IMPLEMENTATION OF HYBRID MODEL, FOR FUSION OF MOVABLE DIGITAL IMAGE

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ABSTRACT

Image fusion is the process of combining the relevant information from a set of images into a single image and improves the quality of the images. In this paper results are obtained by using three fusion techniques (Principle component analysis (PCA), Intensity Hue saturation (IHS), wavelet transform) separately, and hybrid model is proposed and implemented using MATLAB software. Parameters pixel values(RGB) & correlation coefficient of all three techniques is compared with hybrid model and better results are obtained from hybrid model as compare to single fusion technique.

Keywords: IHS, PCA, RGB.

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INTRODUCTION

The concept of data fusion was developed in 1950's and 1960's, with the search for practical methods of merging images from various sensors to provide a composite image which could be used to better identify natural and manmade objects. 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.

Methods of Image Fusion

Image fusion methods can be broadly classified into two groups - spatial domain fusion and transform domain fusion. The fusion methods such as averaging, Brovey method, 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. Spectral distortion becomes a negative factor while we go for further processing, such as classification problem. Spatial distortion can be very well handled by frequency domain approaches on image fusion. The multi resolution analysis has become a very useful tool for analyzing remote sensing images. The discrete wavelet transform has become a very useful tool for fusion.

The images used in image fusion should already be registered. Misregistration is a major source of error in image fusion. **[9].**Some well-known image fusion methods are:

- IHS transform based image fusion
- PCA based image fusion
- Multi scale transform based fusion:-

(a) High-pass filtering method

(b) Pyramid method:-(i) Gaussian pyramid (ii) Laplacian Pyramid (iii) Gradient pyramid (iv) Morphological pyramid (v) Ratio of low pass pyramid

(c) Wavelet transform image fusion (i) Discrete wavelet transforms (DWT) (ii) Stationary wavelet transforms (iii) Multi-wavelet transforms (d) Curvelet transforms pair-wise spatial frequency matching.

Intensity Hue saturation based image fusion (IHS)

The IHS transform effectively transforms an image from low resolution Red-Green-Blue (RGB) domain into spatial (I) and spectral (H, S) information. The intensity component of the IHS space is then replaced by the high-resolution panchromatic image and transformed back into the original RGB space with previous H and S components.

Principle of component analysis (PCA)

Principal component analysis is a statistical analysis for dimension reduction. It basically projects data from its original space to its Eigen space to increase the variance and reduce the covariance by retaining the components corresponding to the largest Eigen values and discarding other components. PCA helps to reduce redundant information and highlight the components with biggest influence so as to increase the signal-to-noise ratio.

PCA is also a linear transformation that is easy to be implemented for applications in which huge amount of data is to be analyzed. PCA is widely used in data compression and pattern matching by expressing the data in a way to highlight the similarities and differences without much loss of information.

Wavelet Transform

Wavelet transform is used to decompose the input image into pyramidal coefficients of low pass and high pass sub bands. The approximate detail coefficients can be calculated with pyramidal algorithms. The two dimensional signal can be represented in terms of these coefficients. The original principle of wavelet Image fusion is to get the best resolution without altering the spectral contents of the image. **[2]**

Typical wavelets for image fusion are usually dyadic in image space. Hence image size is often limited to power of 2.

PROPOSED WORK

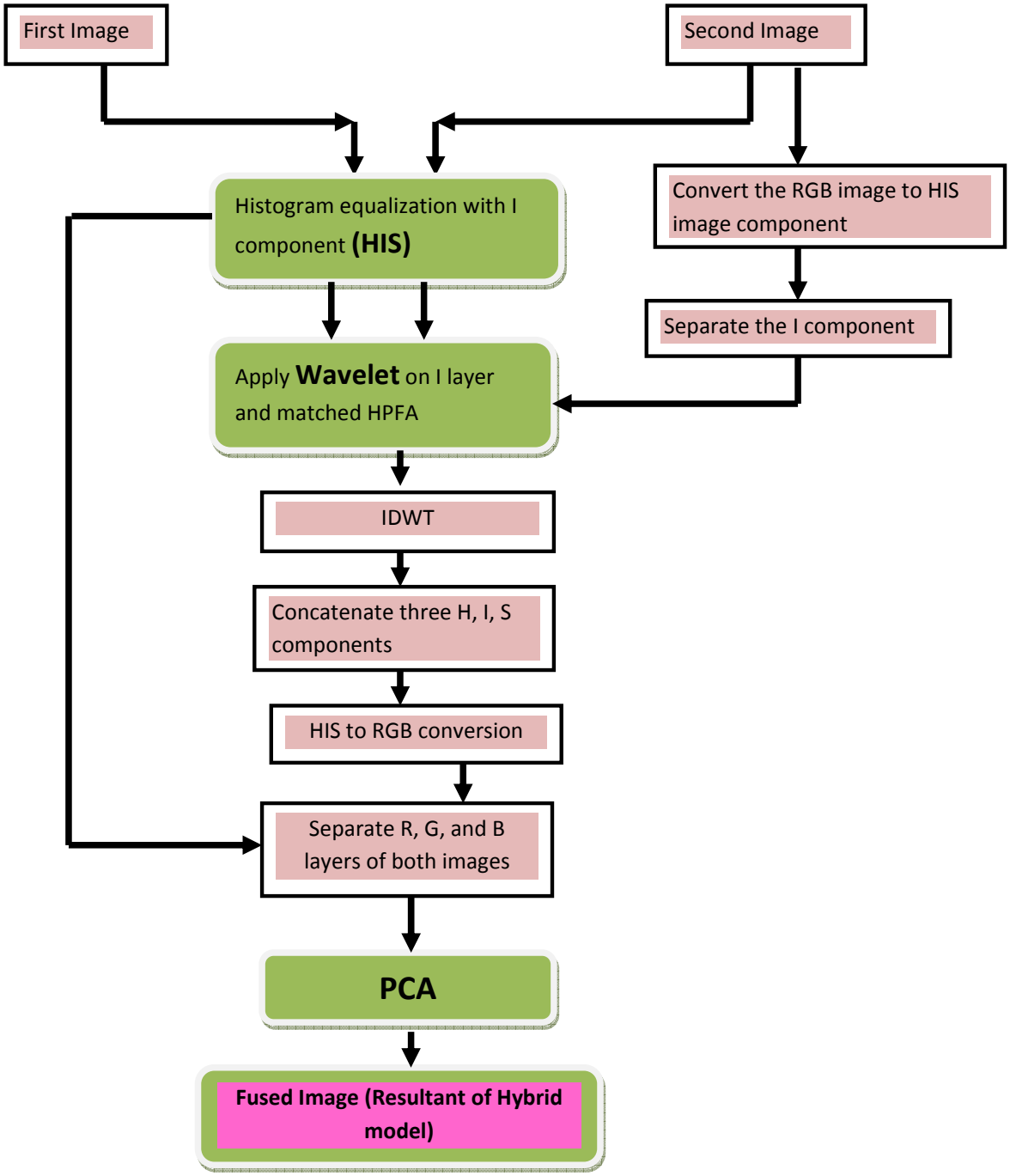
Simulation of Proposed model is done by using Image Processing tool of MATLAB software. MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming environment. Furthermore, MATLAB is a modern programming language environment: it has sophisticated data structures, contains built-in editing and debugging tools, and supports object-oriented programming. These factors make MATLAB an excellent tool for teaching and research. MATLAB has many advantages compared to conventional computer languages (e.g., C, FORTRAN) for solving technical problems.

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. It is always recognized as one of the leading programs for linear algebra It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use graphics commands that make the visualization of results immediately available. Specific applications are collected in packages referred to as toolbox. There are toolboxes field processing, symbolic computation, control theory, simulation, optimization, and several other fields of applied science and engineering.

Proposed Hybrid Model

In this model a combination of all three (PCA, IHS, Wavelet) techniques is used and implied on the fusion of images for better results.

Flow chart for the Hybrid Model



RESULTS AND CONCLUSION

The results of simulation are compared with the help of parameters RGB pixel values and correlation coefficients of all the three techniques (PCA, IHS, and Wavelet) and hybrid

model. Results are shown with help of figures and tables to compare the parameters. Better results are obtained from hybrid model as compared to single fusion technique. For the display of results the Bar graphs are plotted with the help of MATLAB. The two input images are taken which are to be fused together:

Figure 1: First input image

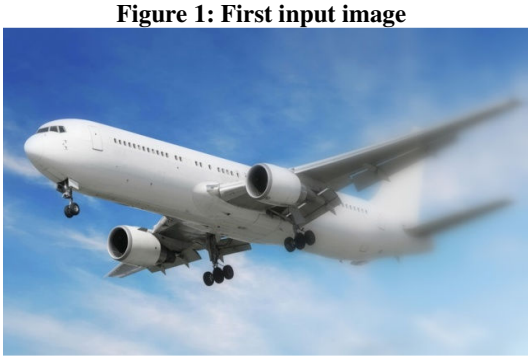


Figure 2: Second input image

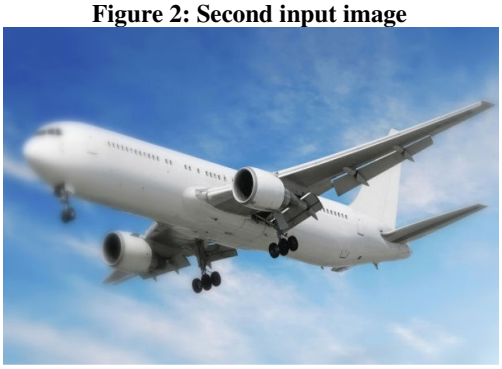
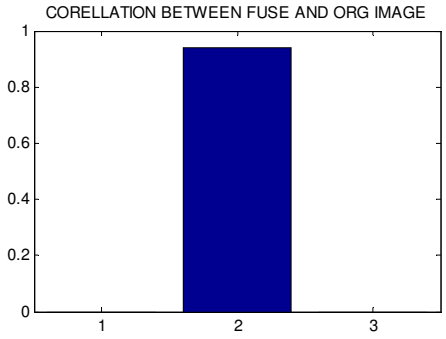


Figure 3: Resultant Image of HIS fusion

Figure 4: Graph showing correlation after HIS fusion



HIS Fusion:

After the simulation the results obtained for HIS fusion are as follows:

Correlation coefficient of original images – **0.98**

Value of Red pixels- **130.0567**

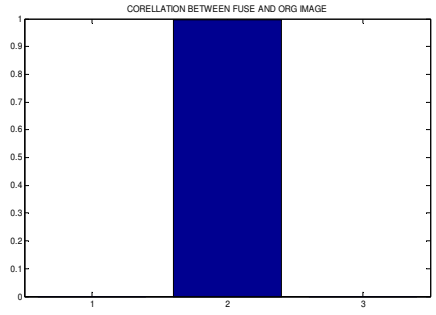
Value of Green pixels- **157.1291**

Value of Blue pixels- **186.1948**

Correlation coefficient- **0.94128**

Figure 5: Resultant Image of wavelet fusion

Figure 6: Graph showing correlation after Wavelet fusion



WAVELET Fusion:

After the simulation the results obtained for Wavelet fusion are as follows:

Correlation coefficient of original images – **0.98**

Value of Red pixels- **127.7432**

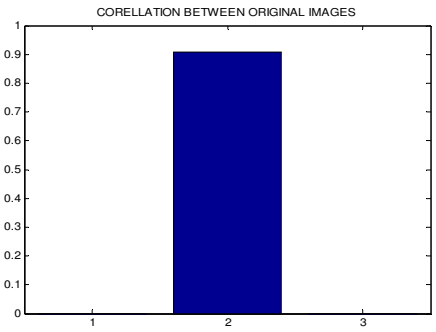
Value of Green pixels- **156.6992**

Value of Blue pixels- **188.7242**

Correlation coefficient- **0.9952**

Figure 7: Resultant Image of PCA fusion

Figure 8: Graph showing correlation after PCA fusion



PCA Fusion:

After the simulation the results obtained for PCA fusion are as follows:

Correlation coefficient of original images – **0.98**

Value of Red pixels- **127.7087**

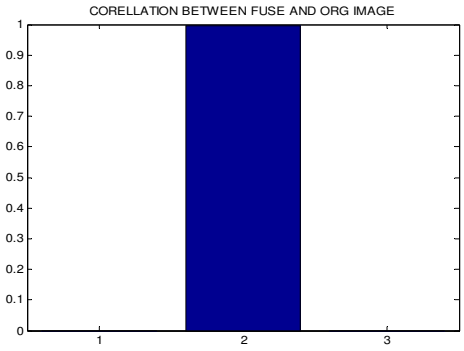
Value of Green pixels- **156.7086**

Value of Blue pixels- **188.788**

Correlation coefficient- **0.99**

Figure 9: Resultant Image of proposed hybrid fusion

Figure 10: Graph showing correlation after proposed hybrid fusion



Proposed Hybrid Fusion:

After the simulation the results obtained for PCA fusion are as follows:

Correlation coefficient of original images – **0.98**

Value of Red pixels- **159.559**

Value of Green pixels- **164.9487**

Value of Blue pixels- **191.4891**

Correlation coefficient- **0.99595**

Among all three techniques if examined individually the PCA fusion techniques gives better results and if all three techniques are combined together i.e the proposed Hybrid model gives the best results.

Table 1: showing the summary of the results obtained

S.NO	Red Pixels	Green Pixels	Blue Pixels	Correlation Coefficient
HIS	130.0567	157.1291	186.1948	0.94128
Wavelet(DWT)	127.7432	156.6992	188.7242	0.995
PCA	127.7087	156.7086	188.788	0.99
Proposed(HIS+ DWT+PCA)	159.559	164.9487	191.4891	0.99595

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