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IMAGE COMPRESSION METHODS: A COMPREHENSIVE REVIEW ON LOSSLESS AND LOSSY ALGORITHMS

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Abstract

As a result of technological advances, the bandwidth of communication networks has continuously increased. The launch of new networks and the extension of existing ones, however, have resulted in even higher bandwidth demand. This explains the many efforts in the field of data compression currently being invested. The main objective of these works is to improve information source coding techniques such as voice, image and video to decrease the number of bits needed to represent a source without significantly degrading its content. With the significant increase in digital image data production, there has been a correspondingly large increase in research activity in the field of compression of images. The aim is to represent a picture in the least number of bits without sacrificing the content of the important information inside. Three key types of information are stored in images: redundant, meaningless, and useful. Redundant information is the deterministic portion of the information stored in the image that can be replicated without the loss of other information.

Keywords: *Communication Channel, Correlation Coefficient, Image Transmission, Lossless Compression.*

I. INTRODUCTION

Images are important representative objects. They can represent transmitted television or satellite pictures, medical or computer storage pictures and much more [199]. When a two dimensional light intensity signal is sampled and quantised to create a digital image, a huge amount of data is produced [1]. The size of the digitised picture could be so great that results in impractical storage or transmission requirements [2]. Image compression deals with this problem such that the information required to represent the image is reduced thus making the transmission or storage requirements of images more practical [3]. The applications of image

compression for transmission purposes are limited by real-time considerations. On the other hand, the applications of image compression for storage purposes are less strict [4].

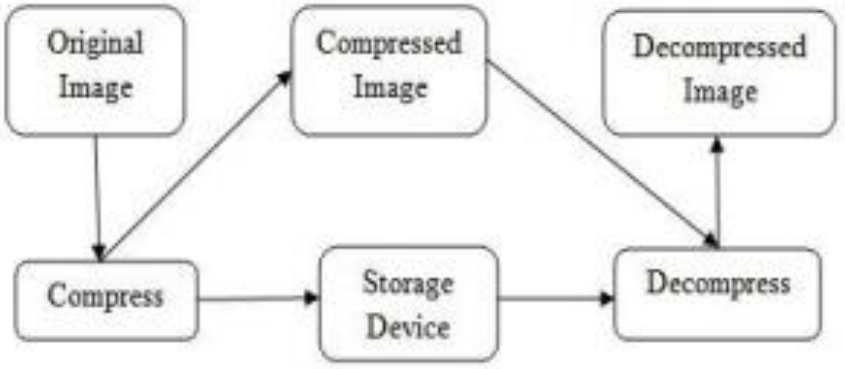

Fig. 1 Illustrates the flow diagram of the image compression

The Figure 1 shows the flow diagram of the image compression. There are two types of compression methods, lossless and lossy image compression. In the former method, the compressed image should be an exact replica of the original image [5][5]. Lossless image compression has wide applications such as the archival of medical or business documents and digital radiography where any loss of information in the original image can result in improper diagnosis. Other applications of lossless compression include the compression of image for camera system, the storage and transmission of thermal images captured by Nano-satellite and remote sensing applications such as monitoring forest fires and determining the soil moisture[6].

$$MAE = \frac{1}{W \times H}\sum_{i=1}^{H}\sum_{j=1}^{W}|p(i,j) - E(i,j)|$$

Lossless image compression in the field of multimedia communication is an important activity. Traditional image codecs, such as the Site, JPEG2000, and FLIF, generally support lossless mode. The ability at this stage has recently begun to be seen by deep learning-based approaches. For lossy image compression, Hyperprior is an efficient technique proposed. This article generalises the hyperprior from lossy model to lossless compression and recommends an L2-norm term to speed up the training procedure in the loss function. In addition, this paper also analysed various parameterized models for latent codes and proposed using Gaussian mixture probabilities to achieve adaptive and versatile background models. Experimental results confirm that our technique can outperform established lossless compression based on deep learning, and outperform JPEG2000 and Web for JPG photos. The correlation coefficient is another essential constraint to ensure that how much efficient is the encryption algorithm.

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improve information source coding techniques such as voice, image and video to decrease the number of bits needed to represent a source without significantly degrading its content [6].

$$r_{x,y} = \frac{C(x,y)}{\sqrt{D(x)}.\sqrt{D(y)}}$$

Where $C(x,y), D(x)$ and $D(y)$ can be evaluated by using the following equations.

$$C(x,y) = \frac{\sum_{i=1}^{K}(x_i - E(x))(y_i - E(y))}{K}$$

$$D(x) = \frac{1}{K}\sum_{i=1}^{K}(x_i - E(x))^2$$

$$D(y) = \frac{1}{K}\sum_{i=1}^{K}(y_i - E(y))^2$$

II. LITERATURE REVIEW

Lucas et al. conducted a research on image encryption using chaotic logistic map. In recent years, chaos-based cryptographic algorithms have proposed many new and efficient ways of creating secure image encryption techniques. In this interaction, we propose a new approach to image encryption, based on chaotic logistic maps, to meet the requirements of secure image transfer [1].

Mathew et al. conducted another research on image encryption for secure internet multimedia applications. In recent years, Internet multimedia applications have become very popular. However, when in storage and during network transmission, sensitive multimedia content such as digital images is vulnerable to unauthorised access. For streaming digital images, elevated network bandwidth for transmission is also needed. Therefore, for efficient image transmission over the internet, both security and bandwidth issues must be considered.

III. DISCUSSION AND CONCLUSION

A survey on the subject of image compression is given in this paper. The growing demand for multimedia computing has led to the need for digital images to be used. The manipulation, storage and transmission of these images in their raw form is very costly, slowing down the transmission considerably and making storage expensive. The need to manage larger amounts of digital image data comes with the growing use of digital imaging. In modern digital communication, video signal processing, and storage systems, data compression has become an integral part. Although the bandwidth of communication networks has been gradually growing, even greater bandwidth is needed by the implementation of new services and the expansion of existing ones. The compression of image data is concerned with the minimization of the data volume used to display an image.

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