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Weighted Correction and Discrete Wavelet based Fusion for Aerial Images

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Abstract

Background/Objectives: The work introduces new image mixture method combining Aerial Images using improved discrete cosine harmonic wavelet transforms (DCHWT). **Methods/Statistical Analysis:** An innovative method is planned that provides better results. Firstly, the input histogram image is converted into many segments and then the proposed method is applied to every segment taken for fusion. The performance of the proposed method is evaluated on the basis of PSNR, SSIM and Execution Time. **Findings:** The method was found to be quite efficient, fast and accurate. **Applications/ Improvements:** Significant improvement in PSNR and SSIM values is observed resulting in improved quality of the Aerial images.

Keywords: DCHWT, PSNR, RSWHE, SSIM, Wavelet

1. Introduction

Aerial imaging is the captivating of photographs of the earth from a prominent site. Generally the ground-based formation is not supported by camera. The platform for aerial imaging consist of helicopters, kites, balloons, fixed-wing aircrafts, stand-alone telescoping and vehicle-mounted poles. The work introduces new image mixture method combining Aerial Images using improved discrete wavelet transforms of aerial images. For change of digital images through a digital computer deal with Digital image processing. It is a part of signals and system but mainly focus on pictures. An image which is two dimensional signal can be defined by the numerical purpose k (i, j) where i, j are two coordinates horizontally & vertically. Amplitude k called intensity or gray level of the image. A given image is said to be digital image when points (i,j) and every single value of are finite ie. Discrete quantities to represent basics of a digital image we used pixel as a term.

Image processing basically consists of the subsequent steps.

- Picture Acquirement
- Pre-processing
- Segmentation
- Representation and Feature mining
- Detection & Interpretation

In the picture acquirement using the appropriate camera, the image is captured and undergoes to digitize. The digicam which is used to obtain the picture can be a neutral or multi-colored have the capacity to produce pictures at 25 imageries per sec.

In second one the preprocessing of captured image. In this the image is to be enhance in such a way that it increases the probability for accomplish of another processes. For enhancing distinction of the image, elimination unwanted noise and dividing the objects the preprocessing techniques is used.

In Segmentation deals with input image is divided into its component parts. In this automatic component classification is used to take out the border of the object from surroundings.

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2. Image Enhancement

Primary aim of image augmentation is to recover the input in such a way that the output image is more proper for interpretation by the human being the same as by machines. It accentuates image characteristics such as contrast, edge & boundaries to build a realistic display which helpful for

scrutiny. The method of image augmentation is based on application specific, such that a method which is appropriate for enhancing images for one type of application might not be suitable for other. Image augmentation can be categorized into two types:

- Spatial province
- Frequency province

In the first one spatial province performed to the picture plane itself and they depend on straight exploitation pixels in a picture. An expression for the above process is given by the equation as follows:

$$p(i,j)=T[k(i,j)] \quad (1.1)$$

Here, k(i,j) is original image, p(i,j) is processed image and T is an operator over area of (i,j).

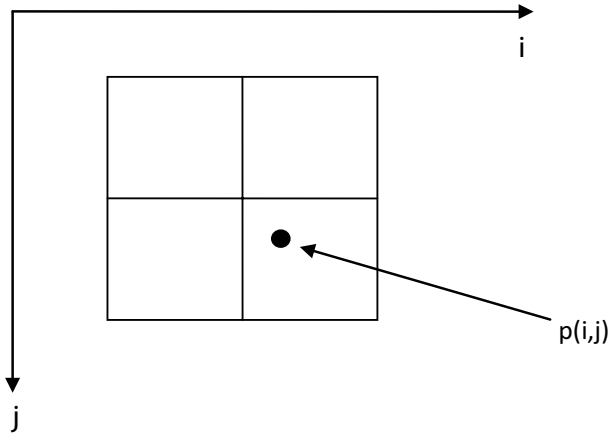

Figure 1.

The primary approach in defining a region about a point *(i,j)* is to use a rectangular sub image or square area centered at *(i,j)*. The center of the sub figure is moved from one pixel to another. The operator *T* is useful to yield the output at that particular location. The minimum possible size of the region is 1 × 1. Here in above Figure 1, neighborhood is *(i,j)* & p(i,j) lying on the value k at (i,j) and T. Eq 1.1 becomes an intensity alteration purpose of form

$$s = T(r) \quad (1.2)$$

where s, r are variables denoting intensity of *k* and *p* at any point *(i,j)*. In this case spatial domain processing called intensity transformation. It is also called gray level transformations[1]. Gray level transformation includes image negatives, log transformation and power law transformation used for image enhancement.

2.1 Image Negatives

Negatives images of various digital images are found useful in the field of medical science and a monochromatic positive film used as normal slides. The transformation rationale *T* is given as

$$p(i,j) = L - k(i,j) \quad (1.3)$$

where, *L* be maximum power

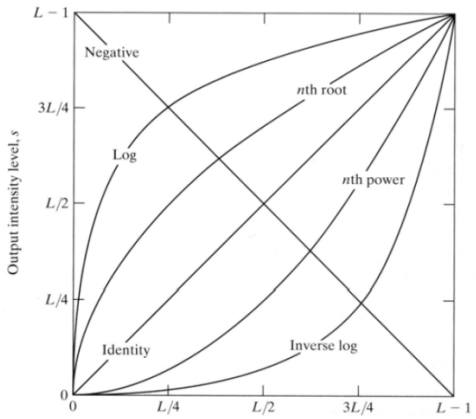

Figure 2. Gray level transformation function used for image enrichment.

As shown in (Figure 2) the intensity level of negative image is in the range[2]. To obtains negative image of photography it simply reverses the intensity levels of an image.

(a)

(b)

Figure 3. (a) represents the original stature and (b) represents negative images.

However, eminence results are obtained for the combination MS and PAN images obtained from various satellites launch post-1999 (e.g. Land sat 7, Quick Bird, IKONOS, and Orb View). This strategy employed fusion technique or color adjustment.

3. Aerial Imaging

Aerial imaging is the captivating of photographs of the earth from a prominent site. Generally the ground-based formation is not supported by camera. The platform for aerial imaging consist of helicopters, kites, balloons, multi-rotor fixed-wing aircraft, stand-alone telescoping and vehicle-mounted poles.. Aerial taking photos and air-to-air photography are two different things; where aircrafts are used as pursue planes.

Figure 4. Example of Aerial Image you can see effect of fog and weather conditions.

In this more than one picture can be taken for aerial cinematography or used as a single picture. Aerial cinematography is somehow classier as compare to panchromatic film; however, in some other situation added cost overcome by amount of additional detail that can be extract from one film as compare to another. Otherwise, the photo scale may not be well-matched with map scale or vertical. When deal with these organizations, customers must believe whatever coverage is available, which either required or not. When such type of request coming from these organizations, it is prudent to offer them a map purposely exactness area of interest.

4. Applications of Image Fusion

- Intellectual robots
- Require control motion based on response from the surroundings are visual, force/torque
- Intellectual screening control
- Automatic target detection and track
- Imaging medical
- Computed Tomography (CT) and Magnetic Resonance (MR) imagery
- Computer assist surgery
- Spatial register of mains surface
- Electronic path and component scrutiny
- Measurement of product surface and scrutiny
- Construction process monitor
- Compound machine/device diagnostic
- Masked weapon detection
- Combat zone monitoring
- Night pilot direction
- Sensing of remote
- Electro-magnetic spectrum
- Fusion techniques are classifying into photographic and numerical method.

5. Related Work

Xiao-Bo Qu et al., 2007 used Non sub sampled contour transform (NSCT) provides shift-invariant can trounce the pseudo-Gibbs phenomenon approximately singularities along with province energy and cousin connection are defined to represent the neighbors and cousins information, respectively[3]. Gangkofner et al. utilized combination of low-high spatial declaration data with high-low spatial declaration optical data[4]. It also improved the High-Pass

Filter Additive (HPFA) fusion method towards a versatile, yet identical image fusion tool. Kumar et al. planned a complete variation come near for pixel-level synthesis to merge imagery acquire by numerous sensors[5]. The possibility of the planned calculations is established on imagery from CT and magnetic resonance along with infrared sensors. Krishnamoorthy et al., collected relevant information from different set of images and combined together to provide the resultant information which is far superior to any other input image[6]. This paper also includes the three types of image synthesis algorithms – the necessary fusion algorithms, pyramid based algorithms and DWT algorithms. Gong et al. used approach of artificial aperture radar images based on an image synthesis plan and a novel fuzzy cluster algorithm[7]. For low and high frequency band wavelet fusion rules and minimum local area energy is used. For reduce the noise and enhancing the image spatial context in a novel fuzzy way is proposed. Sahu et al. provided resultant image which is far better than any set of input images[8]. This paper presents a discussion on some of the image mixture technique for image fusion like Discrete Wavelet transform based fusion, primitive fusion (Averaging Method, Select Maximum, and Select Minimum) and Principal Component Analysis (PCA) based fusion etc. Evaluation of all technique conclude better result for its upcoming research. Yang et al. used image fusion technique that integrates information from different images to form a single image which contains information suitable for human eye[9]. Sparse depiction is used to explores the sparseness of natural signals .Thus, this paper used the signal sparse representation theory. In addition, orthogonal technique is introduced to provide same set of thesaurus bases, which is key to image picture[10].

6. Results Analysis in MATLAB

In this section, a group of images are taken to assess the presentation of the future process we will discuss the tentative consequences produced by two methods. In our results we use qualitative and quantitative analysis are used. Two parameters are selected for measure the quantitative results that are PSNR, SSIM. For image enhancement, these methods are applied to improve various grayscale dimmed aerial imaginary. In our results firstly, we will discuss about the qualitative results and then quantitative results.

We have taken Aerial images as input in our experiment. The main aim of image enhancement is to enhance the quality and visual appearance of an image, or to provide a better transform representation for future automated image processing[11]. It is important to qualitative evaluate the contrast improvement. The important aim of the qualitative evaluate is to judge if the resultant image is visually acceptable to human eyes and has a normal appearance. In order to calculate the performance of two algorithms namely subjective & objective analysis is used. In subjective or qualitative analysis picture enhancement results are analyzed by humans. This is good method for analysis in cases where changes can be detected by the humans. In order to detect small changes and get consistent results some objective or quantitative methods are also used. These objective methods are statistical in nature and help us to measure the performance of PROPOSED and Optimize Alpha algorithms. PSNR and SSIM are the two parameters which are used to measure the quantitative results. The contrast enhancement can be observed by PSNR values[12]. Greater the PSNR significance, better will be the image performance. The SSIM index is a decimal value between 0 and 1. A value of 0 would mean zero correlation with the original image, and 1 means the exact same image. The value of PSNR should be as high as possible and the value of SSIM lie between 0 to 1 in order to get the enhanced image. These parameters are useful to find whether the image is enhanced numerically or not as compared to the other method.

Figure 5 shows qualitatively outcome for aerial 1 (a) unique given image; (b) Result of projected method; (c) Result of Optimize alpha method (RSWHE method) and its quantitative outputs are shown in Table 1. Table 1 shows the comparisons between the PROPOSED and proposed method by using the two parameters- Peak Signal to Noise (PSNR) and Absolute Mean Brightness Error(AMBE).

(a) (b)

(c)

Figure 5. Enhancement results for Aerial_1 image. (a) Original given Image; (b) Result of PROPOSED method; (c) Optimize Adjusted parameter (Optimize Alpha Parameter).

Figure 6. Original image.

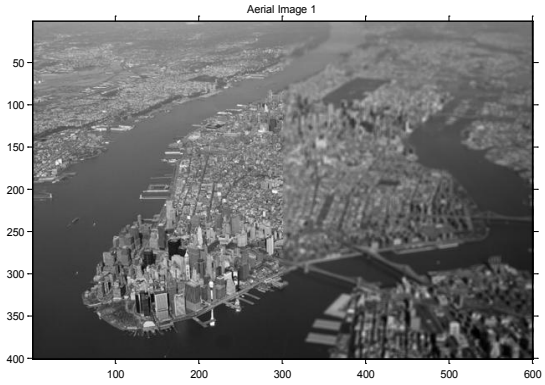

Figure 7. Aerial image with right Side having low intensity and contrast.

Figure 8. Aerial image with blurred left side.

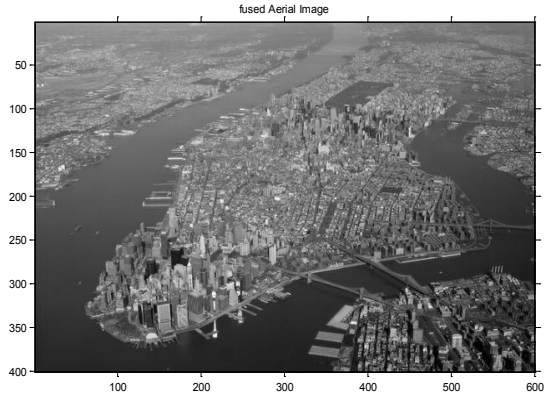

Figure 9. Fused aerial image.

Figure 10. Histogram equalized and improved fused image.

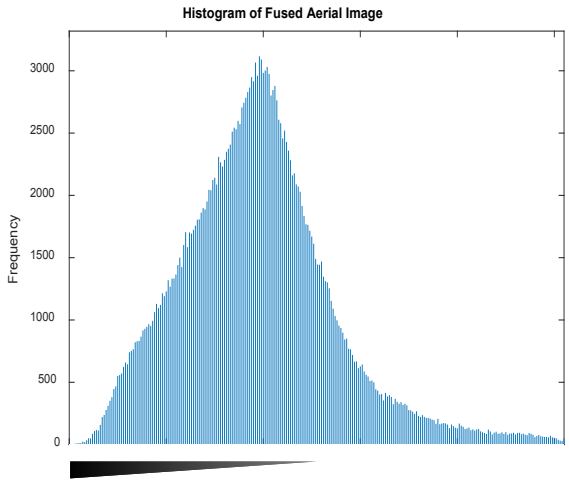

Figure 11. Histogram of fused aerial image.

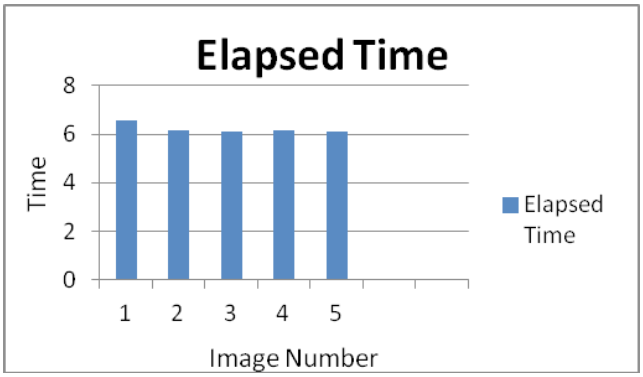

Figure 12. Execution time of various aerial images taken for fusion in proposed method.

It is obvious from the results that method is quite efficient, fast and accurate producing up to 50% improvement in PSNR values in just 5-6 seconds.

7. Conclusion and Future Scope

The function of picture synthesis is to merge information from different sources into single image that ideally contains all relevant information which is acceptable by human being along with machines. At present these schemes can be classified into region & pixel based. Both methods have their own importance in term of implementing the images. Aerial cinematography for map and geographic information scheme project may be described purposely. There is growing accessibility & exploitation of imaging sensors operating in numerous ethereal bands. This work introduces new image mixture method combining Aerial Images using improved discrete wavelet

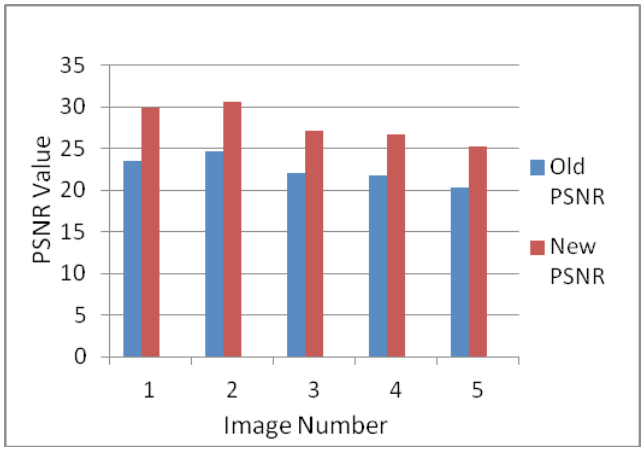

Figure 13. PSNR improvement using proposed fusion process.

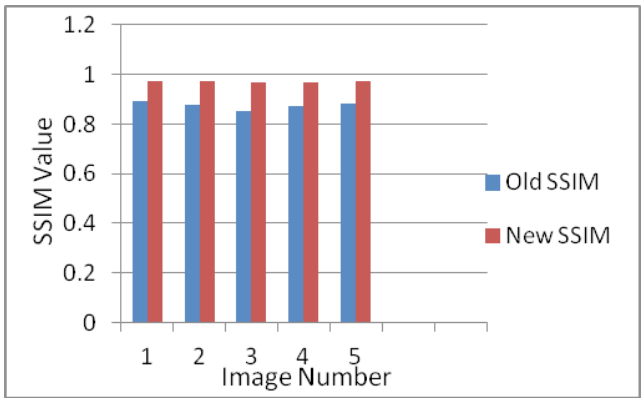

Figure 14. SSIM improvement using proposed fusion process.

Table 1. Comparison table of aerial images

Image/ Fusion Technique (DCHWT)	Elapsed Time (sec)	Old SSIM (db)	New SSIM (db)	Old PSNR (db)	New PSNR (db)
1	6.57158	0.8911	0.9743	23.5420	29.9470
2	6.14537	0.8777	0.9720	24.6276	30.6255
3	6.10742	0.8507	0.9675	22.0420	27.1452
4	6.13603	0.8707	0.9679	21.7388	26.7661
5	6.08773	0.8817	0.9726	20.3833	15.1820

transforms of aerial images. The method was found to be quite efficient, fast and accurate producing up to 50% improvement in PSNR values in just 5-6 seconds.

In future experiments we like to record fixed aerial images, for which specific location of object boundaries with dissimilar cameras will be established unambiguously, together with most favorable situation and to be kept for a longer era of time. For high-quality-labeled semantic reference the available ground images providing distinct semantic images will be utilized together. These allusion limit images will be used to obtain image synthesis schemes for dissimilar cognitive applications. A vigorous image mixture technique may be planned which will be used for fuse loud multi-sensor pictures, where image fusion and demising can be used together.

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