A Literature Survey of Gray Scale Image Contrast Enhancement by Fusion Technology

[1]Vibha Mal, [2]Jaikaran Singh, [3]Ramanad Singh
[1,2,3]Dept. of Electronics and Communication, SSSIST Sehore, RGPV, India

Abstract
In this survey paper we have introduced a literature review on gray scale images contrast enhancement on the basic of image fusion technique. There are different techniques are existing for contrast enhancement but fusion based technique plays a vital role in image enhancement. Because image fusion applicable in various fields like computer vision, remote sensing, intelligent robots and different defense operation in air, earth and also on under water operations. Image Fusion plays an important role for luminance correction, contrast adjustment also sensor or multiple sensor in order to improve its visual appearance. In this literature survey focus on the HIS (Intensity Hue Saturation) Transform, Principle Component Analysis (PCA) Pyramid technique–Laplacian and Gaussian techniques.

Keywords
Fusion, Contrast, PCA, HIS, Remote Sensing.

I. Introduction

In the field of image processing image fusion is one of the burning topic for medical and satellite image enhancement. These are many researches are focused on image fusion with different techniques. A great deal on image fusion based contrast enhancement techniques has been done. It will be useful to analyze the existing method for both gray scale and color images. Which help to do future research? An image is often corrupted during its acquisition or transmission. Many images such as medical images, remote sensing images, and electron-microscopy images even real life photographic picture suffer from poor contrast. Therefore it is necessary to enhance the contrast. Histogram of images provides a global description of the appearance of an image. There are too much work which already done over the topic like image enhancement.

The term fusion in general means, an approach to extract information that is in several domains. The image fusion process is to integrate multisensory or multi-view or multi-focus information into a new image that contains better quality features and is more informative of all the individual input information. Based on the processing levels, image fusion techniques can be divided into different categories. These are pixel level, feature level and symbol level/decision level. Pixel level method is the simplest and widely used method. This method processes pixels in the source image and retains most of the original image information. Compared to other two methods pixel level image fusion gives more accurate results. Feature level method processes the characteristics of the source image. This method can be used with the decision level method to fuse images effectively. Because of the reduced data size, it is easier to compress and transmit the data. The top level of image fusion is decision making level.

II. Back Ground

Image improvement processes are essentially a group of techniques that ask for to enhance the interpretability or perception of images for the human viewers and providing higher input for the automated image process techniques. The principal aim of the image improvement technique is to change the attributes in an image to form it more appropriate for the given task and specific purpose. Throughout the improvement method the amount of attributes to be changed varies from one to more. Digital image improvement techniques offer the wide selection of selections for up the visual quality of image. The appropriate alternative of the technique to be applied is influenced by the image equipment's, task in hand and viewing Merging of various information image is done to enhance the visual and analytical quality of the information.

III. Fusion

The main plan developed here is to use image fusion to mix the helpful properties and suppress the disadvantages of the varied local and global contrast improvement techniques. The fusion-based distinction improvement schemes are summarized in next session below. Image fusion typically involves choosing the foremost informative areas from the supply images and blending these local areas to urge the fused output images.

The foremost necessary issue regarding image fusion is to work out a way to mix the detector images. In recent years, many image fusion techniques are planned [13]. The primitive fusion schemes perform the fusion right the source images. One in every of the only of these image fusion ways simply takes the pixel-by-pixel grey level average of the supply images. This oversimplified approach typically has serious side effects like reducing the distinction.

IV. Type of Fusion

In order to realize optimum fusion results, numerous wavelet-based fusion schemes had been tested by several researchers. during this review, a couple of new concepts/algorithms of the higher than scheme are discussed.

A. Intensity-hue-saturation (IHS) Tranform Based Fusion

It is an improved Intensity-Hue-Saturation methodology for IKONOS Image Fusion. this system is employed in various applications of remote sensing involves the fusion of panchromatic (Pan) and multispectral (MS) satellite images. The fusion of a panchromatic (Pan) image with a high special and low spectral resolution or multispectral (MS) images with a low special and high spectral resolution has become a robust tool in several remote sensing applications that need each high spacial and high spectral resolution, like feature detection, modification watching, urban analysis, land cover classification, and recently GIS-based applications.
In general, the IHS fusion based converts a color image from the red, green, and blue (RGB) area into the IHS color space. The intensity (I) band within the IHS area is replaced by a high-resolution Pan image so transformed back to the first RGB space at the side of the previous hue (H) band and therefore the saturation (S) band, leading to an IHS fused image. but the IHS methodology are often simply enforced by the procedure during which the fused pictures are often obtained by adding the difference image between Pan and i images to the MS images, severally. This methodology is termed the quick IHS fusion methodology.

Steps for getting IHS rework fusion image:

- The IHS fusion for every element are often formulated.
- The intensity component I is replaced by the Pan image.
- The fused image [F(R); F(G); F(B)]T are often simply obtained from the first image [R;G;B]T just by exploitation addition operations.

B. Principal Component Analysis (PCA) Based Fusion

PCA could be a mathematical tool that transforms variety of related variables into variety of unrelated variables. The PCA is employed extensively in compression and image classification. The PCA involves a mathematical procedure that transforms variety of related variables into variety of unrelated variables known as principal elements. It computes a compact and optimum description of the info set. In [7], exploitation PCA algorithmic rule, color elements are thought of as options from that a representative set springs. This system is employed to cut back variety the quantity of elements to a little number of elements supported the individual weights of the corresponding Eigen values. an elliptical model classifier is employed for classification of skin and non-skin pixels for skin detection. For face recognition, the necessary step is to pick the options [8]. The foremost extensively used classifier is principal part analysis that serves two purposes: feature extraction and classification or recognition. It's one in every of the extensively used classifiers that has low time complexness. Feature extraction from human faces exploitation PCA [9], proposes facial feature extraction step before playing PCA analysis that helps to deal with 2 needs for this technique. Firstly, the hunt for faces doesn't have to be compelled to be disbursed at each element location within the image since a little search area are often obtained exploitation the detected facial feature points. Secondly, the face detection method are often disbursed in one cycle over a normalized search area, thereby avoiding the need of process the image at multiple scales.

C. Multi Scale Transform Based Fusion Brovey Transform

Pixel level image fusion is finished by exploitation Brovey transform. Brovey per-forms a transformation component three multispectral and therefore the panchromatic satellite image scene channels. Brovey rework is additionally known as the color standard-isation rework as a result of it involves a red-green- blue (RGB) color transform methodology. The Brovey transformation was developed to avoid the disadvantages of the increasing methodology. It's a simple method-ology for combining information from completely different sensors. It a mix of arithmetic operations and normalizes the spectral bands before they're increased with the panchromatic image. It retains the corresponding spectral feature of every element, and transforms all the luminousness information into a panchromatic image of high resolution.

D. High-Pass Filtering

High-pass and low-pass filters also are employed in digital image process to perform image modifications, enhancements, noise reduction, etc., exploitation styles worn out either the spacial domain or the frequency domain. A high-pass filter, if the imaging software system doesn't have, one are often done by duplicating the layer, putting a gaussian blur, inverting, so mixing with the first layer exploitation capability (say 50%) . The unsharp masking, or sharpening, operation employed in image writing software could be a high-boost filter, a generalization of high- pass filtering scheme.

E. Image Pyramid Approaches

An image pyramid consists of a group of low pass or band pass copies of an image, every copy representing pattern data of a different scale. Typically, in an image pyramid each level could be a issue 2 smaller as its predecessor, and therefore the higher levels can target the lower spacial frequencies. a picture pyramid will contain all the knowledge required to reconstruct the first image.

1. Gaussian Pyramid

The mathematician pyramid consists of low-pass filtered, reduced density (i.e., down sampled) Gaussian of the preceding level of the pyramid, wherever the bottom level is defined because the original image. The technique involves making a series of images that are full using a gaussian average and scaled down. once this technique is employed multiple times, it creates a stack of in turn smaller images, with every element containing a local average that corresponds to a element neighborhood on a lower level of the pyramid.

2. Laplacian Pyramid Fusion

Laplacian pyramid (fundamental tool in image processing) of an image could be a set of band pass images; during which each is a band pass filtered copy of its predecessor. Band pass copies are often obtained by calculating the distinction between low pass images at successive levels of a gaussian pyramid. during this approach, the Laplacian pyramids for every image component (IR and Visible) are used. A strength live is employed to determine from that supply what pixels contribute at every specific sample location. Take the common of the two pyramids such as every level and add them. The ensuing image is easy average of two low resolution images at every level. secret writing of an image is finished by increasing, then summing all the levels of the fused pyramid that is obtained by easy averaging. The Laplacian pyramid is derived from the gaussian pyramid illustration, that is largely a sequence of more and more filtered and down-sampled versions of an image. the method of face detection is accomplished by exploitation easy and economical algorithmic rule for multi-focus image fusion known as Laplacian pyramid algorithmic rule. Multi- resolution signal decomposition theme is with efficiency used for any applications like gestures, texture, create and lighting conditions whereas taking an image [1]. a form of fusion approach is extremely useful for applications like Hand Gesture. Hand gestures play a major role in Human computer Interaction. They function primary interaction tools for gesture based mostly computer management [2].

F. Fusion in Wavelet Domain

Wavelet transform is considered as an alternative to the short time Fourier transforms. It's advantageous over Fourier transform in this it provides desired resolution in time domain yet as in frequency domain whereas Fourier rework offers an honest resolution in precisely frequency domain. In Fourier transform, the signal is decomposed into sine waves of various frequencies whereas the wavelet transform decomposes the signal into scaled and shifted styles of the mother wavelet or function. Within the image fusion exploitation rippling rework, the input images are decomposed into approximate and informative coefficients exploitation DWT at some specific level. A fusion rule is applied to mix these two coefficients and therefore the resultant image is obtained by taking the inverse rippling rework [10]

G. Discrete Cosine wave Transform Fusion

Discrete cosine transform has found importance for the compressed pictures in the form of MPEG, JVT etc. By taking discrete cosine transform, the spatial domain image is converted into the frequency domain image. Chu-Hui Lee and Zheng-Wei Zhou dynasty have divided the images into three components as low frequency, medium frequency and high frequency. Average illumination is diagrammatic by the DC value and therefore the AC values are the coefficients of high frequency. The RGB image is split into the blocks of with the scale of 8*8 pixels. The image is then sorted by the matrices of red, green and blue and transformed to the greyscale image.

The two Dimensional discrete cosine second transform is then applied on the greyscale image. The frequency of the greyscale block is regenerate from the spacial domain to frequency domain. Once the DCT coefficients are calculated, fused DCT coefficients are obtained by applying the fusion rule. By taking inverse DCT, the fused image is obtained. DCT based mostly ways are more reliable in terms of time and thence they're helpful in real time systems. DCT coefficients show energy compactness as a result of all DCT coefficients are brought along within the low frequency zone. It gives real results once the real time information is given as an input [9].

V. Conclusion

It has has been found that the quality fusion ways perform well spatially however typically introduce spectral distortion. to beat this downside, varied multi- scale transform based fusion schemes are planned. attributable to the various multi-scale rework, completely different fusion rules are planned for various functions and applications. For methods like HIS, PCA and Brovey rework, that have lower completeness and quicker time interval, the foremost important downside is color distortion. Wavelet- based mostly schemes perform higher than those ways in terms of minimizing color distortion. the event of more refined wavelet-based fusion algorithms (such as Curvelet, and Contourlet transformation) may improve performance result, however they typically cause larger completeness in computation and parameters setting.

Image quality are often evaluated by suggests that of quantitative measures like Root mean square error (RMSE) Entropy, peak signal to noise magnitude relation then on. It's necessary to judge matrices for combining images without introducing some form of distortion.

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