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Discrete Wavelet Transformation over Digital Image in Order to Increase Image Quality

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Abstract* - Digital images are electronic snapshots taken of a scene or scanned from documents, such as photographs, manuscripts, printed texts, and artwork. The digital image is sampled and mapped as a grid of dots or picture elements (pixels). Each pixel is assigned a tonal value (black, white, shades of gray or color), which is represented in binary code (zeros and ones). The binary digits ("bits") for each pixel are stored in a sequence by a computer and often reduced to a mathematical representation (compressed). The bits are then interpreted and read by the computer to produce an analog version for display or printing. Some time these images can be needed to make them clearer. The brightness preservation is one of the techniques so that image can enhance quality. This paper is a review on these approaches of image processing.

Keywords: Digital Image Brightness Preservation histogram.

I. INTRODUCTION

Recent trends show that the usage of image processing has becoming more and more prominent in our daily life. In addition to television, camera, camcorder, and personal computer, many high-tech electronic products, such as hand-phone, or even refrigerator, nowadays are being equipped with capabilities to display digital images [1]. Unfortunately, the input images that are provided to (or captured by) these devices are sometimes not really in good brightness and contrast. Therefore, a process known as digital image enhancement is normally required to increase the quality of these low brightness images [2].

The goal of image enhancement techniques is to improve a quality of an image such that enhanced image is better than the original image. Several image enhancement techniques have been proposed in both spatial and transform domains. In the spatial domain techniques, intensity values of images have been modified whereas in the transform domain techniques, transform domain coefficients are modified, typically, scaled [3].

There are many organizations used for digital image processing. This has created the need for a means to manage and search these different types of organizations like image enhancement, image segmentation, image compression etc for enhance the feature of different types of images. Development of image enhancement algorithms for multimedia data such as satellite images, medical images and captured any format images by any digital equipments, and increase in the network image transformation speed have allowed widespread use of applications, which rely on digital image.

Therefore, finding efficient using image enhancement mechanisms has become a wide area of interest to researchers. Image enhancement technique is among the simplest and most appealing area of digital image processing [4, 5]. Enhancement techniques like brightness preservation, contrast enhancement highlight certain features means depend which part of the image want to be enhance some application some input image including noise, reduction or removal of noise is also form of image enhancement.

For the last few decades, researchers have been working on image enhancement processes and two types of promising techniques have been developed such as, spatial domain image enhancement and frequency or spectral domain image enhancement.

II. DIGITAL IMAGE PROCESSING

A digital image is a representation of two dimensional as a finite set of digital values called picture elements or pixels. An image may be defined as a two dimensional function F(x, y) where x and y are spatial coordinates and amplitude of F at any pair of coordinates (x, y) is called the intensity or gray level of the image at particular point [1]. When x, y and the amplitudes values of F are all finite discrete quantities called the image as digital image. The definition of f may be extended: as

N-dimensional function, i.e. 3D: f(x, y, z) or image sequence f(x, y, t) with amplitudes composed as a vector of data, i.e. Colour image: 3 components at each point, Complex number.

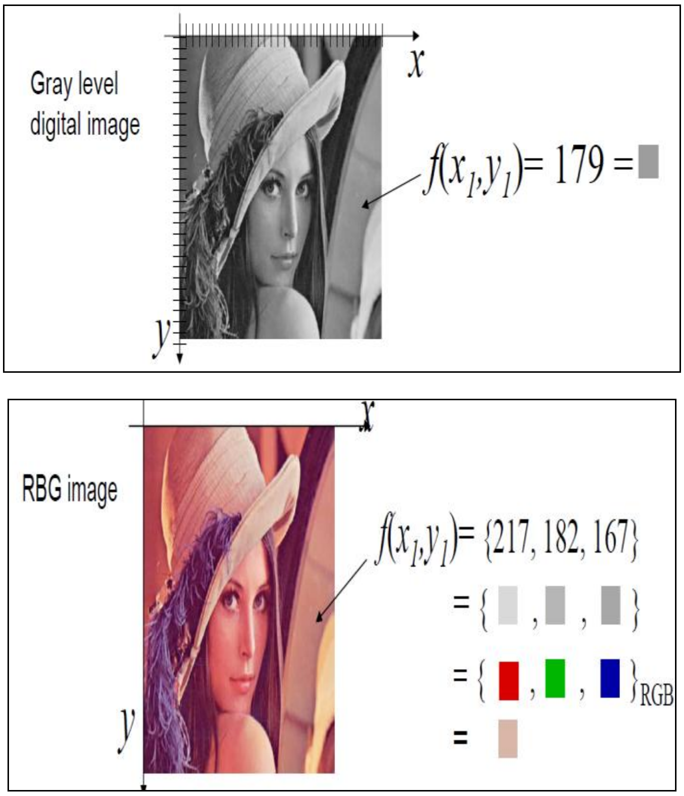

Figure1: RGB and Grey Image of lena

III. CLASSIFICATION OF DIP

Digital image processing whose input and output are images and method whose input may be images but whose outputs are attributing extracted from those image like edges, boundary, any pixel etc. Interest in digital image processing methods focus on two major tasks-(1) Processing of image data for storage, transformation and representation for autonomous machine perception and (2)Improvement of pictorial information for human perception [1,2]. The continuum from image processing to computer vision can be broken up into low-, mid- and high-level processes.

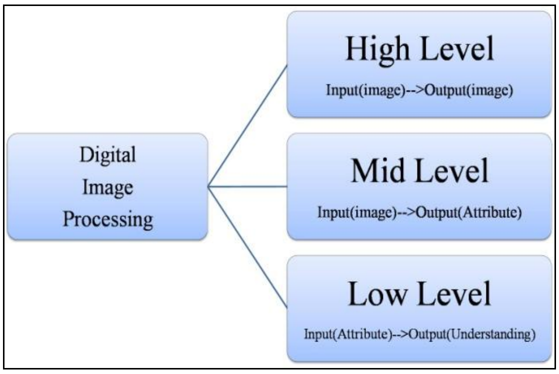

Figure 2: Classification of Digital image processing

IV. IMAGE ENHANCEMENT

Image enhancement is application depended technique image enhancement plays a fundamental role in many image processing applications where human beings (experts) makes decisions depend on the image information. But, some problem arises in the interface between the experts and machines. In the image processing, we usually use some objective quality criteria to ascertain the goodness of the results. There is no general theory of image enhancement, when an image is processed for visual interpretation the viewer is the ultimate judge of how well a particular method works [4, 5].

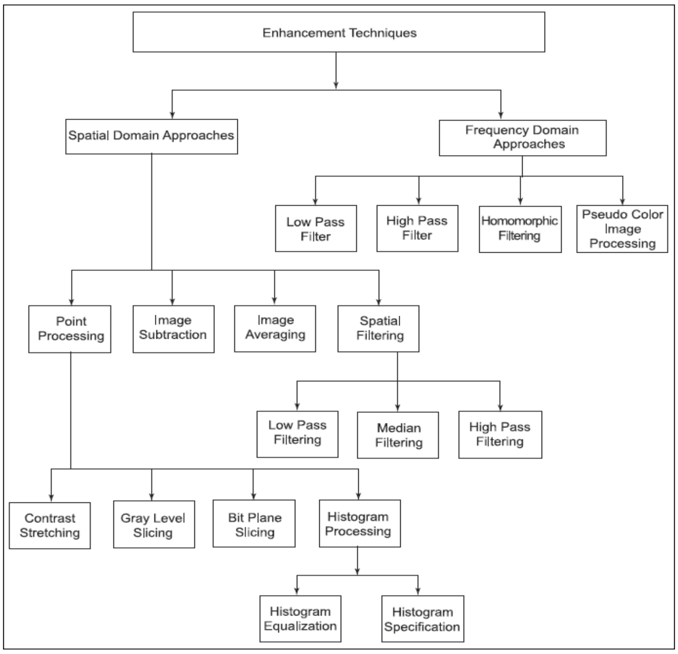

Figure 3: Classification of Image enhancement Technique

The purpose of image enhancement is to "improve" images in terms of the visual appearance for human interpretation, or the suitability for subsequent computer processing. The meaning of "improved" is very application dependent, so it can be difficult to form general theoretical frameworks here so most work on image enhancement is qualitative [4]. Indeed, describes image enhancement as an algorithm

V. DISCRETE WAVELET TRANSFORM

Wavelet transform is used to image compression which is involves reducing the typically massive amount of data needed to represent image. WT is also used to detect the edge information, enhancement, fusion, de-noise and so on. WT provide a time frequency representation of the signal [6,7].

The wavelet series is just a sampled version of continuous wavelet transformation. DWT which is based on sub band coding is formed to yield fast computation of wavelet transformation. it is easy to implement and reduce to computation time and resources required. The DWT is computed by successive low pass and high pass filtering of the discrete time domain signal [8, 9].

In DWT signal is denoted by I[n] sequence ,where n is integer, low pass filter is denoted by LP and high pass filter is denoted by HP and ↓ denotes sub sampling.at each level HP produces detail information Di(n) [10-12]. While the LP associated with scaling function produce approximation A(n). If a low-pass threshold filters out most of high-frequency coefficients, much noise will be deleted, and the image will become smoother. But, the image will also become blurring, because many detail characters are also deleted. It means that it is not enough to distinguish noise ingredient from detail ingredient simply according to the frequency of WT.DWT are defined as follows:-an input image I (n), let I(X, Y) represent be a 2D image and HP and LP be wavelet analysis filters, and then the N level wavelet transform of image can be described as

$$In(X,Y) = \sum_{m,n\in z} HP(m)\,LP(n)\,An-1(2x-m,2y-n)$$

$$D1n(x,y) = \sum_{m,n\in z} HP(m)\,LP(n)\,An-1(2x-m,2y-n)$$

$$D2n(x,y) = \sum_{m,n\in z} HP(m)\,LP(n)\,An-1(2x-m,2yn)$$

$$D3n(x,y) = \sum_{m,n\in z} HP(m)\,LP(n)\,An-1(2x-m,2y-n)$$

The wavelet transform has a reconstruction algorithm which can be described as

$$\begin{aligned} An-1(x,y) = 4*[&\textstyle\sum_{m,n\in z} \widetilde{HP}(m)\,LP(n)\,\widetilde{An}\left(\frac{x-m}{2},\frac{y-n}{2}\right)] \\ &+\textstyle\sum_{m,n\in z} \widetilde{HP}(m)\,LP(n)\,\widetilde{D1n}\left(\frac{x-m}{2},\frac{y-n}{2}\right) \\ &+\textstyle\sum_{m,n\in z} \widetilde{HP}(m)\,LP(n)\,\widetilde{D2n}\left(\frac{x-m}{2},\frac{y-n}{2}\right) \\ &+\textstyle\sum_{m,n\in z} \widetilde{HP}(m)\,LP(n)\,\widetilde{D3n}\left(\frac{x-m}{2},\frac{y-n}{2}\right) \end{aligned}$$

Classification of wavelet is two types, 1.orthogonal and 2.biorthogonal.orthogonal filter coefficients are real numbers [13, 14]. The filters are of the same lengths but not symmetric. LP and HP filters are related to each others

$$HP(Z) = Z^{-N} LP(-Z^{-1})$$

This property is useful in many signal and image processing applications. They have regular structure which leads to easy implementation and scalable architecture. In the bi-orthogonal wavelet filter, low pass filter is always symmetric while the high pass filter is either symmetric or anti-symmetric .the coefficients of these filter are either real number or integer [15]. The linear phase bi-orthogonal filters are the most popular filter for data compression applications.

VI. CONCLUSION

Here, two dynamic histogram equalization techniques can be applicable for the image brightness enhancement. The paper shows that the image brightness through discrete wavelet transformation might be provide better results as compared to the other wavelet transformation. This paper is a review on the various image processing and other approaches to enhance the quality of an image.

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