Multi-Temporal Image Fusion Using Subtraction Method

N.Vishnu Devi, A.Sivasankar M.E. and S. Iswariya

Abstract-This paper proposes a novel method ,using discrete wavelet transform in labVIEW environment and independent component analysis for image fusion of various images . The multitemporal approach recognizes two different aims. Images of the same scene are acquired at different times either to find and evaluate changes in the scene or to obtain a less degraded image of the scene. Firstly, each of images was decomposed by 2-D discrete wavelet transform. At last, we use wavelet reconstruction to synthesize one image which could contain more integrated accurate detail information Wavelet algorithms are useful tool for signal processing such as image compression and denoising. The main aim is to modify the wavelet coefficients in the new basis, the noise can be removed from the data.

Index Terms – DWT, IWT, Image Denoising ,labVIEW.

I.INTRODUCTION

In [1] proposed a method for image fusion where the fused image is obtained by inverse transforming a synthetic wavelet transform array which combines information from the two input images. A medical image fusion based on discrete wavelet transform using LabVIEW approach descriptors to combine the salient feature of images obtained from different compatible medical devices and integrated this method into a distributed application [2]. In [3] a novel image fusion scheme based on bioorthogonal wavelet decomposition is presented in which two images are decomposed into sub-images with different frequency, and information fusion is performed using these images under the certain criterion, and finally these sub-images are reconstructed in the result image with plentiful information. In [4] an introduction to wavelet transform theory and an overview of image fusion techniques are given, and the results from a number of wavelet- based image fusion approaches are compared and it has been proved that, in general, wavelet-based schemes perform better while minimizing color distortion. There are many methods of eliminating noise, which approximately are divided into space and transformation fields. The space field is a data operation carried on the original image, and processes the image gray value, like neighborhood average method.

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The transformation field is managed in the transformation field of images.Image fusion is to reduce uncertainty and minimize redundancy in the output while maximizing relevant information from two or more images of a scene into a single composite image that is more informative and is more suitable for visual perception or processing tasks like medical imaging, remote sensing, concealed weapon detection, weather forecasting, biometrics etc. Image fusion combines registered images to produce a high quality fused image with spatial and spectral information. The fused image with more information will improve the performance of image analysis algorithms used in different applications.

II. WAVELET TRANSFORM

The wavelet expansion set is not unique. A wavelet system is a set of building blocks to construct or represents a signal or function. It is a two dimensional expansion set, usually a basis, for some class one or higher dimensional signals. The wavelet expansion gives a time frequency localization of the signal. Wavelet systems are generated from a single scaling function by scaling and translation. And the coefficients after transformation are processed.

Image denoising algorithm consists of few steps; consider an input signal x (t) and noisy signal n (t). Add these components to get noisy data y (t) i.e.

$$Y(t) = x(t) + n(t). \quad (1)$$

Here the noise can be Gaussian, Poisson's, speckle and salt and pepper, then apply wavelet transform to get w (t).

$$Y(t) \dashrightarrow w(t) \quad (2)$$

Modify the wavelet coefficient w (t) using a different threshold algorithm and take inverse wavelet transform to get denoising images x (t).

$$W(t) \dashrightarrow x(t) \quad (3)$$

The system is expressed in figure. 1.

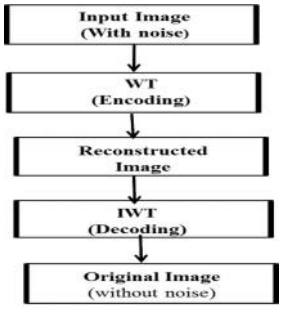


Figure 1: Process Flow Diagram of Image Fusion using wavelet transform

A. Image Fusion using Wavelet Transform

The wavelet transform is a type signal representation that can give the frequency content of the signal at a particular instant of time. In [5] the wavelet based image fusion process proposed in which steps mainly involved are registering source images, performing wavelet transform on each input image, then generating a fusion decision map based on a defined fusion rule and constructing Fused wavelet coefficient map from the wavelet coefficients of the input images according to the fusion decision map. Finally, transform back to the spatial domain. Image fusion based on wavelet transform is the most commonly used approach, which fuses the source images information in wavelet domain according to some fusion rules.

B. Wavelet Based Image Fusion Algorithm

Wavelets are localized waves .They have finite energy. They are suited for analyses of transient signal.They are finite duration oscillatory functions with zero average value. The irregularity and good localization properties make them better basis for analysis of signals with discontinuities.
The steps involved in wavelet based image fusion algorithm are as follows [7] :
1. Read the two input images, I1 and I2 to be fused.
2. Perform independent wavelet decomposition of the two images
3. Apply pixel based algorithm for approximations which involves fusion based on taking the maximum valued pixels from approximations of source images I1and I2
4. Based on the maximum valued pixels between the approximations, a binary decision the map is generated gives the decision rule for fusion of approximation coefficients in the two source images I1and I2.
5. The final fused transform corresponding to approximations through the maximum selection pixel the rule is obtained.
6. Concatenation of fused approximations and details gives the new coefficient matrix.
7. Apply inverse wavelet transform to reconstruct the resultant fused image and display the result.

III IMAGE FUSION METHODS

we categorize the IF methods according to the data entering the fusion and according to the fusion purpose. We distinguish the following categories.
i) Multiview fusion of images from the same modality and taken at the same time but from different viewpoints.
ii) Multimodal fusion of images coming from different sensors (visible and infrared, CT and NMR, or panchromatic and multispectral satellite images).
iii) Multitemporal fusion of images taken at different times in order to detect changes between them or to synthesize realistic images of objects which were not photographed in a desired time.
iv) Multifocus fusion of images of a 3D scene taken repeatedly with various focal length.
v) Fusion for image restoration. Fusion two or more images of the same scene and modality, each of them blurred and noisy, may lead to a deblurred and denoised image. Multichannel deconvolution is a typical representative of this category. This approach can be extended to superresolution fusion, where input blurred images of low spatial resolution are fused to provide us a high-resolution image.
In each category, the fusion consists of two basic stages: image registration, which brings the input images to spatial alignment, and combining the image functions (intensities, colors, etc) in the area of frame overlap. Image registration works usually in four steps.
i) Feature detection. Salient and distinctive objects (corners, line intersections, edges, contours, closedboundary regions, etc.) are manually or, preferably, automatically detected. For further processing, these features can be represented by their point representatives (distinctive points, line endings, centers of gravity), called in the literature control points.
ii) Feature matching. In this step, the correspondence between the features detected in the sensed image and those detected in the reference image is established. Various feature descriptors and similarity measures along with spatial relationships among the features are used for that purpose.
iii) Transform model estimation. The type and parameters of the so-called mapping functions, aligning the sensed image with the reference image, are estimated. The parameters of the mapping functions are computed by means of the established feature correspondence.
iv) Image resampling and transformation. The sensed image is transformed by means of the mapping functions. Image values in non-integer coordinates are estimated by an appropriate interpolation technique.

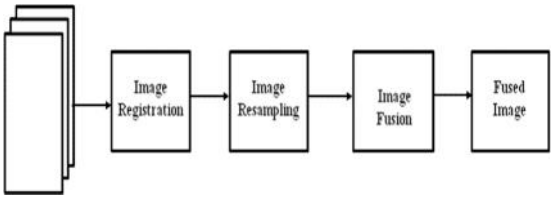


Figure.2. Preprocessing of image fusion.

IV. PROPOSED FUSION METHODOLOGY

Images of the same scene are acquired at different times either to find and evaluate changes in the scene or to obtain a less degraded image of the scene.(Usually of same Modality).Input: Several Images of Same Scene.Output:One Image of High Quality.
Goal : Detection of Changes. Method : Subtraction.

SUBTRACTION PROCESS:

Subtraction of the digitized phase image with digitized mask image.Finally the subtracted binary image is converted into grayscale image.

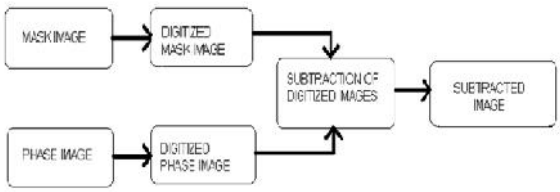
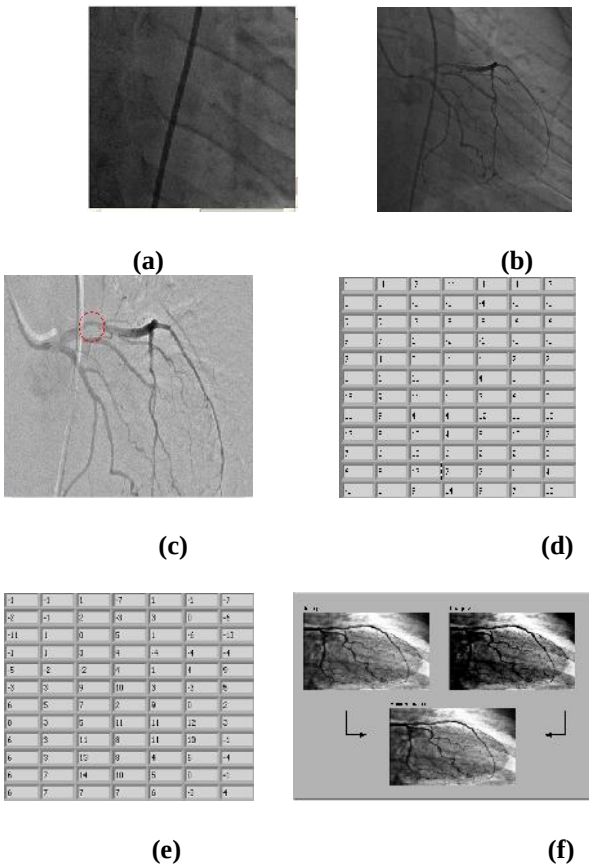


Figure.3. Digital Sutraction Unit

V. SIMULATION RESULTS

Given are the images obtained before and after subtraction. When both the images are compared the resolution is increased in the image taken after subtraction. Hence subtraction of angiographic images plays an important role in bio-medical field. The resolution of the image increases when the pixel value increases. Image parameters has not disturb when denoising. When denoising we have to preserve contrast of the image. Image brightness in denoising kept same .



(a) **(b)**

(c) **(d)**

(e) **(f)**

Figure.4.

Some example images: IMAGE (a) and IMAGE (b) specifies the mask & phase images . When these two images are subtracted the output will be as shown. From this subtracted image, it is easy to identify the blocks in arteries. Once the blocks are identified, further the diagnostics work like stenting can be done. (d) & (e) Pixel Values of Phasec & Subtracted Image (f) Fused Image. Our experimental results show that proposed labVIEW based image fusion approach provides better performance and quality on compared to conventional wavelet transform (WT) and weighted average discrete wavelet transform based image fusion.

VI. CONCLUSION

There are a large number of applications in remote sensing that require images with both spatial and spectral resolution. Numerous fusion applications have appeared in medical imaging like simultaneous evaluation of CT, MRI, and/or PET images. The former aim is common in medical imaging, especially in change detection of organs and tumors, and in remote sensing for monitoring land or forest exploitation. In this paper, the potentials of pixel level image fusion using LabVIEW approach have been explored along with quality assessment evaluation measures. Fused images are primarily used to human observers for viewing or interpretation and to be further processed by a computer using different image processing techniques. The experimental results clearly show that the introduction of the proposed image fusion using LabVIEW gives a considerable improvement on the quality of the fusion system. It is hoped that the technique can be further extended to all types of images, for the fusion of multiple sensory images and to integrate valid evaluation measures of image fusion using Vision module. Future work also includes Image Averaging, which efficiently gives good results.

VII. REFERENCES

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