IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Volume-2, Issue-3 E-ISSN: 2347-2693

DESIGN AND IMPLEMENTATION OF IMAGE FUSION SYSTEM

VIKAS KUMAR MISHRA[1], SHOBHIT KUMAR[2] & RAM KAILASH GUPTA[3]

[1]Computer Science and Engineering, Uttar Pradesh technical University, India, mail2vym@gmail.com
[1]Computer Science and Engineering, Uttar Pradesh technical University, India, shobhit5786@gmail.com
[1]Computer Science and Engineering, Uttar Pradesh technical University, India, kailashcs09@rediffmail.com

www.ijcseonline.org

Received: 04 March 2014 Revised: 17 March 2014 Accepted: 22 March 2014 Published: 30 March 2014

Abstract— Image fusion can be broadly defined as the process of combining multiple input images or some of their features into a single image without the introduction of distortion or loss of information. The aim of image fusion is to integrate complementary as well as redundant information from multiple images to create a fused image output. We introduce the basic principles of image fusion at pixel level, feature, and decision. Design rules and steps of graphical user interface (GUI) are described. Image fusion system based on graphical user interface has been designed and implemented below. We give you part of the overall design of the system and explain their method of use. The system has many functions: image denoising, image enhancement, image registration, image segmentation, image fusion, and evaluation of the merger.

Keywords/Index Term—Image Fusion, GUI.

I. INTRODUCTION

Image fusion is one of the types of information fusion. Multiple images of different image sensors are fused in order to obtain a new image that contains more information and is more positive description of the same scene image. Image fusion has so far been widely used not only in some military applications such as object detection and tracking, sensitivity to context and so on fields, but also in many areas including civil navigation airport security check , intelligent traffic, geographic information system, medical imaging, and human visual aids.

Fusion research began in the nineties. After the Gulf War, the information fusion technology caused a great attention in China. Since then, some universities and research institutions have conducted research in this area, but most are part of the theoretical study. At present, image fusion study in China is still in a state of backwardness, especially in the practical aspects of engineering research.

We design and implement a system of image fusion, which can merge images from multiple source by traditional wave, multiple wavelets, and pulse couple neural networks (PCNN) to pixel level image. It is well known that image fusion can be performed at three levels: pixel level, feature level and decision level. Of course, you can also choose to process image fusion entity level or decision level. So far there is little fusion system images can be fused images based on wavelet multi-wave, and PCNN.

II. STANDARD IMAGE FUSION METHODS

Image fusion methods can be broadly classified into two groups - spatial domain fusion and transform domain fusion. The fusion methods such as averaging, Bovey method, principal component analysis (PCA) [1] [3] and IHS transform [3] based methods fall under spatial domain approaches. Another important spatial domain fusion method is the high pass filtering based technique. Here the high frequency details are injected into up sampled version of MS images. 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 multiresolution analysis has become a very useful tool for analysing remote sensing images. The discrete wavelet transform has become a very useful tool for fusion.

Some other fusion methods are also there, such as Laplacian pyramid based [2], curvelet transform based etc. These methods show a better performance in spatial and spectral quality of the fused image compared to other spatial methods of fusion.

- High pass filtering technique
- IHS transform based image fusion
- PCA based image fusion
- Wavelet transform image fusion
- pair-wise spatial frequency matching

Corresponding Author: *V.Y.Mishra.,mail2vym@gmail.com*

A. *Remote Sensing Image Fusion*

In remote sensing [4] 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. In satellite imaging, two types of images are available.

Image fusion in remote sensing has several application domains. An important domain is the multi-resolution image fusion (commonly referred to pan-sharpening). In satellite imagery we can have two types of images:

Panchromatic images

An image collected in the broad visual wavelength range but rendered in black and white.

Multispectral images

Images optically acquired in more than one spectral or wavelength interval. Each individual image is usually of the same physical area and scale but of a different spectral band.

The SPOT PAN satellite provides high resolution (10m pixel) panchromatic data while the LANDSAT TM satellite provides low resolution (30m pixel) multispectral images. Image fusion attempts to merge these images and produce a single high resolution multispectral image.

The standard merging methods of image fusion are based on Red-Green-Blue (RGB) to Intensity-Hue-Saturation (IHS) transformation. The usual steps involved in satellite image fusion are as follows:

1. Resize the low resolution multispectral images to the same size as the panchromatic image.
2. Transform the R, G and B bands of the multispectral image into IHS components.
3. Modify the panchromatic image with respect to the multispectral image. This is usually performed by histogram matching of the panchromatic image with Intensity component of the multispectral images as reference.
4. Replace the intensity component by the panchromatic image and perform inverse transformation to obtain a high resolution multispectral image.

B. *Medical Image Fusion*

Medical Imaging [4] has become a vital component of a large no of application, including diagnosis, research and treatment**.** Image fusion has become a common term used within medical diagnostics and treatment. The term is used when multiple patient images are registered and overlaid or merged to provide additional information. Fused images may be created from multiple images from the same imaging modality, or by combining information from multiple modalities, such as C. All these modalities used for different purposes and information for example CT [3] image provide dense structure like bones and MRI [3] provide normal and pathological soft tissues but not provide information about bones. In this case one kind of image will not provide the sufficient and accurate clinical information for physician therefore fusion of multimodal medical image is required.

III. IMAGE FUSION CATEGORIES

Image fusion methods can be grouped into three categories: Pixel or sensor level [4], feature level [4] and decision level [4].

A. *Pixel Level*

In pixel level fusion the source images are fused pixel-by-pixel followed by the information/feature extraction. To implement the pixel level fusion, arithmetic operations are widely used in time domain and frequency transformations are used in frequency domain.

The main goal of pixel level fusion is to enhance the raw input images and provide an output image with more useful information than either input image. Pixel level fusion is effective for high quality raw images but not suitable for images with unbalanced quality level because information from one physical channel might beimpeded by the other. The scheme of pixel level fusion is shown in Figure1

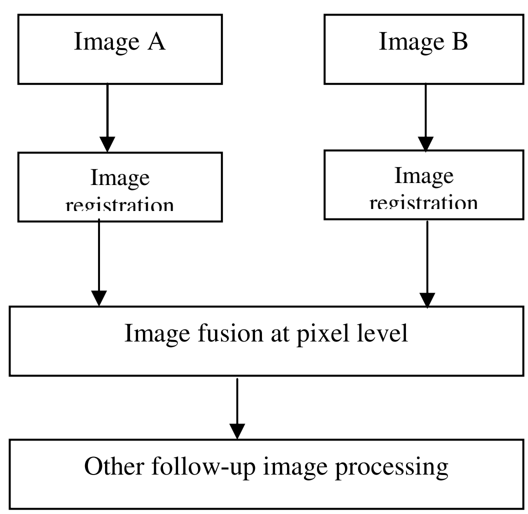

Figure1 Pixel level fusion

B. *Feature Level*

In feature level fusion the information is extracted from each image source separately then fused based on features from input images. The feature detection is typically achieved through edge enhancement algorithms, artificial neural networks, and knowledge based approaches. Feature level fusion is effective for raw images with unbalanced quality level. It requires a feature-extraction algorithm effective for both physical channels. The scheme of feature level fusion is shown in Figure2

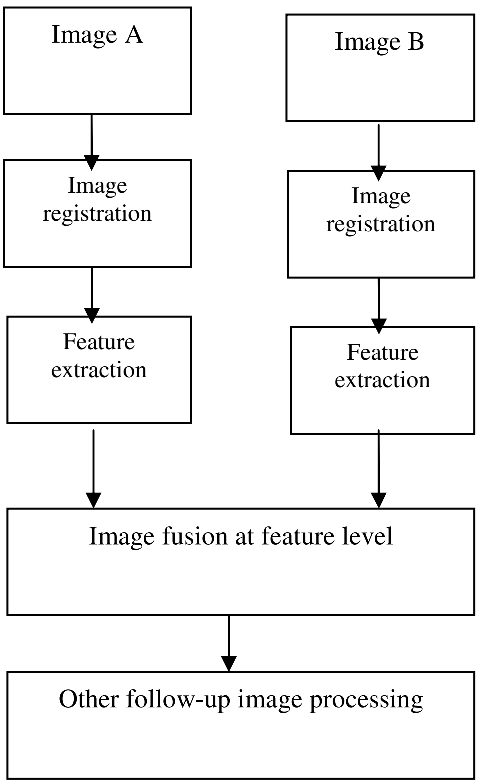

Figure2 Feature level fusion

C. *Decision Level*

In decision level fusion information is extracted from each source image separately and then decisions are made for each input or source channel. Finally these decisions are fused to generate the final decision or image. Decision level fusion is effective for complicated systems with multiple true or false decisions but not suitable for general applications. The scheme of decision level fusion is shown in Figure3

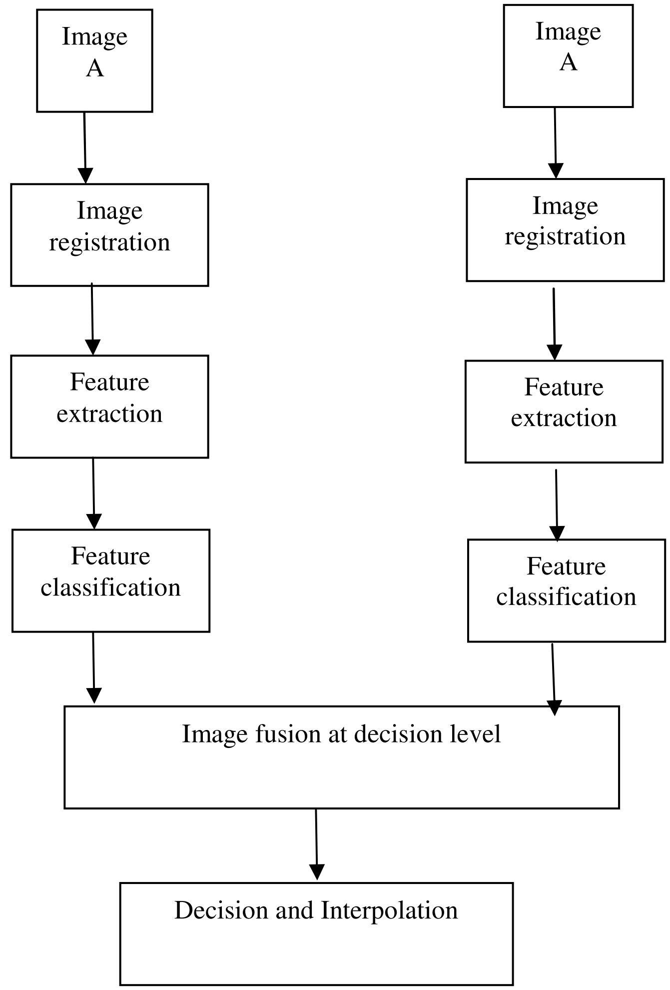

Figure3 Decision level Fusion

IV. THE DESIGN RULES AND STEPS FOR GRAPHICALUSER INTERFACE

Graphical User Interface (GUI) is a user interface consisting of window, cursor, keys, and menu, etc. The user selects or activates these graphic objects through a certain method so as to make the computer completes certain actions, such as achieving a certain algorithm or drawing.

V. DESIGN PRINCIPLES OF GUI

In short, a good user interface should follow three principles that are simplicity, consistency, and familiarity [5].
Simplicity means that designer should reflect the functions and features of the user interface simply, directly and clearly.
As for consistency, it requires that the new interface should be consistent with other existing interface, by which the same thing is handled like the new one.

When designing a new interface, designer should make full use of the familiar signs and symbols. This is the rule advocated by familiarity.

VI. DESIGN STEPS OF GUI

In order to achieve a GUI with good performance, the specific design steps are as follows:

- Analysis the main function that the interface requires, determine the design task.
- Draw an outline sketch of the interface and examine it standing the poison of users.
- According to the sketch, design static interface firstly and check it carefully.
- Write the dynamic program through implementing the corresponding callback functions of the objects on the interface.

It is an unavoidable fact that the design steps maybe need to be modified several times so as to get a satisfy interface finally [5].

VII. IMPLEMENTING AN IMAGE FUSION SYSTEM BASED ON GUI

In recent years, major research has been focused on the pixel-level image fusion with the development of some fusion algorithms. The approach of image fusion at pixel level can be divided into simple method, pyramid decomposition, wavelet decomposition, etc. Simple method includes largest value selection, smallest value choice, average value selection, and entropy choice. Although these methods have lower degree of complexity, they reduce the entropy value and the contrast of the image.
The fusion method based on pyramid decomposition or wavelet decomposition can stress the Important characteristics and detail information of image in multi-scale and multi resolution. However, pyramid-based decomposition [2] approaches have no direction, and wavelet system can not simultaneously have orthogonality, symmetry, smoothness, compact support, vanishing moments that are very important in image processing. Multi-wavelets is an expansion of traditional wavelet and has more advantages. It is most important that a multiwavelets system can simultaneously have these characteristics that are preserving length (orthogonality), good performance at the boundaries because of linear-phase symmetry, and a high order of approximation also named vanishing moments. Thus, multi-wavelets transform offers the possibility of superior performance for image fusion, compared with traditional scalar wavelets. The wavelet toolbox is illustrated in figure4

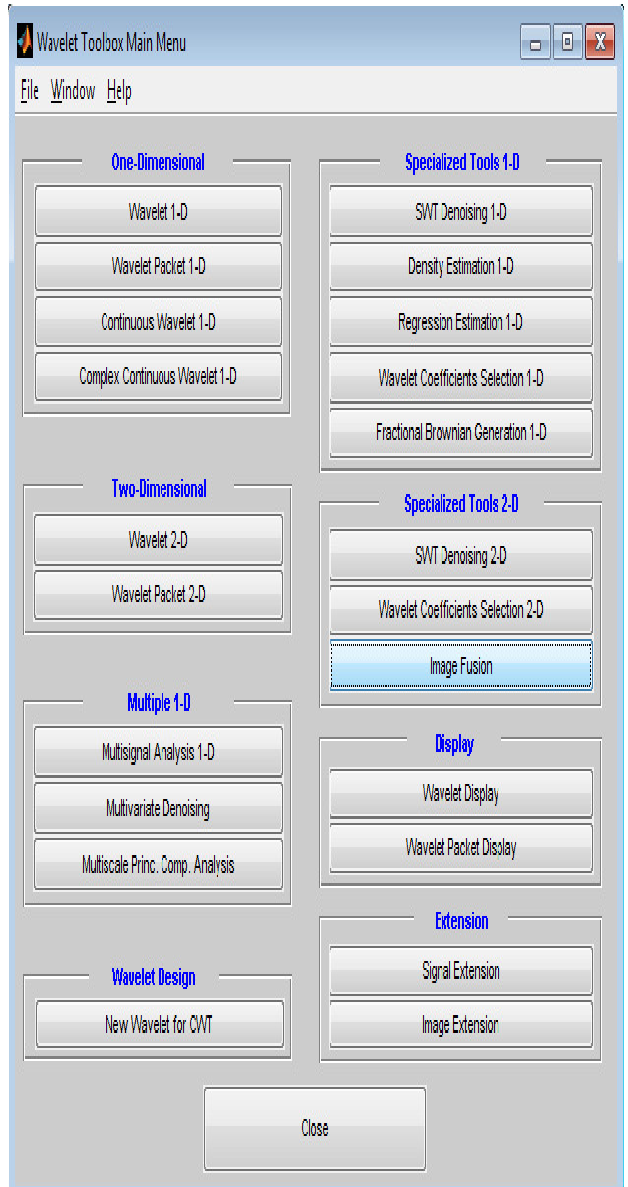

Figure4 Wavelet toolbox Main Menu

VIII. OVERALL DESIGN OF FUSION SYSTEM

We design an image fusion system which can implement image fusion based on wavelet, or multi-wavelets, through GUI. It can also realize feature-level fusion or decision-level fusion. From the functional point of view, the image fusion system can perform image denoising, image enhancement, image registration, pixel-level image fusion, feature-level fusion, and decision- level fusion, etc. the image fusion system is given in figure5

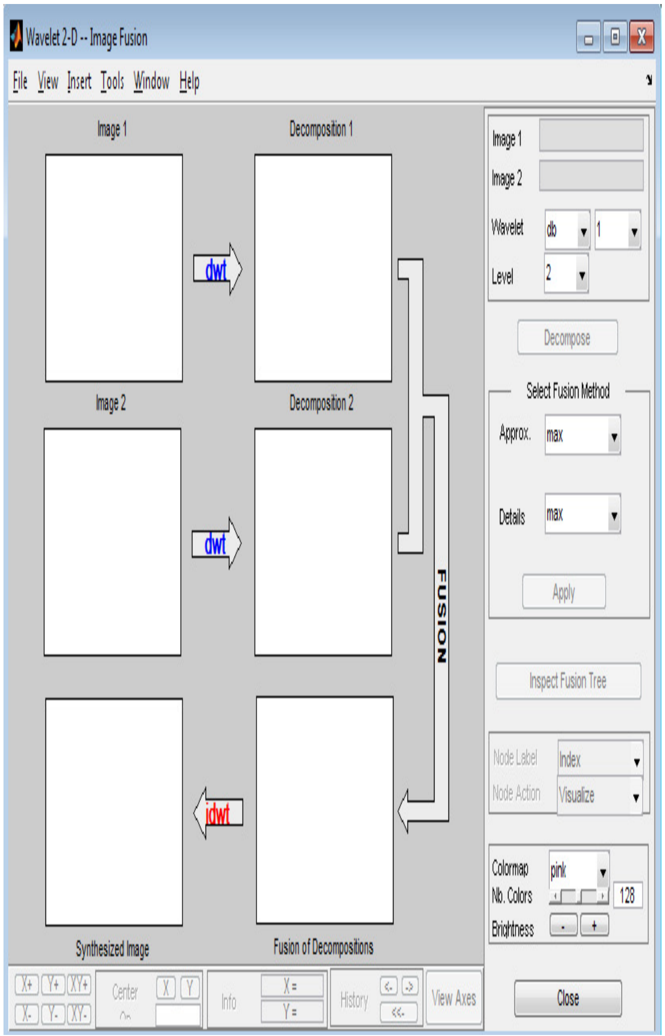

Figure5 Image Fusion Toolbox

IX. Implementation of Image Fusion Toolbox

The implementation process involves the selection of two images (image 1 and image 2) to be fused. The desired parameters are set such as 'wavelet' and 'level' and finally decomposition is done to obtain decomposed images 1 and 2 respectively by applying DWT [3]. The decomposed images are fused by selecting the parameter such as 'approx' and 'detail' to their max values. Finally the inverse of DWT is taken to obtain synthesized image (reconstructed image) from decompose fused image. This process is shown in figure6

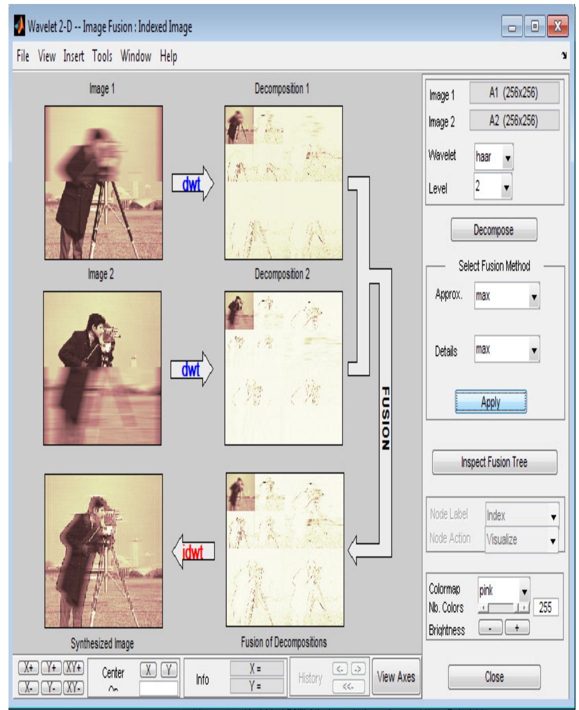

Figure6 Implementation of Image Fusion Toolbox

.

References/Bibliography

[1] Y. Zhou, A. Mayyas and M. A. Omar "Principal Component Analysis Based Image Fusion Routine With Application To Stamping Split Detection", Research in Nondestructive Evaluation, pp78-79, 2011.

[2] P.J. Burt and E.H Adelson, "The Laplacian Pyramid as a Compact Image Code", IEEE Transactions on Communications, Vol. com-31, Issue 4, pp 4, April 1983.

[3] Y. Yang, D.S.Park, S. Huang and N. Rao, "Medical Image Fusion via an Effective Wavelet-Based Approach", EURASIP Journal on Advances in Signal Processin, Vol. 2010, pp1-12, March 2010.

[4] O. Prakash, R. Srivastava and A. Khare, "Biorthogonal Wavelet Transform Based Image Fusion Using Absolute Maximum Fusion Rule", IEEE Conference on Information and Communication Technologies, pp577-578, 2013.

[5] Z. Wang, Y. Tie and Y. Liu, "Design and Implementation of Image fusion System", International Conference on Computer Application and System Modeling, pp 141, 2014

AUTHORS PROFILE-1

VIKASH KUMAR MISHRA

Mr. Vikash Kumar Mishra has done his Schooling from Lucknow Public school, Lucknow. He scored 74% in U. P. Board Matriculation Exams and 78% in U. P. Board Intermediate Exams. He has received his B. Tech. degree from IIMT College of Engineering with 74.02%, and M. Tech. from U. P. T. U. Lucknow.

PERSONAL DETAIL:
Father's Name: Mr. Yogendra Mishra
Mother's Name : Mrs. Asha Mishra
Date of Birth : 30-Jan-1989
Language : Hindi, English, Bhojpuri.
Hobbies : Listening songs, Playing Cricket, watching Movies, Politics.
Strength : Positive attitude, Dynamic, Confident, Optimistic, quick learner.

AUTHORS PROFILE-2

SHOBHIT HUMAR

Mr. Shobhit kumar is a computer science professional and received his B. Tech degree from U. P. T. U. Lucknow and worked as Software Engineer in many companies and currently working as Asst. Prof. at MKRECIT, Ambedkar Nagar.

AUTORS PROFILE-3

RAM KAILASH GUPTA

Mr. R. K. Gupta is an Academic Professional, He has received hi B. Tech. and M. Tech. degree and then after he has worked in many prestigioue colleges and currently Working as Asst. Prof. at A.I.E.T. Lucknow

