

# Image Fusion using Hybrid Technique (PCA + SWT)

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## Abstract

Image fusion is to reduce uncertainty and minimize redundancy. It is a process of combining the relevant information from a set of images, into a single image, wherein the resultant fused image will be more informative and complete than any of the input images. Till date the image fusion techniques were like DWT or pixel based. These conventional techniques were not that efficient and they did not produced the expected results as the edge preservance, spatial resolution and the shift invariance are the factors that could not be avoided during image fusion. This paper discusses the implementation of two categories of image fusion. The Stationary wavelet transform (SWT), and Principal component analysis (PCA). The Stationary wavelet transform (SWT) is a wavelet transform algorithm designed to overcome the lack of translation-invariance of the discrete wavelet transform (DWT). Whereas The Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. To overcome the disadvantages of the earlier techniques used for image fusion a new hybrid technique is proposed that works by combining the SWT and PCA i.e. stationery wavelet transform and principal component analysis. This hybrid technique is proposed to obtain a better efficient and a better quality fused image which will have preserved edges and its spatial resolution and shift invariance will be improved. This hybrid technique will produce better fusion results. The image obtained after fusion using proposed technique will be of better quality than the images fused using conventional techniques.

**Keywords:** Image fusion, Wavelet Transform image fusion, IHS transform image fusion , PCA transform image fusion .

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## 1. Introduction

In computer vision, Multisensory 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. In remote sensing applications, the increasing availability of space borne sensors gives a motivation for different image fusion

algorithms. Several situations in image processing require high spatial and high spectral resolution in a single image. Most of the available equipment is not capable of providing such data convincingly. The image fusion techniques allow the integration of different information sources. The fused image can have complementary spatial and spectral resolution characteristics. However, the standard image

fusion techniques can distort the spectral information of the multispectral data while merging.

Some well-known image fusion methods are:

- IHS transform based image fusion
- PCA based image fusion
- Wavelet transform image fusion

### 1.1. Wavelet Transform image fusion

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 fusing (), 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.

### 1.2. IHS transform image fusion

The IHS technique is a standard procedure in image fusion, with the major limitation that only three bands are involved [3]. 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.

### 1.3. PCA transform image fusion

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.

## 2. LITERTURE SURVEY

### 2.1. Wavelet for Image Fusion , Shih-Gu Huang.

Image fusion is the process that combines information from multiple images of the same scene. The result of image fusion is a new image that retains the most desirable information and characteristics of each input image. The main application of image fusion is merging the gray-level high-resolution panchromatic image and the colored low-resolution multispectral image. It has been found that the standard fusion methods perform well spatially but usually introduce spectral distortion. To overcome this problem, numerous multiscale transform based fusion schemes have been proposed. In this paper, we focus on the fusion methods based on the discrete wavelet transform (DWT), the most popular tool for image processing. Due to the numerous multiscale transform, different fusion rules have been proposed for different purpose and applications. In this paper, experiment results of several applications and comparisons between different fusion schemes and rules are addressed.

### 2.2. Discrete Wavelet Transform and Canny Operator, Ai Deng, Choosing one reliable and effective fusion method to determine fusion coefficients is the key of the image fusion. This text puts forwards a new algorithm based on discrete wavelet transform (DWT) and canny operator from the perspective of the edge detection. First make original images multi-scale decomposed using DWT, and then acquire the level, vertical as well as diagonal edge information by detecting low-frequency and high-frequency components' edges. Whereafter carry out a comparison of the energy of each pixel and consistency verification to more accurately determine the edge points and ensure the

clarity of the fusion image. The comparison between the traditional method and this new method is made from the three aspects: independent factors, united factors and comprehensive evaluation. The experiment proved the usefulness of the method, which is able to keep the edges and obtain better visual effect.

### 2.3. The IHS Transformations Based Image Fusion

**Firouz Abdullah Al-Wassai.** The IHS sharpening technique is one of the most commonly used techniques for sharpening. Different transformations have been developed to transfer a color image from the RGB space to the IHS space. Through literature, it appears that, various scientists proposed alternative IHS transformations and many papers have reported good results whereas others show bad ones as will as not those obtained which the formula of IHS transformation were used. In addition to that, many papers show different formulas of transformation matrix such as IHS transformation. This leads to confusion what is the exact formula of the IHS transformation?. Therefore, the main purpose of this work is to explore different IHS transformation techniques and experiment it as IHS based image fusion. The image fusion performance was evaluated, in this study, using various methods to estimate the quality and degree of information improvement of a fused image quantitatively.

### 2.4. Isha Mehra and Naveen K. Nishchal,

Image fusion is a popular method which provides better quality fused image for interpreting the image data. In this paper, color image fusion using wavelet transform is applied for

securing data through asymmetric encryption scheme and image hiding. The components of a color image corresponding to different wavelengths (red, green, and blue) are fused together using discrete wavelet transform for obtaining a better quality retrieved color image. The fused color components are encrypted using amplitude- and phase-truncation approach in Fresnel transform domain. Also, the individual color components are transformed into different cover images in order to result disguising information of input image to an attacker. Asymmetric keys, Fresnel propagation parameters, weighing factor, and three cover images provide enlarged key space and hence enhanced security. Computer simulation results support the idea of the proposed fused color image encryption scheme.

### 3. PROBLEM FORMULATION

PCA and HIS were not so efficient and had numerous limitations. Thus to overcome them a new enhancement is made. The main disadvantage of Pixel level method is that this method does not give guarantee to have a clear objects from the set of images.

But in PCA spatial domain fusion may produce. These method are complex in fusion algorithm. Required good fusion technique for better result and final fused image has a less spatial resolution.

To overcome all the issues a new implementation is done using mixture of techniques. In our thesis we are going to implement image fusion using two techniques combine. It is hybrid methodology of PCA and wavelet technique.

As image fusion is very helpful technique for merging information of multiple sensors. So many algorithm has been propose as per latest literature review an approach for combining techniques of wavelet and PCA has been introduced. In this thesis we are going to propose a new hybrid approach which will have the combination of Two techniques i.e.

- Wavelet transform image fusion
- PCA image fusion

We will implement a hybrid approach and will analysis the results on basis of mean color contents and correlation between original and resulted images.

### 4. Objectives

The objectives of this topic are:

- To hybrid the two main techniques of image fusion (PCA + SWT).
- To get the fused image with less possible changes in the pixels and resolution of the images.
- To get the better result after fusing the images.
- To calculate the results based on two parameters correlation and RGB contents.

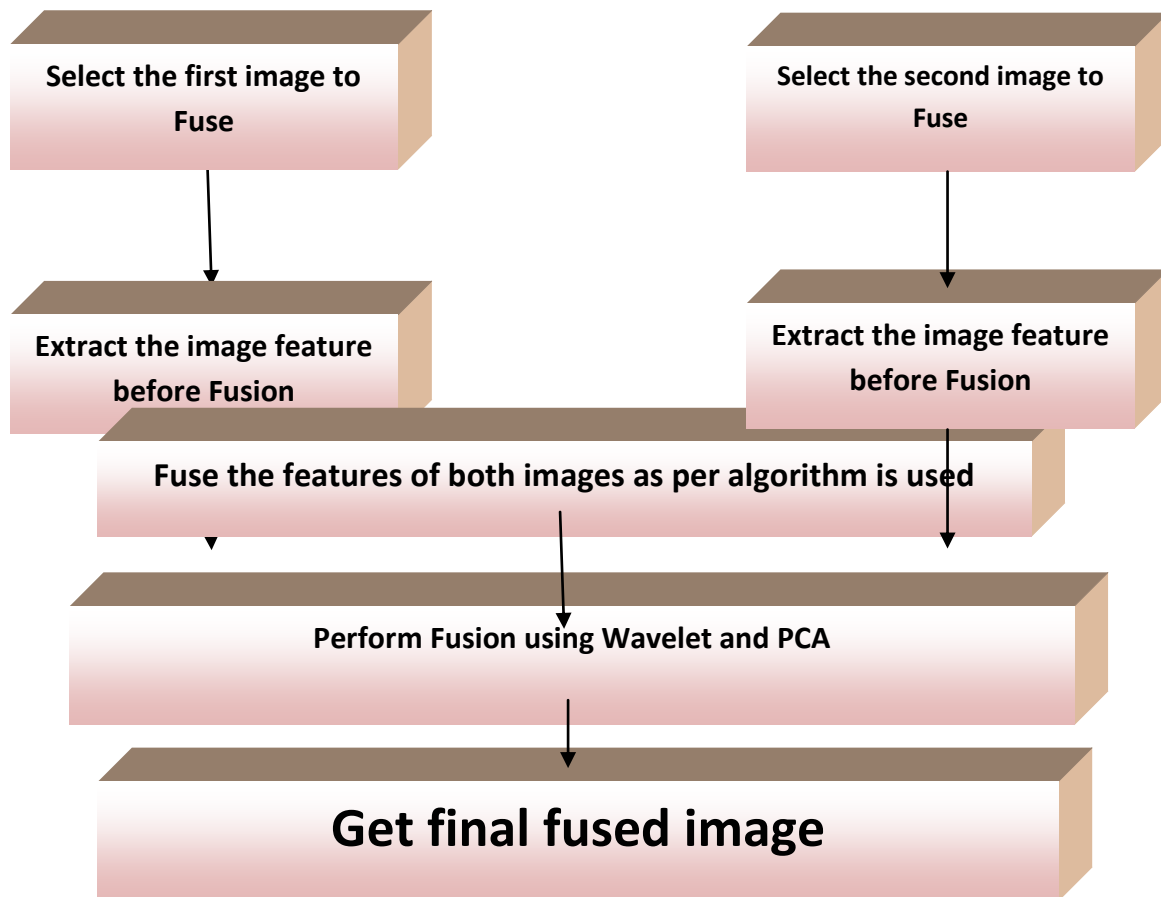
### 5. METHODOLOGY/ PLANNING OF WORK

#### Steps

1. Firstly we will have the sample image from user

2. Secondly second image which is to fuse in first one
3. Then apply SWT on image 1 and get detail features of image
4. After applying SWT and PCA we will apply properties to mixed the images
5. Next step is to mix both detail coefficients of two image with a thresh hold value and the high pass features
6. And finally we will get fused image
7. Final step is to get results on parameters like Correlation, Color contents of images

### **BLOCK DIAGRAM**



### **6. Conclusion**

Over the past decade, a significant amount of research has been conducted concerning the application of wavelet transforms in image fusion. In this paper, an introduction to wavelet transform theory and an overview of image fusion

technique are given, and the results from a number of wavelet-based image fusion schemes are compared. It has been found that, in general, wavelet-based schemes perform better than standard schemes, particularly in terms of minimizing colour distortion. Schemes that combine

standard methods with wavelet transforms produce superior results than either standard methods or simple wavelet-based methods alone. The results from wavelet-based methods can also be improved by applying more sophisticated models for injecting detail information; however, these schemes often have greater set-up requirements. . In our thesis we are going to implement image fusion using two techniques combine. It is hybrid methodology of PCA and wavelet technique.

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