Image Fusion using HIS, PCA and Wavelet Technique

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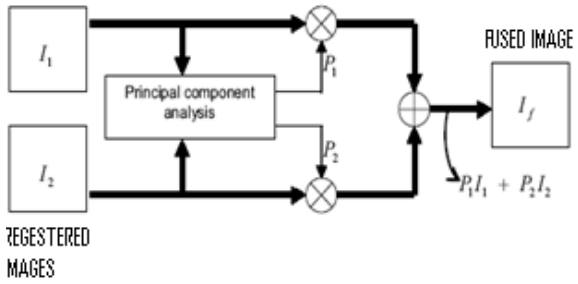
Abstract: **Image Fusion is a process of combining the relevant information from a set of images into a single image, where the resultant fused image will be more informative and complete than any of the input images. Image fusion techniques can improve the quality and increase the application of these data. This paper presents a literature review on some of the image fusion techniques for image fusion like, Wavelet transform based fusion, and Principal component analysis (PCA) based fusion and HIS technique. In this wavelet transform of different images are appropriately combined by taking inverse wavelet transform of fused wavelet coefficients. Max. area selection rule & consistency verification step are used for feature selection. The Intensity Hue Saturation transformation, a method mainly used for merging multi resolution and multispectral data and for contrast stretching applications, has never been applied. In this study, a method is presented by which transforming the RGB values of a three channel composite to HIS values.**

Keywords: **Dct, mean square erroe, peak signal to noise ratio, HIS and PCA**

I INTRODUCTION

Fusion (also called synthesis) is the process of combining two or more distinct entities into a new whole. Image fusion is the process of combining relevant information from two or more images into a single image. The resulting image will be more informative than any of the input images. With rapid advancements in technology, it is now possible to obtain information from multi source images to produce a high quality fused image with spatial and spectral information. Image Fusion is a mechanism to improve the quality of information from a set of images. Important applications of the fusion of images include medical imaging, microscopic imaging, remote sensing, computer vision, and robotics. Use of the Simple primitive technique will not recover good fused image in terms of performance parameter like peak signal to noise ratio (PSNR), Normalized correlation (NC), and Mean square error (MSE). Recently, Discrete Wavelet Transform (DWT) and Principal Component Analysis (PCA), Morphologial processing and Combination of DWT with PCA and Morphological techniques have been popular fusion of image. These methods are shown to perform much better than simple averaging max and min. The purpose of this paper is to demonstrate an image enhancement technique for easy, rapid & effective mapping of investigating areas, separating the needed spectral information into one new component.



II IMAGE FUSION TECHNIQUES

Resultant image whose quality is superior to any of the input images .Image fusion method can be broadly classified into two groups

1. Spatial domain fusion method.
2. Transform domain fusion.

In spatial domain techniques, we directly deal with the image pixels. The pixel values are manipulated to achieve desired result. In frequency domain methods the image is first transferred in to frequency domain. It means that the Fourier Transform of the image is computed first. All the Fusion operations are performed on the Fourier transform of the image and then the Inverse Fourier transform is performed to get the resultant image. The fusion methods such as averaging, principal component analysis (PCA) and IHS based methods fall under spatial domain approaches. The disadvantage of spatial domain approaches is that they produce spatial distortion in the fused image.

Wavelet transform:-

A multi resolution decomposition of an image in a bi orthogonal basis and results in non redundant image representation. This basis is called wavelets. First the images are transformed to the wavelet domain with the function

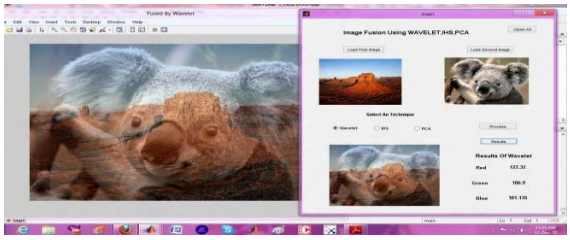
wfusimg(), where the number of scales, the wavelet filter and the edge handling are specified .Then, a decision mask is built in the same way as it was explained in the Laplacian fusion implementation. The next step is carried out by constructing the fused transformed image with this decision mask. Finally, the fused image is obtained by applying an inverse wavelet transform.

Fusion rules schemes implemented using wavlet transform:

Maximum selection (MS) scheme:
This simple scheme just picks the coefficient in each sub band with the largest magnitude.

Weighted average (WA) scheme:
This scheme developed by Burt and Kolczynski uses a normalized correlation between the two images" sub bands over a small local area. The Resultant coefficient for reconstruction is calculated from this measure via a weighted average of the two images" coefficients;

Window based verification (WBV) scheme:
This scheme developed by Li et al. creates a binary decision map to choose between each pair of coefficients using a majority filter.



HIS technique:-

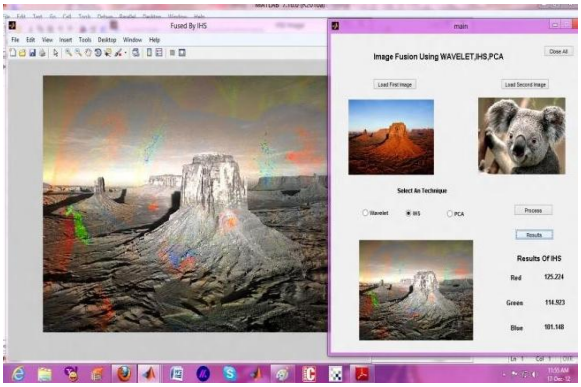
The IHS technique is a standard procedure in image fusion, with the major limitation that only three bands are involved. Originally, it was based on the RGB true color space. It offers the advantage that the separate channels outline certain color properties, namely intensity (I), hue (H), and saturation (S). This specific color space is often chosen because the visual cognitive system of human beings tends to treat these three components as roughly orthogonal perceptual axes. However, in remote sensing, arbitrary bands are usually assigned to the RGB channels to produce false color composites for display purposes only.

Four steps used in HIS:

1. Transform the red, green, and blue (RGB) channels (corresponding to three multispectral bands) to IHS components.
2. Match the histogram of the panchromatic image with the intensity component.
3. Replace the intensity component with the stretched panchromatic image; and
4. Inverse transform IHS channels to RGB channels. The resultant color composite will then have a higher spatial resolution in terms of topographic texture information.

Features of HIS technique

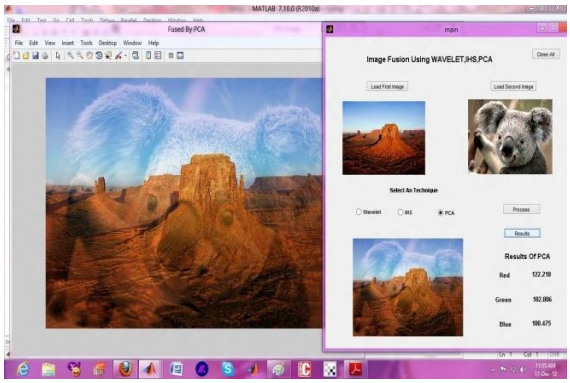
1. It does not require radiometric corrections or radiometric enhancements.
2. It does not require the assessment of training areas.
3. It produces a new data set in which the burned areas are well discriminated.
4. Confusion between burned areas and other land cover land use categories, such as shadows, urban areas, and water bodies is eliminated.



PCA technique:-

The first principal component image contains the information that is common to all the bands used as input to PCA, while the spectral information that is unique to any of the bands is mapped to the other components. Then, similar to the IHS method, the first principal component (PC1) is replaced by the HRPI, which is first stretched to have the same mean and variance as PC1.As a last step, the HRMIs are determined by performing the inverse PCA transform. In data sets with many variables, groups of variables often move together. One reason for this is that more than one variable might be measuring the same driving principle governing the behavior of the system. In many systems there are only a few such driving forces. But an abundance of instrumentation enables you to measure dozens of system variables. When this happens, you can take advantage of this redundancy of

information. You can simplify the problem by replacing a group of variables with a single new variable. Principal component analysis is a quantitatively rigorous method for achieving this simplification. The method generates a new set of variables, called principal components. Each principal component is a linear combination of the original variables. All the principal components are orthogonal to each other, so there is no redundant information. The principal components as a whole form an orthogonal basis for the space of the data. There are an infinite number of ways to construct an orthogonal basis for several columns of data.



III CONCLUSION

Selection of fusion algorithm is problem dependent but this review results that spatial domain provide high spatial resolution. But spatial domain have image blurring problem. So The Wavelet transforms is the very good technique for the image fusion provide a high quality spectral content. It includes the review of various fusion techniques .now further it can be done by combination of wavelet technique, PCA technique and HIS Technique and comparison will be made on different parameters.

IV REFERENCES

[1] Deepali A.Godse, Dattatraya S. Bormane (2011)"Wavelet based image fusion using pixel based maximum selection rule" International Journal of Engineering Science and Technology (IJEST), Vol. 3 No. 7 July 2011, ISSN : 09755462.

[2] Susmitha Vekkot, and Pancham Shukla "A Novel Architecture for Wavelet based Image Fusion". World Academy of Science, Engineering and Technology 57 2009.

[3] L.Wald, "Some terms of reference in data fusion," IEEE Trans. Geosci.Remote Sens.
, vol.37, no. 3, pp. 1190–1193, May 1999.

[4] Ravi K. Sharma, Probabilistic Mode-based Multisensor Image Fusion. PhD thesis, Oregon Graduate Institute of Science and
Technology, Portland, Oregon, 1999.

[5] BogdanJ. Matuszewski, Lik-Kwan Shark, Martin R. Varley, Region-Based Wavelet Fusion Of Ultrasonic, Radiographic And Shearographyc Non-Destructive TestingImages 15th World Conference WCNDT, 15 21 October 2000, Rome.

[6] J. Zhou, D. L. Civco, and J. A. Silander, "A wavelet transform method tomerge Landsat TM and SPOT panchromatic data," Int. J. Remote Sens.vol. 19, no. 4, pp. 743-757, 1998.