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IMAGE TRANSFORMATION & DWT BASED IMAGE DECOMPOSITION FOR COVERT COMMUNICATION

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ABSTRACT
Widely used computer, and therefore require large-scale data storage and transfer, and efficient method of data storage has become necessary. Image compression is to reduce the number of bytes in an image file, without degrading the image quality to an unacceptable level. In reducing the file size to allow more images to be stored in a given amount of memory or disk space. It also reduces the desired image is transmitted from a website via the Internet or downloaded time. Gray image is 256 × 256 pixels of 65,536 Yuan, to store and a typical 640 × 480 colour image of nearly one million. These files are downloaded from the Internet can be very time-consuming task. A significant portion of the image data of the multimedia data comprises they occupy the major portion of the communication bandwidth used for the multimedia communication. Therefore, the development of effective techniques for image compression has become quite necessary [9]. The basic goal of image compression is to find the image representation associated with fewer pixels. Two basic principles used in image compression is redundant and irrelevant. Source Redundancy eliminating redundant and irrelevant omit pixel values rather than by the human eye to detect. International standard for image compression work began in the late 1970s with the CCITT (now ITU-T) requires specification of the binary image compression algorithm facsimile communications. Image compression standard brings many benefits, such as: (1) different image files between devices and applications easily exchanged; (2) the re-use of existing hardware and software products are more widely; (3) the existence of benchmarks and benchmark data sets for new and alternative development.

KEYWORDS- Image Transformation, Compression, Discrete Wavelet Transformation, DCT, Image Fragmentation.

INTRODUCTION
Image decomposition is used specially for the compression of images where tolerable degradation is required. With the wide use of computers and consequently need for large scale storage and transmission of data, efficient ways of storing of data have become necessary. With the growth of technology and entrance into the Digital Age, the world has found itself amid a vast amount of information. Dealing with such enormous information can often present difficulties. 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. These image files can be very large and can occupy a lot of memory. A gray scale image that is 256 x 256 pixels have 65, 536 elements to store and a typical 640 x 480 color image have nearly a million. Downloading of these files from internet can be very time consuming task. Image data comprise of a significant portion of the multimedia data and they occupy the major portion of the communication bandwidth for multimedia communication. Therefore development of efficient techniques for image compression has become quite necessary [9]. A common characteristic of most images is that the neighboring pixels are highly correlated and therefore contain highly redundant information. The basic objective of image compression is to find an image representation in which pixels are less correlated. The two fundamental principles used in image compression are redundancy and irrelevancy. Redundancy removes redundancy from the signal source and irrelevancy omits pixel values which are not noticeable by human eye. JPEG and JPEG 2000 are two important techniques used for image compression.

1.1 Image Transformations
Image transformations typically involve the manipulation of multiple bands of data, whether from a single multispectral image or from two or more images of the same area acquired at different times (i.e. multi temporal image data). Either way, image transformations generate "new" images from two or more sources which highlight particular features or properties of interest, better than the original input images.

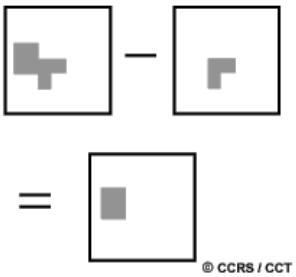


Figure: 1.1

Basic image transformations apply simple arithmetic operations to the image data. **Image subtraction** is often used to identify changes that have occurred between images collected on different dates. Typically, two images which have been geometrically registered (see section 4.4), are used with the pixel (brightness) values in one image (1) being subtracted from the pixel values in the other (2). Scaling the resultant image (3) by adding a constant (127 in this case) to the output values will result in a suitable 'difference' image. In such an image, areas where there has been little or no change (A) between the original images, will have resultant brightness values around 127 (mid-grey tones), while those areas where significant change has occurred (B) will have values higher or lower than 127 - brighter or darker depending on the 'direction' of change in reflectance between the two images . This type of image transform can be useful for mapping changes in urban development around cities and for identifying areas where deforestation is occurring, as in this example.

Image division or **spectral rationing** is one of the most common transforms applied to image data. Image rationing serves to highlight subtle variations in the spectral responses of various surface covers. By rationing the data from two different spectral bands, the resultant image enhances variations in the slopes of the spectral reflectance curves between the two different spectral ranges that may otherwise be masked by the pixel brightness variations in each of the bands. The following example illustrates the concept of spectral rationing. Healthy vegetation reflects strongly in the near-infrared portion of the spectrum while absorbing strongly in the visible red. Other surface types, such as soil and water, show near equal reflectance's in both the near-infrared and red portions. Thus, a ratio image of Landsat MSS Band 7 (Near-Infrared - 0.8 to 1.1 mm) divided by Band 5 (Red - 0.6 to 0.7 mm) would result in ratios much greater than 1.0 for vegetation, and ratios around 1.0 for soil and water. Thus the discrimination of vegetation from other surface cover types is significantly enhanced. Also, we may be better able to identify areas of unhealthy or stressed vegetation, which show low near-infrared reflectance, as the ratios would be lower than for healthy green vegetation.

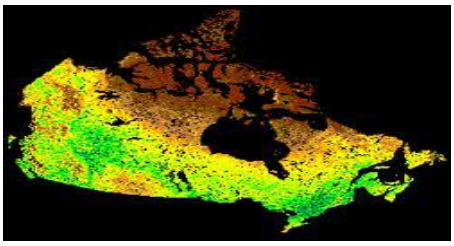


Figure: 1.2

Another benefit of spectral rationing is that, because we are looking at relative values (i.e. ratios) instead of absolute brightness values, variations in scene illumination as a result of topographic effects are reduced. Thus, although the absolute reflectance's for forest covered slopes may vary depending on their orientation relative to the sun's illumination, the ratio of their reflectance's between the two bands should always be very similar. More complex ratios involving the sums of and differences between spectral bands for various sensors have been developed for monitoring vegetation conditions. One widely used image transform is the **Normalized Difference Vegetation Index (NDVI)** which has been used to monitor vegetation conditions on continental and global scales using the Advanced Very High Resolution Radiometer (AVHRR) sensor onboard the NOAA series of satellites (see Chapter 2, section 2.11).

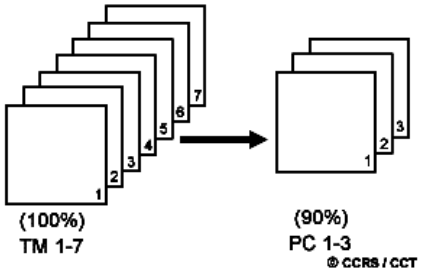


Figure: 1.3

Different bands of multispectral data are often highly correlated and thus contain similar information. For example, Land sat MSS Bands 4 and 5 (green and red, respectively) typically have similar visual appearances since reflectance's for the same surface cover types are almost equal. Image transformation techniques based on complex processing of the statistical characteristics of multi-band data sets can be used to reduce this data redundancy and correlation between bands. One such transform is called **principal components analysis**. The objective of this transformation is to reduce the dimensionality (i.e. the number of bands) in the data, and compress as much of the information in the original bands into fewer bands. The "new" bands that result from this statistical procedure are called components. This process attempts to maximize (statistically) the amount of information (or variance) from the original data into the least number of new components. As an example of the use of principal components analysis, a seven band Thematic

Map per (TM) data set may be transformed such that the first three principal components contain over 90 percent of the information in the original seven bands. Interpretation and analysis of these three bands of data, combining them either visually or digitally, is simpler and more efficient than trying to use all of the original seven bands. Principal components analysis, and other complex transforms, can be used either as an enhancement technique to improve visual interpretation or to reduce the number of bands to be used as input to digital classification procedures, discussed in the next section.

RELATED WORK

Marshall McLuhan was a leading and influential media communication theorist who coined the familiar phrase "The medium is the message". He believed that it is the "medium that shapes and controls the scale and form of human association and action." According to him the focus should not be on the content or what is being said, but the medium by which it is delivered. The subject matter is by no means irrelevant, but the delivery format is a crucial factor in how the message comes across. This is where the immense power and influence of multimedia lie.

Media, by definition, is the plural of medium. It has evolved to mean **"facilitating or linking communication"**—be it via a phone, the Web, TV, or some other instrument. Speaking directly with a person one on one is immediate and does not require mediation. This is communication in its purest form.
The purpose of a medium is to assist in the conveying of a message. When using more than one type of medium, we refer to it as multimedia, whether or not it is computer-based. At one time, media mainly applied to newspapers as a way to disseminate news and information to the masses. Now, media encompasses many forms of communication. Multimedia is a synergistic process whereby various media elements work together to make a stronger, more cohesive whole. A combination of media adds richness and provides a complete sensory experience

In 1967, pop artist Andy Warhol organized "multimedia" events called the Exploding Plastic Inevitable, where he showed films combined with live performances that were illuminated with flashing, colored lights to create a multisensory atmosphere. The technology necessary for joining individual media did not exist at that time. Computers were not accessible to the general public and those that did exist were large, complex, costly, and primarily geared toward scientists and researchers.

Today, the term multimedia is associated almost exclusively with the computer, and the components that make up a multimedia program are digital. Various media are brought together to perform in unison on the computer as a single entity, and they are programmed or scripted using authoring software or programming languages. Diverse forms of communication are combined with multimedia to allow for a myriad of outcomes.

In the early 1900s, Vannevar Bush, an American computer scientist who developed patented devices, came up with inventive ideas about ways to link information. He saw the potential of storing information with built-in connections to other data. Bush called his notion associative indexing, which would link information in a way that is more meaningful to the user, rather than the more traditional numerical and alphabetical classifications. He developed the Memex System in 1945, and although it was never implemented, it would have allowed the operator to input notes and drawings using an early method of photocopying. Data was interconnected and could be stored for later recall. His theory led to the development of interlinked hypertext methods, similar to those that are used today.

We can notice multimedia everywhere or one can say "Multimedia here and multimedia there". In the same trail, an interactive website with Flash animation can also increase the acceptance, if the use of a smart way. Considering that this is an important key to the success of a Flash website. Do not overload flash animation, or make your website navigation too complicated. In order to get a visitor's attention and stay awake and not let them loose patience and leave your overloaded Flash website! In many ways, multimedia will help you improve your acceptance of information, but it will go far beyond that. People can also develop multimedia applications, such as interactive multimedia tutorials to save time coach or to your customers. Provide this kind of multimedia support, your customers could seriously improve their training process and save them time. Over years, multimedia and interactive promoting services got more cost-effective.

Andrew B. Watson, The discrete cosine transform (DCT) is a technique for converting a signal into elementary frequency components. It is widely used in image compression. Here we develop some simple functions to compute the DCT and to compress images. These functions illustrate the power of Mathematical in the prototyping of image processing algorithms.

Prabhakar.Telagarapu ET. Al. Image compression is a widely addressed researched area. Many compression standards are in place. But still here there is a scope for high compression with quality reconstruction. The JPEG standard makes use of Discrete Cosine Transform (DCT) for compression. The introduction of the wavelets gave different dimensions to the compression. This paper aims at the analysis of compression using DCT and Wavelet transform by selecting proper threshold method, better result for PSNR have been obtained. Extensive experimentation has been carried out to arrive at the conclusion.

Lei Wang et. al. A progressive image compression scheme is investigated using reversible integer discrete cosine transform (RDCT) which is derived from the matrix factorization theory. Previous techniques based on DCT suffer from bad performance in lossy image compression compared with wavelet image codec. And lossless

compression methods such as IntDCT, I2I-DCT and so on could not compare with JPEG-LS or integer discrete wavelet transform (DWT) based codec. In this paper, lossy to lossless image compression can be implemented by our proposed scheme which consists of RDCT, coefficients reorganization, bit plane encoding, and reversible integer pre- and post-filters. Simulation results show that our method is competitive against JPEG-LS and JPEG2000 in lossless compression. Moreover, our method outperforms JPEG2000 (reversible 5/3 filter) for lossy compression, and the performance is even comparable with JPEG2000 which adopted irreversible 9/7 floating-point filter (9/7F filter).

Samir Kumar Bandyopadhyay et. al. — Image compression is currently a prominent topic for both military and commercial researchers. Due to rapid growth of digital media and the subsequent need for reduced storage and to transmit the image in an effective manner Image compression is needed. Image compression attempts to reduce the number of bits required to digitally represent an image while maintaining its perceived visual quality. This study concentrates on the lossless compression of image using approximate matching technique and run length encoding. The performance of this method is compared with the available jpeg compression technique over a wide number of images, showing good agreements.

Ram Verma et. al. Image compression is very important in the present scenario. The compression is not only the main objective but also the image quality is an important factor which should be kept in mind for choosing any compression method. In this paper we will discuss the necessity of hybrid coding over classical coding schemes and why DCT – DWT hybrid approach is so important among various hybrid schemes. The goal is to achieve higher PSNR i.e. peak signal to noise ratio where original image means signal and the noise is error in reconstructed image

PROPOSED WORK

We propose to ensure key less encryption of image using Discrete Wavelet Transformation for image Fragmentation which decomposes the image into 4 different fragments and then DCT is used to transform the components separately instead of doing block processing. These processed components are again combined together using inverse DWT to provide an encrypted image.
The image which is communicated to the receiver is decomposed back by him using inverse process, which involves the process of image fragmentation using DWT and then applying inverse DCT on those components and then applying inverse DWT on them.

Our work comprise of two stages:

Stage 1:

It is done at the sender end; in this case the sender encrypts the image using Discrete Wavelet Transformation for image Fragmentation which decomposes the image into 4 different fragments and then DCT is used to transform the components separately instead of doing block processing. These processed components are again combined together using inverse DWT to provide an encrypted image
The flow chart at the sender end is as follows:

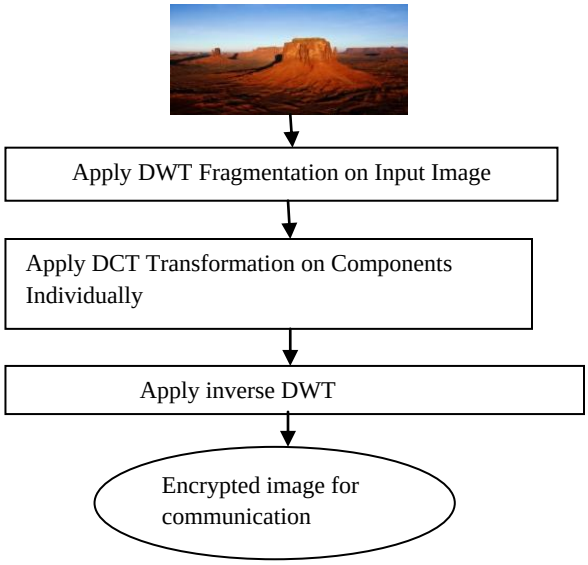


Figure: 3.1

Stage 2:

It is done at the receiver end; the receiver decomposes image back using inverse process, which involves the process of image fragmentation using DWT and then applying inverse DCT on those components and then applying inverse DWT on them.

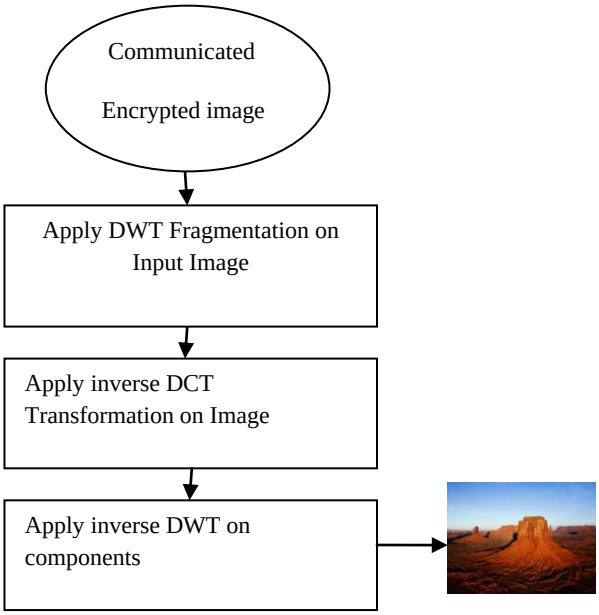


Figure: 3.2

The snapshots of original image, encrypted image and decrypted image are as follows**:**

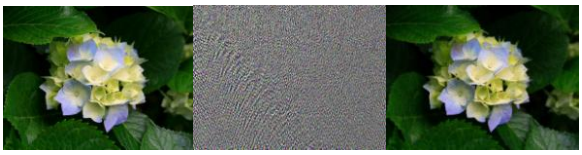


Figure: 3.3: Hyna Flower

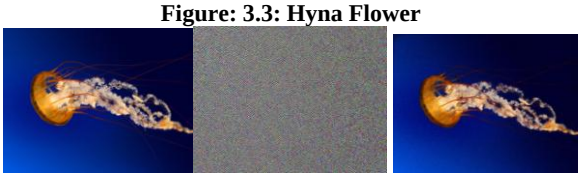


Figure: 3.4: Jelly Fish

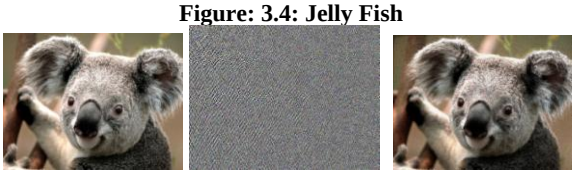


Figure: 3.5: Koala

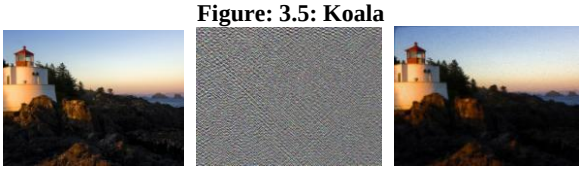


Figure: 3.6: Light House

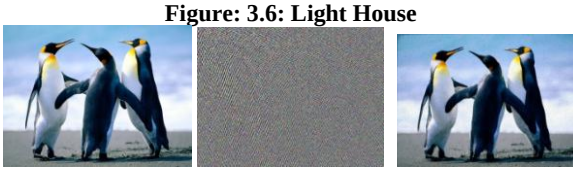


Figure: 3.7: Penguins

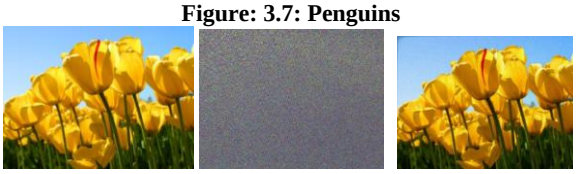


Figure: 3.8: Tulip Flower

RESULTS AND ANALYSIS

After performing all the experiments it is time to do the analysis of the results obtained of the outcome of the same.

We analyze the outcome of efforts made by the sender and compare the results of reverse process applied on receiver end. Here we compare the outcomes of images Encrypted using DWT and DCT and reversed back using decrypted back using DCT and DWT.

Table: 4.1: PSNR of Original Image compared with Decrypted Image

S. No.	Name of Image	Size of Image	PSNR
1	**Hydra Flower**	1024 X 768	23.2249
2	**Jelly Fish**	1024 X 768	23.8657
3	**Koala**	1024 X 768	20.9024
4	**Light house**	1024 X 768	22.3665
5	**Penguin**	1024X 768	21.7837
6	**Tulip Flower**	1024X 768	23.2849

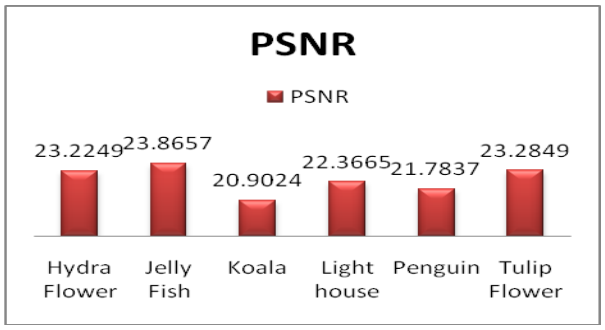
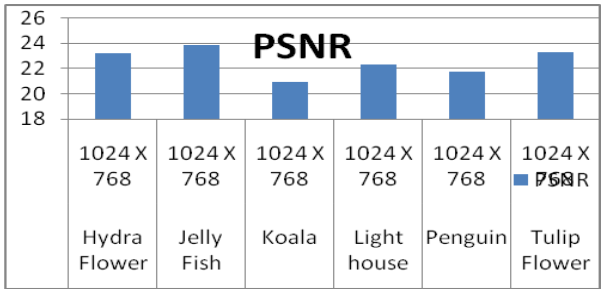


Figure: 4.1: PSNR Values of all test images



FUTURE WORK

In future one can perform the further task to enhance better results and good security:

1. Use transforms other than DCT or DWT
2. Use various kind of images formats.
3. Use other multimedia formats like moving images & video.
4. Better image transformation techniques can also be implemented.

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