (bits per pixel) to 3.1 bpp less then that obtain using MS-VLI without RLE scheme.

In 2013 S. Dharanidharan, et al [15] presents a new modified international data encryption algorithm to encrypt the full image in an efficient secure manner, and encryption after the original file will be segmented and converted to other image file. By using Huffman algorithm the segmented image files are merged and they merge the entire segmented image to compress into a single image. Finally they retrieve a fully decrypted image. Next they find an efficient way to transfer the encrypted images to multipath routing techniques. The above compressed image has been sent to the single pathway and now they enhanced with the multipath routing algorithm, finally they get an efficient transmission and reliable, efficient image.

In 2014 B. Gupta et al [16] wrote a paper "Image Compression Technique under JPEG by Wavelets Transformation". In this paper they described that image compression is minimizing the size in bytes of a graphics file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the Internet or downloaded from Web pages.JPEG and JPEG 2000 are two important techniques used for image compression.JPEG image compression standard use dct (discrete cosine transform). Now there wavelets Transform is using with JPEG 2000 standard. It is a widely used and robust method for image compression. It has excellent compaction for highly correlated data. Wavelets transform divided the image into high frequency components which gives good compromise between information packing ability and computational complexity.

In 2015 Zhang Ning et. al. [17] wrote a paper "Study on Image Compression and Fusion Based on the Wavelet Transform Technology". In this paper they described the Registration algorithm that has better robustness to image noise, and can achieve sub-pixel accuracy; the registration time has also been greatly improved. In terms of image fusion, the images to be fused through wavelet transform of different resolution sub image, using a new image fusion method based on energy and correlation coefficient. The high frequency image decomposed using new energy pixels of the window to window energy contribution rate of fusion rules, the low frequency part by using the correlation coefficient of the fusion strategy, finally has carried on the registration of simulation experiments in the Matlab environment, through the simulation experiments of fusion method in this paper can get the image fusion speed and high quality fast fusion image.

V. CONCLUSION

Image compression is the application of data compression on digital images. Image compression is the technique through which we can reduce amount of data required to represent a digital image It is also used for reducing the redundancy that is nothing but avoiding the duplicate data, which will helpful to increase storage and transmission process's performance. The image compression not only decreases the size of image but also ensures that quality of image is degraded. There are multiple techniques available for compressing the multimedia data such as Discrete Cosine Transform, Discrete Wavelet Transform, Huffman Coding etc. In this paper we have provided review of various image compression techniques.

REFERENCES

[1] Rafael C. Gonzalez, Richard E. Woods. Digital Image Processing, 2nd ed., 1992, NJ: Prentice Hall.\
[2] Wei-Yi Wei,‖ An Introduction to Image Compression‖, pp1-29.
[3] Tzong Jer Chen and Keh-Shih Chuang,‖ A Pseudo Lossless Image Compression Method,‖IEEE, pp. 610-615, 2010.
[4] Mridul Kumar Mathur, Seema Loonker and Dr. Dheeraj Saxena ―Lossless Huffman Coding Technique For Image Compression And Reconstruction Using Binary Trees,‖IJCTA, pp. 76-79, 2012.
[5] Jagadish H. Pujar and Lohit M. Kadlaskar,‖ A New Lossless Method Of Image Compression and Decompression Using Huffman Coding Techniques,‖ JATIT, pp. 18-22, 2012.

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[6] V.K Padmaja and Dr. B. Chandrasekhar,‖Literature Review of Image Compression Algorithm,‖ IJSER, Volume 3, pp. 1-6, 2012.
[7] Firas A. Jassim and Hind E. Qassim, "Five Modulus Method for Image Compression", SIPIJ Vol.3, No.5, pp. 19-28, 2012.
[8] Ashutosh Dwivedi, N Subhash Chandra Bose, Ashiwani Kumar, "A Novel Hybrid Image Compression Technique: Wavelet", MFOCPN pp. 492-495, 2012.
[9] Yi-Fei Tan and Wooi-Nee Tan, "Image Compression Technique Utilizing Reference Points Coding with Threshold Values", IEEE, pp. 74-77, 2012.
[10] S. Sahami and M.G. Shayesteh, "Bi-level image compression technique using neural networks", IET Image Process, Vol. 6, Iss. 5, pp. 496–506, 2012.
[11] C. Rengarajaswamy and S. Imaculate Rosaline, "SPIHT Compression of Encrypted Images", IEEE, pp. 336-341,2013.
[12] S.Srikanth and Sukadev Meher, "Compression Efficiency for Combining Different Embedded Image Compression Techniques with Huffman Encoding", IEEE, pp. 816-820, 2013.
[13] Pralhadrao V Shantagiri and K.N.Saravanan, "Pixel Size Reduction Lossless Image Compression Algorithm", IJCSIT, Vol 5, 2013.
[14] K. Rajakumar and T. Arivoli, "Implementation of Multiwavelet Transform coding for lossless image compression", IEEE, pp. 634-637, 2013.
[15] S. Dharanidharan , S. B. Manoj kumar and D. Senthil kumar, "Modified International Data Encryption Algorithm using in Image Compression Techniques", IJESIT , pp. 186-191,2013.
[16] Bhawna Gupta Manju Gupta Banita Chadha "Image Compression Technique under JPEG by Wavelets Transformation", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 4, Issue 6, June 201
[17] Zhang Ning and Zhu Jinfu "Study on Image Compression and Fusion Based on the Wavelet Transform Technology", International Journal on Smart Sensing and Intelligent Systems Vol. 8, No. 1, March 2015.

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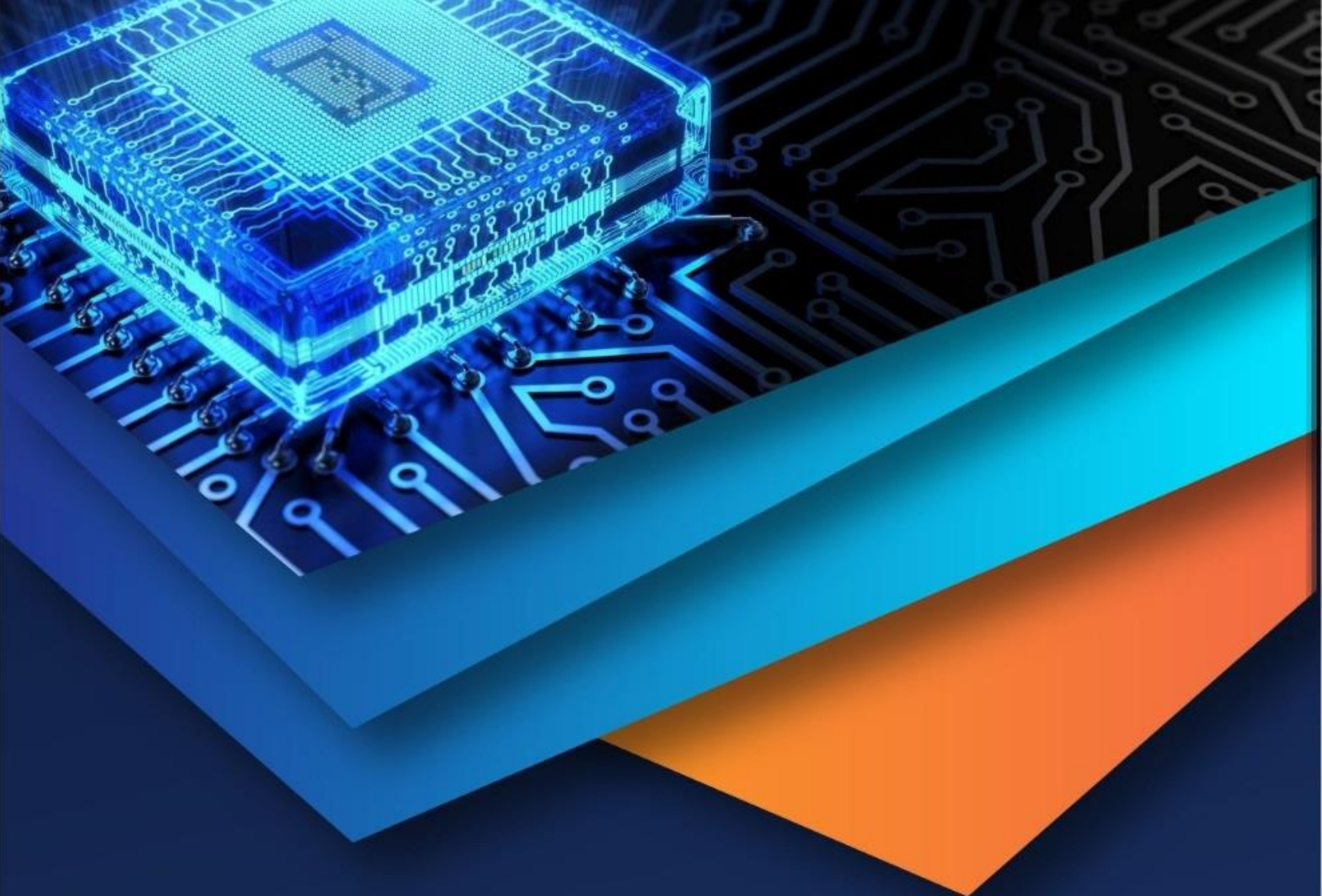

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