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IMAGE COMPRESSION USING WAVELET TRANSFORM

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Abstract: Image Compression is a computer graphics application, which is used in Internet, digital library and photography, mobile communication and multimedia. Image Compression is a technique, which is used to reduce the volume of information that is transmitted about an image. It can be lossless compression or lossy compression. It can be used to reduce duplicity, computational time, cost of image and quality of image. There are many image compression techniques such as JPEG, JPEG 2000, DCT, DWT, Wavelet, Huffman Coding, Quantization, Lossy Compression Or Lossless Compression. In this paper we will introduce the best image compression technique and provide many benefits over the others. It uses large variety of wavelets to decomposition of images and coding techniques are used like EZW & SPIHT and embedded block coding techniques use the wavelet convert basic and collective steps. In this paper we use different wavelets to complete a transform of test image and result to be discussed & analyzed.

Keywords: Image Compression, Wavelet, Fourier transform , Haar wavelets, Wavelet transform.

1. INTRODUCTION

Wavelets are mathematical functions in which data should be divided into different frequency components and then matched the resolution into its scale. Wavelet transforms change a signal into a series of wavelets. In Wavelet Image Processing a single image can store different parts of resolutions, which should be divided into many parts. Wavelet is applicable for compressing the image using less storage space and also containing the full details of the image. An image can be decomposed into approximate, horizontal, vertical and diagonal details. Joseph Fourier discovered sine's and cosines that are used to symbolize the approximation functions of an image and these functions are non-local functions. Scale used to represent data, which play important role in wavelet analysis and wavelet algorithms method representing at diverse scales or different resolutions. If window should be large it provides large features and if window should be small it provides minor features. Wavelets are right for estimating data with sharp breaks. The wavelet analysis determines wavelet prototype function that is known as analyzing wavelet.

2. FOURIER TRANSFORM

The Fourier transform may be defined as a mathematical process with many uses in physics and engineering that states a mathematical function of time as the function of frequency, called as its frequency spectrum. Fourier transforms used to transform time domain signals into a frequency domain. Time domain representation is the function of time that the frequency spectrum and the frequency domain representation. It works by transforming a function from a time domain to the task in the frequency domain. The signal can be examined for its frequency content because the Fourier coefficient of the changed function shows the influence of every sine and cosine function at every frequency. An inverse Fourier transform do just the same as what you expect, alter data from the frequency domain to the time domain. The inverses Fourier transforms represent the frequency domain function, which contain in the time domain function.

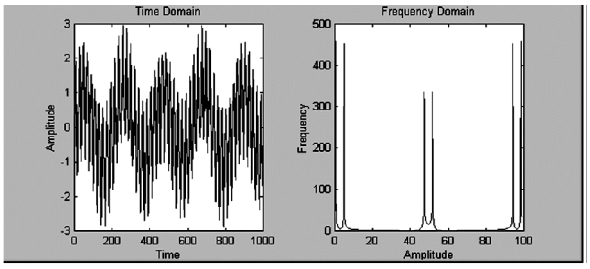

Figure : Signal Plotted in the Time Domain is Shown in Left Graph and the Fourier Transform of a Signal is Shown in Right Graph

2.1 Categories of Fourier Analysis

2.1.1 Discrete Fourier Transform

The Discrete Fourier Transform (DFT) used in Fourier analysis of a function. It converts one function into another that is named the frequency domain representation. The discrete Fourier

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transform need an input function that is discrete. Sampling of a continuous function represents these inputs. The discrete input functions containing a finite duration having one period of a periodic sequence. The discrete Fourier transforms containing the properties of the continuous Fourier transform. The formulae of the inverse discrete Fourier transform can be simply determined with the help one of the discrete Fourier transform, as both the formulae are very much the same. So the DFT is called as a transform for Fourier analysis of finite-domain discrete-time functions.

2.1.2 Windowed Fourier Transform

Window Fourier Transform is performed over a local area in which signal at one place will never disturb the signal at alternative location of spectral analysis. The spectrum of the signal in a native area is much easier than the spectrum of a complete field signal. The Windowed Fourier Transform (WFT), a Windowed Fourier Filtering (WFF) algorithm and a Windowed Fourier Ridges (WFR) algorithm have been planned for fringe pattern analysis .If a non periodic signal f(t) is the sum of the periodic functions of cosine and sine the it will have problems in representing the signal properly. You can duplicate lengthen the signal which make it periodic but it can need more continuousness on the endpoint. The windowed Fourier transform (WFT) is the result of the query, which can be better represent non-periodic signal. The WFT provide info about signal in the frequency domain and in the time domain.

2.1.3 Fast Fourier Transform

Fast Fourier transforms is an appropriate algorithm, which is used for computing discrete Fourier transform and its opposite. There are many FFT algorithms, which should contained wide variety of mathematics functions and arithmetic functions of complex numbers. To find the approximated function of a sample and to find the approximated Fourier integral by a discrete Fourier transform should be looked-for relating a matrix having order is the number sample point's *n*. If multiplying a matrix by the vector cost on the order of arithmetic operations then a problem can occur and number of sample point increase. If the samples are uniformly spread out then the Fourier matrix will be divided to a product of limited scant matrices and the resultant factors should be applied to a vector in a total of order arithmetic operations. It is known as Fast Fourier Transform (FFT). A discrete Fourier transform divided the sequence of valued into components which containing different frequencies. This method is used in different fields but it is slow in practical.

3. LIST OF WAVELET RELATED TRANSFORM

3.1 Continuous Wavelet Transform (CWT)

A continuous wavelet transform is an addition of scaled and mother wavelet ψ. Continuous wavelet transform is used for breakdown time function into wavelets. This continuous wavelet transform has the capacity to make time frequency, which is used to represent signal. The continuous wavelet transforms containing C coefficients with containing functions of scale and translations.

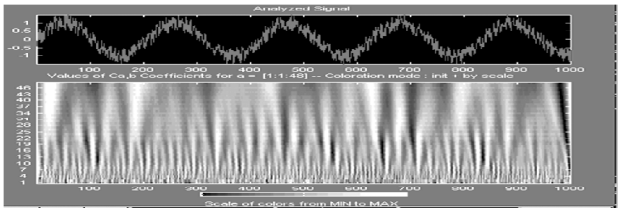

Figure : Screen Print Matlab Wavelet Toolbox GUI. The Graph on Top Shows the Signal to be Analyzed with CWT. The Coefficients at Corresponding Scale and Times are Shown in the Bottom Graph

3.2 Multi Resolution Analysis

A multi resolution analysis (MRA) or multistate approximation (MSA) is design methods of a practically related discrete wavelet transform (DWT) and a explanation for a algorithm of a fast Fourier Wavelet Transform (FWT). Stephane Mallat has developed it in 1988 and Peter J. Burt has developed pyramid methods and differential equations in 1981. Vector spaces are the first component of multi resolution analysis. Each vector space containing another vector spaces with high resolution whenever you get the final image and similarly each vector space containing another vector space with low resolution. The scale function for the wavelet is basis of the each vector space.

3.3 Discrete Wavelet Transform

The Discrete wavelet transform is used for transform image. In functional analysis and discrete analysis, a Discrete Wavelet Transform (DWT) is a wavelet transform that has the wavelets as discretely sampled. As with other wavelet transforms, temporal resolution is the main benefit it has on Fourier transforms. It has the both location and the frequency information.

3.4 Fast Wavelet Transforms

The fast Wavelet transform is the mathematical algorithm made to turn a signal or a waveform in time domain to a series of coefficients based on a orthogonal basis of small finite waves, or wavelets. The transform can be simply

stretched to a multidimensional signs, like image, where the time domain is exchanged by space domain.

4. HAAR WAVELET

The Haar wavelets are sequence of functions in mathematics forms. It is first invention of wavelet form. Alfred Harr generates the HAAR WAVELET in 1990. The Haar wavelet is a simple wavelet form. It is not continuous and it is the disadvantage of Haar wavelet. Wavelets are mathematical functions that have been developed by scientists for sorting data by frequency by working in several different fields. Translated data sorted in the resolution, which matches into its scale. Data should be studied at different stages, which helps in the development of more complete picture. Both large features and small features contained in different levels because they are studied separately. The wavelet transform is not Fourier-based in the discrete cosine transform and a discontinuity in data has been handled in a better way.

4.1 Results

The image shown on the left side is the real image and the image that is on the right side is the compressed one. The point is that the image on the left you are right now viewing is compressed using Haar wavelet method and the loss of quality is not visible. Because image compresses by using Haar Wavelet is one of the simplest ways.

Original Image

Compressed Image

5. CONCLUSION

Haar wavelet transform for image compression is simple algorithm which should compared to other algorithms it is more effective. The quality of compressed image is also maintained.

REFERENCES

[1] http://www.scribd.com/doc/44395089/Image-Compression-Using-Wavelet-Transforms

[2] http://www.buzzdock.com/Pages/Search.aspx?a=1&guid=5a97e91f-c7bd-4daa-9f1f-7de58cdf24af#introduction+wavelet+transform+ppt

[3] http://en.wikipedia.org/wiki/Multiresolution_analysis

[4] http://davis.wpi.edu/~matt/courses/wavelets/

[5] http://www.debugmode.com/image.cmp

[6] Jayant N. and Noll P., "Digital Coding of Waveform: Principles and Applications to Speech and Video", NJ: Prentice-Hall, 1984.

[7] Polikar R.B. "Wavelet Tutorial Part 1,2,3,4".

[8] Http://user.rowan.edu/polikar/WAVELETS/WTtutorial.html,2003

[9] David Saloman, "Data Compression the Complete". Reference, 2nd Ed. 2002, nces