International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 4 (2015) pp. 9425-9431

http://www.ripublication.com

An Efficient Implementation of Enhanced Image Fusion Techniques

Dr.K.P.Sampoornam[1]
Associate Professor Department, ECE
Vivekanandha Engineering College for Women Sankari,Salem
sambu_swasti@yahoo.com
Dr.K.Rameshwaran[2]
Professor Department, ECE
Shanmuganathan Engineering College
Arasampatti,Pudukkottai
krameshwaran@gmail.com
Honeytha.N[3]
PG Scholar, Department, ECE
Vivekanandha Engineering
College for Women, Sankari,Salem
honey.aravindakshan@gmail.com

Abstract

In this paper describes an approach to image fusion using the combination of Laplacian Pyramid[1] and Wavelet Algorithm[2]. Image fusion involves merging two or more images in such a way as to retain the most desirable characteristics of each. Several situations in image processing require both high spatial and high spectral information in a single image. This is important in remote sensing. Here The algorithm begins by applying DWT to decompose the input images in to different sub bands . The basic idea of Laplacian Pyramid perform pyramid decomposition on each Source image. Most of the wavelet-based image fusion algorithms use only the high- level sub bands and ignores LL sub and. Thus in this paper Laplacian Pyramid perform to the LL sub bands of the source images and the wavelet transform[3] is applied to low- high bands, high-low bands and high-high bands of source images. Finally combine the fused images and reconstruct by apply IDWT.

Introduction

Multisensor data fusion[4] has become more general formal solutions to a number of application cases. Several situations in image processing require both high spatial and high spectral information in a single image. This is important in remote

sensing[5]. However, the instruments are not capable of providing such information design. One possible solution for this is data fusion. Image fusion techniques allow the integration of different information sources. In general image fusion algorithms are desired to achieve benefits like high accuracy and reliability , faster acquisition of information , cost effective acquisition of information . In recent years, image fusion has been attracting a large amount of attention in a wide variety of applications[6] such as Concealed Weapon Detection (CWD) , remote sensing[7] , medical diagnosis , defect inspection and military surveillance.

In single sensor image fusion system the sensor captures the real world as a sequence of images. This kind of systems has some limitations [8] due to the capability of the imaging sensor that is being used. Multi-sensor image fusion system [9] overcomes the limitations of a single sensor fusion system. In this system combining the images from these sensors to form a composite image. Multi sensor image fusion[10] provides the benefits like extended range of operation, extended spatial and temporal coverage, robust system performance, increased reliability.

There are several techniques are being used for image fusion. In which Laplacian pyramid algorithms and wavelets have gained more popularity. The Laplacian image fusion algorithm integrates multisource information at the basic level and can provide more abundant, accurate and reliable detail information.

The basic idea of Laplacian pyramid is perform pyramid decomposition on each Source image. But Laplacian pyramid[11] does not take into account important details like edges, boundaries. And the wavelet-based image fusion algorithms use only the high-level sub bands and ignores LL sub band. A combination of Laplacian pyramid algorithm and wavelets[12] for image fusion is proposed in this paper. This model to introduce hybrid model to provide a without the introduction of distortion or loss of information.

Image Fusion Scheme

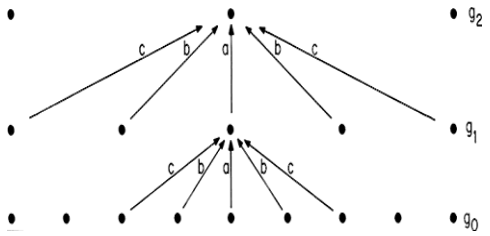
This image fusion scheme is begins by applying DWT to decompose the input images .Dwt is the algorithm used to reduce dimensionality of image so it used for image compression, feature extraction process. DWT algorithm decomposes the image into 4 sub band (sub image) i.e., LL,LH,HL,HH. dwt output extract the detailed output of input image. LL is the approximate image of input image it is low frequency sub band so it is used for further decomposition process.. LH sub band extract the horizontal features of original image HL sub band gives vertical features HH sub band gives diagonal features. In this paper Laplacian pyramid is applied to the LL sub bands of the source images and wavelet transform is applied to the higher sub bands. Finally combine the fused images and reconstruct by apply IDWT.

Gaussian Pyramid

The Laplacian Pyramid [12] is computed from the Gaussian Pyramid. The Gaussian pyramid consists of low-pass filtered, reduced density (i.e., down sampled) images of the preceding level of the pyramid, where the base level is defined as the original image. In Figure.1 dots in the each row represents the nodes of each level of the

pyramid. The value of each node is the gray level of a corresponding image pixel. The value of each node in the higher level is the weighted average value of node values in the next lower level. g1 is a reduced version of g0.In a similar way we form g2 as a reduced version of g1, and so on. The sequence of images g0, g1, gn is called the Gaussian pyramid.

Gaussian Pyramid



g0 = IMAGE
gL = REDUCE [gL-1]

Figure 1: Gaussian Pyramid

More formally, let the two dimensional original image be denoted by I(x, y). The Gaussian pyramid is defined recursively as follows, for levels $0 < l < N$ and nodes i, j, $0 < i < Cl$,

$0 < j < Rl$.

$$g_l(i, j) = \sum_{m=-2}^{2} \sum_{n=-2}^{2} w(m, n) g_{l-1}(2i + m, 2j + n).$$

Here N refers to the number of levels in the pyramid, while Cl and Rl are the dimensions of the lth level. Where w(m, n) is a weighting function termed as generating kernel which adheres to the following properties: separable, symmetric. When w is separable

$$w(m, n) = \hat{w}(m)\, \hat{w}(n).$$

if weighting function is 5,and function $\hat{w}$ is

$$\sum_{m=-2}^{2} \hat{w}(m) = 1$$

normalized, then and symmetric

$$\hat{w}(i) = \hat{w}(-i) \text{ for } i = 0, 1, 2.$$

Laplacian Pyramid

The Laplacian Pyramid is a decomposition of the original image into a hierarchy of images such that each level corresponds to a different band of image frequencies. This is done by taking the difference of levels

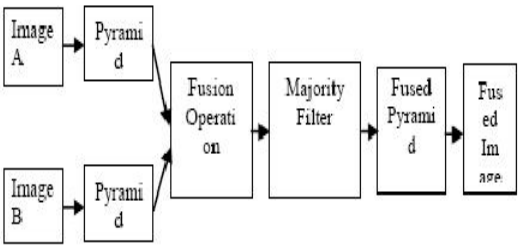


Figure 2: Laplacian Pyramid fusion method

in the Gaussian pyramid. Each level of the Laplacian pyramid [7] difference between two consecutive levels of Gaussian pyramids. Thus Laplacian pyramid is a set of band pass filtered images as shown in Figure 2.

After perform the pyramid decomposition on each source image, integrate all these decompositions to form a composite representation, and finally reconstruct the fused image by performing an inverse pyramid transform.

Wavelet Transform

After applying DWT to source images to decompose, wavelet transform[6] applied to low-high bands, high-low bands and high-high bands of the images. Since larger absolute transform coefficients correspond to sharper brightness changes, a good integration rule is select, at every points in the transform domain, the coefficients whose absolute values are higher. In this way the fusion is takes place for all resolution levels (Figure.3).

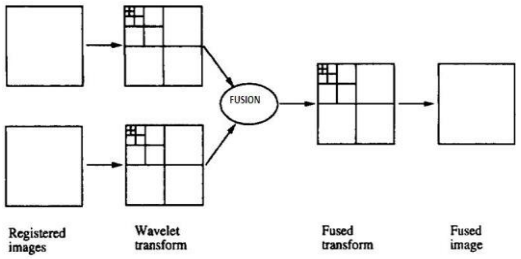


Figure 3: Image fusion using wavelet transform

Implementation and Conclusion

In the first phase image fusion using Laplacian Pyramid fusion algorithm is completed. Applying Laplacian Pyramid algorithm to LL sub band of the image. The results were

implemented using MATLAB. In the second phase combination of Laplacian pyramid algorithm and wavelets based fusion is implemented as shown in Figure.4.

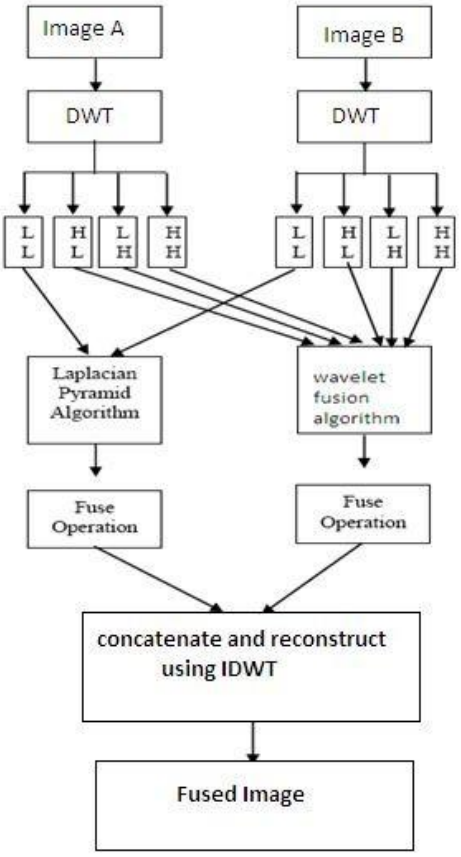


Figure 4: Proposed Hybrid model

Image A

Image B

Figure 5: Fused image using Laplacian Pyramid

Then the resultant fused images concatenate and reconstruct the image by using the IDWT. Applying Laplacian Pyramid algorithm to LL sub bands of the image A and image B is shown in Figure.5

References

[1] M.Pradeep,"Implementation of Image Fusion algorithm using MATLAB (LAPLACIAN PYRAMID)", IEEE Transactions ,June 2013.

[2] Hui Li, B.S. Manjunath, Sanjit K. Mitra H. Li, "Multisensor Image Fusion Using the Wavelet Transform", Proc. First international conference on image processing, ICIP 94, Austin, Texas,

[3] M. Antonini, M. Barlaud, P. Mathieu, and I. Daubechies, "Image Coding Using the Wavelet Transform", IEEE Trans on Image Processing, Pages 205-220,Apri 1992

[4] Yaonan Wang, "Multisensor Image Fusion: Concept, Method and Applications", Faculty of Electrical and Information Engineering, Hunan University, Changsha, 410082, China

[5] G. Simone, A. Farina, F. C. Morabito, S. B. Serpico and L. Bruzzone,“ Image Fusion Techniques for Remote Sensing Applications”, Information Fusion, Volume 3, Issue 1, Pages 3- 15, March 2002

[6] Deepu Rajan and Subhasis Chaudhuri, “Generalized Interpolation and Its Application in Super-Resolution Imaging”, Image and Vision Computing, Volume 19, Issue 13, Pages 957-969, 1November 2001.

[7] Timo Bretschneider, Odej Kao,“ Image Fusion in Remote Sensing**”,** Photogrammetry Engineering and Remote Sensing, Vol. 58, No. 5, pp. 561-567.

[8] A. Garzelli,“ Possibilities and Limitations of the Use of Wavelets in Image Fusion”,IEEE Transactions on image fusion 2002.

[9] W. D. Ross, A. M. Waxman, W. W. Streilein, M. Aguilar, J. Verly, F. Liu, M. I. Braun, P. Harmon, and S. Rak “Multi-Sensor 3D Image Fusion and Interactive Search**”** Lincoln Laboratory Journal, 11 , pp. 41-60, 1998.

[10] J. Núñez, X. Otazu, O. Fors, A. Prades, V. Palà, and R. Arbiol, “Multiresolution-Based Image Fusion with Additive Wavelet Decomposition”, IEEE Transactions on Geoscience and Remote Sensing, vol. 37, no. 3, Pages. 1204-1211, May 1999.

[11] Peter J. Burt and Edward H. Adelson,“ The Laplacian Pyramid as a Compact Image Code”, IEEE Transactions On Communications, VOL. COM-3l, NO. 4, APRIL 2000.

[12] L. J Chipman., T.M. Orr, L.N. Graham, “Wavelets and Image Fusion”, Proceedings International Conference on Image Processing, vol. 3, Pages 248-251, 1995.