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Image Contrast Enhancement Using Adaptive Intensitytransform

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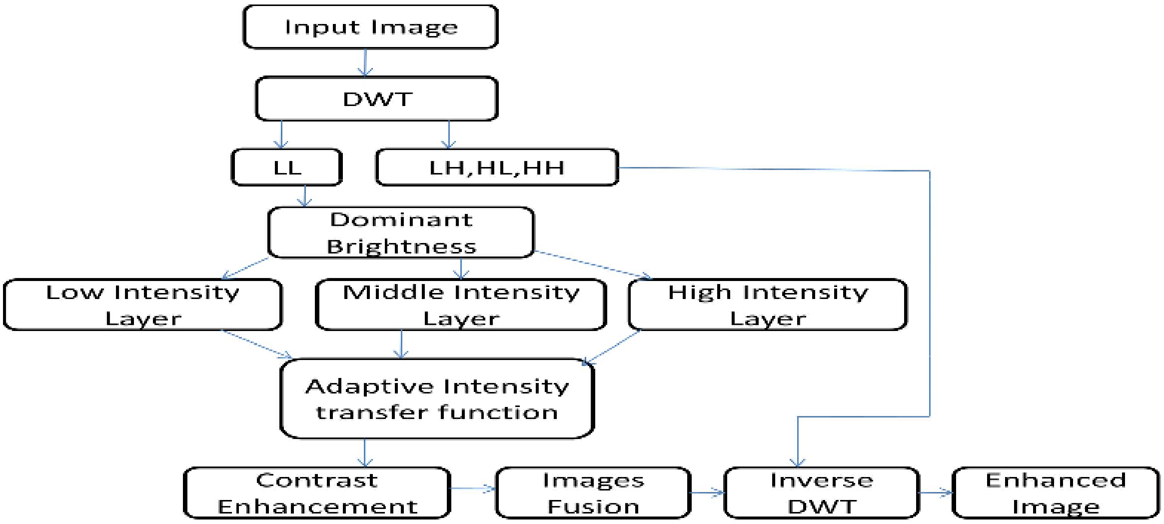
ABSTRACT : *Contrast enhancement approach is mainly improves the image quality, Adding contrast usually adds "pop" and makes an image look vibrant while decreasing contrast can makes image dull..If we consider histogram equalization for a remote sensing images it improves the image quality, but it cannot preserve edge details exhibit in low and high intensity layers to achieve this goal we proposing the novel contrast enhancement method for remote sensing images using dominant brightness level analysis and adaptive intensity transform.. This algorithm computes the brightness-adaptive intensity transform function using the low frequency luminance component in discrete wavelet domain transform and transfer intensity values according to the transfer function. In this method discrete wavelet transform (DWT) input image decomposes into set of band limited components called HH, HL, LH and LL. LL sub band has illumination of low, middle, high, intensity layers using the log average luminance. Adaptive intensity transfer function estimation using the knee transfer function, gamma adjustment function based on the dominant brightness level of each layer. After this process the enhanced image obtained by using inverse DWT*

Keywords:- *Adaptive intensity transfer function, Contrast enhancement, Discrete wavelet transform (DWT), dominant brightness level analysis, inverse DWT*

I. INTRODUCTION

For several decades, remote sensing images have played an important role in many fields such as meteorology, agriculture, geology, education, etc. As the rising demand for high-quality remote sensing images, contrast enhancement techniques are required for better visual perception and color reproduction. Histogram equalization has been the most popular approach to enhancing the contrast in various application areas such as medical image processing, object tracking, speech recognition, etc. HE based methods cannot, however, maintain average brightness level, which may result in either under or over saturation in the processed image. For overcoming these problems, bi-histogram equalization and dualistic sub image HE methods have been proposed by using decomposition of two sub histograms. For further improvement, the recursive mean separate HE method iteratively performs the BHE and produces separately equalized sub histograms. However, the optimal contrast enhancement cannot be achieved since iterations converge to null processing. Recently, the gain controllable clipped HE has been proposed by Kim and Paik the GC-CHE method controls the gain and performs clipped HE for preserving the brightness. Demirel have also proposed a modified HE method which is based on the singular-value decomposition of the LL sub band of the discrete wavelet transform. In spite of the improved contrast of the image, this method tends to distort image details in low-and high intensity regions. In remote sensing images, the common artifacts caused by existing contrast enhancement methods, such as drifting brightness, saturation, and distorted details need to be minimized because pieces of important information are widespread throughout the image in the sense of both spatial locations and intensity levels. For this reason, enhancement algorithms for Satellite images not only improve the contrast but also minimize pixel distortion in the low-and high-intensity regions. To achieve this goal, we present a novel contrast enhancement for remote sensing images using dominant brightness level analysis and adaptive intensity transformation.

II. BLOCK DIAGRAM



III. DWT DECOMPOSITION

In this method discrete wavelet transform input image decomposes into set of band limited components called HH, HL, LH and LL. LL sub band has illumination of low, middle and high intensity layers using the log average luminance. Adaptive intensity transfer function estimation using the knee transfer function, gamma adjustment function based on the dominant brightness level of each layer. After this process the enhanced image obtained by using inverse DWT. This algorithm computes the brightness adaptive intensity transform function using the low frequency luminance component in discrete wavelet domain transform and transfer intensity values according to the transfer function.

IV. ANALYSIS OF DOMINANT BRIGHTNESS LEVEL

In spite of increasing demand for enhancing remote sensing images, existing histogram based contrast enhancement methods cannot preserve edge details and exhibit saturation artifacts in low and high intensity regions. In this section, we present a novel contrast enhancement algorithm for remote sensing images using dominant brightness level based adaptive intensity transformation If we do not consider spatially varying intensity distributions, the correspondingly contrast enhanced images may have intensity distortion and lose image details in some regions. For overcoming these problems, we decompose the input image into multiple layers of single dominant brightness levels. To use the low frequency luminance components, we perform the DWT on the input remote sensing image and then estimate the dominant brightness level using the log average luminance in the LL sub band. Since high intensity values are dominant in the bright region, and vice versa, the dominant brightness at the position (x, y) is computed as

$$D(x, y) = \exp\left(\frac{1}{NL}\sum_{(x,y)\in S}\{\log L(x, y) + \varepsilon\}\right)$$

Where S represents a rectangular region encompassing (x, y), L(x, y) represents the pixel intensity at (x, y), NL presents the total number of pixels in S, and ε represents a sufficiently small constant that prevents the log function from diverging to negative infinity. The decomposed low, middle and high intensity layers are shown in Fig (d)-(f). The low-intensity layer has the dominant brightness lower than the pre specified low bound. The high intensity layer is determined in the similar manner with the pre specified high bound, and the middle-intensity layer has the dominant brightness in between low and high bounds. The normalized dominant brightness varies from zero to one.

V. ADAPTIVE INTENSITY TRANSFORMATION

Adaptive intensity transform function generated Based on the dominant brightness in each decomposed layer since remote sensing images have spatially varying intensity distributions we estimate the optimal transfer function in each brightness range for adaptive contrast enhancement. The adaptive transfer function is estimated by using the knee transfer and the gamma adjustment functions. For the global contrast enhancement, the knee transfer function stretches the low-intensity range by determining knee points according to the dominant brightness of each layer. More specifically, in the low-intensity layer, a single knee point is computed as

$$Pl = bl + wl(bl - ml)$$

where bl represents the low bound, wl represents the tuning parameter, and ml represents the mean of brightness in the low intensity layer

For the high intensity layer, the corresponding knee point is computed as

$$Ph = bh - wh(bh - mh)$$

Where bh represents the high bound, wh represents the tuning parameter, and mh represents the mean brightness in the high intensity layer

In the middle intensity layer, two knee points are computed as

$$Pml = bl - wm(bml - mm) + (Pl - Ph)$$

$$Pmh = bh + wm(bmh - mm) + (Pl - Ph)$$

Where wm represents the tuning parameter and mm represents the mean brightness in the middle intensity layer

Since the knee transfer function tends to distort image details in the low-and high-intensity layers, additional compensation is performed using the gamma adjustment function. The gamma adjustment function is modified from the original version by scaling and translation to incorporate the knee transfer function as

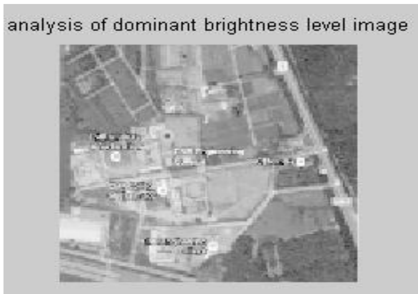
$$G_k(L) = \{(L/M_k)^{1/\gamma} - (1-(L/M_k))^{1/\gamma} + 1\}, \text{ for } k \in \{1, m, h\}$$

Where M represents the size of each section intensity range, such as Ml = bl, Mm = bh −bl, and Mh = 1−bh, L represents the intensity value, and γ represents the pre specified constant. The pre specified constant γ can be used to adjust the local image contrast. As γ increases, the resulting image is saturated around bl/2, bh–bl/2, and 1 –bh/2. Therefore, the γ value is selected by computing maximum values of adaptive transfer function in ranges {0 ≤ L < (bl/2)}, {bl≤ L < (bh–bl/2)}, and {bh≤ L < (1 –bh/2)}, which are smaller than bl/2, bh− bl/2, and 1 − bh/2respectively.

The proposed adaptive transfer function is obtained by combining the knee transfer function and the modified gamma adjustment function as shown in Fig (h).Three intensity transformed layers by using the adaptive intensity transfer function are fused to make the resulting contrast-enhanced image in the wavelet domain. We extract most significant two bits from the low, middle, and high intensity layers for generating the weighting map, and we compute the sum of the two-bit values in each layer. We select two weighting maps that have two largest sums

VI. FIGURES

Fig (a)



Fig(b)

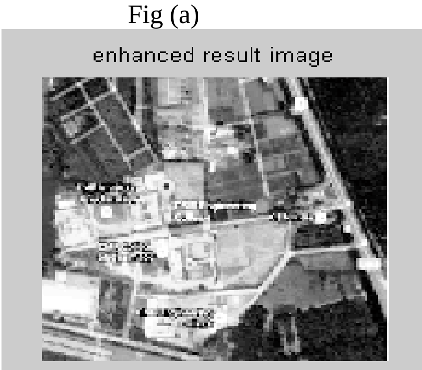
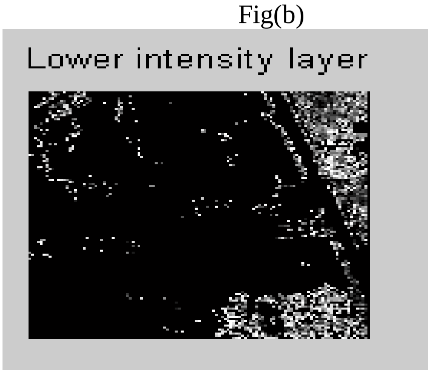


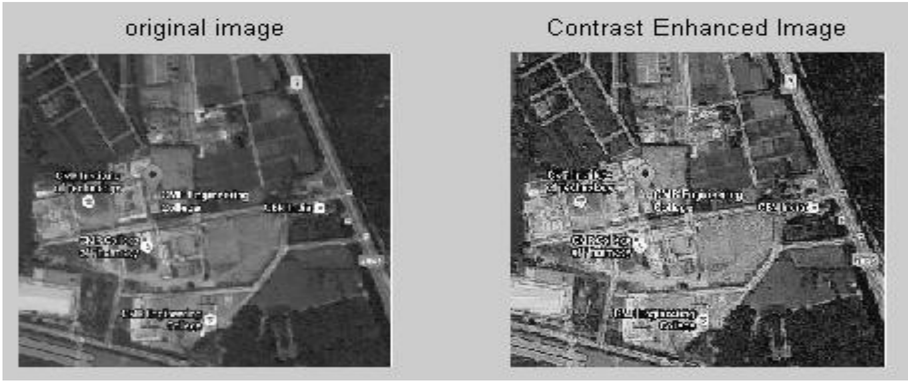
Fig (c)



Fig(d)

Fig(e)

Fig(f)



Fig(g)

Fig1. Image decomposition based on the dominant brightness levels and contrast enhancement results. (a) Original image. (b) Dominant intensity analysis. (c) Enhanced result image. (d) Low intensity layer (e) middle intensity layer (f) high intensity layer (g) Original Image and Contrast enhanced image

VII. CONCLUSION

The project presented the contrast enhancement approach based on dominant brightness level analysis and adaptive intensity transformation for remote sensing images. This algorithm computed brightness-adaptive intensity transfer functions using the low-frequency luminance component in the wavelet domain and transforms intensity values according to the transfer function gamma adjustment function based on the dominant brightness level of each layer. This method proved that an enhances the low quality images with less image distortion and preserves the edge details .

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