unbiased way. We give step wise depiction of how we utilized the PCA calculation for fusion.

a) Produce the column vectors, separately, from the input image matrices.
b) Figure out the co-variance matrix of the two column vectors generated in step-1
c) The slanting components of the 2x2 co-variance vector would contain the difference of every section vector with itself, individually.
d) Figure the Eigen values and the Eigen vectors of the co-variance lattice
e) Standardize the segment vector comparing to the bigger Eigen esteem by isolating every component with mean of the Eigen vector.
f) The estimations of the standardized Eigen vector go about as the weight values which are separately increased with every pixel of the information pictures.
g) Whole of the two scaled networks computed in 6 will be the combined picture network. Flow diagram of PCA method is explained in figure 1.

6. **DWT:** Multi-resolution images are decomposed by Wavelet transforms tool that give various channels representing of image features by diverse frequency sub-bands at multi-scale. It is an acclaimed method in breaking down signals. Signal analysis is frequently done by wavelet transform method. At the point when decomposition is performed, the estimate and subtle element part can be isolated 2-D Discrete Wavelet Transform (DWT) changes over the image from the spatial domain to frequency domain. The image is isolated by vertical and horizontal lines and represent to the initially request of DWT, and the image can be divided in four sections those are LL1, LH1, HL1 and HH1.

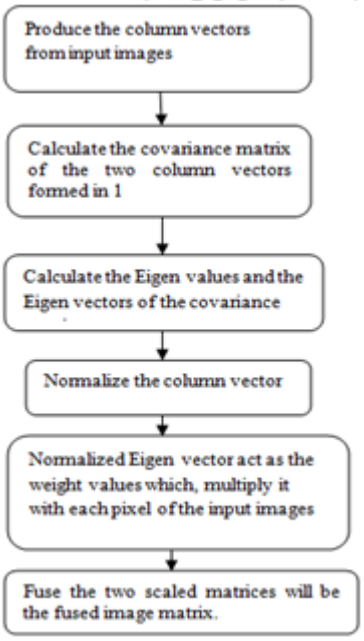

Figure 1: Flow diagram of PCA method

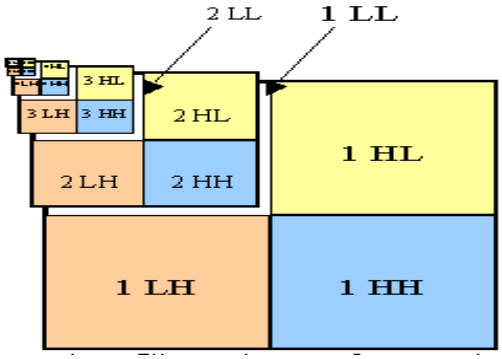

Figure 2: Wavelet Decomposition

Let s(n1,n2) is input image with size N1xN2 then scaling and wavelet function are

$$w_{\emptyset}(j0,k1,k2) = {}^{1}/_{\sqrt{N1N2}} \sum_{n1=0}^{N1-1} \sum_{n2=0}^{N2-1} s(n1,n2)\emptyset_{j0,k1,k2}(n1,n2)$$

$$w_{\epsilon}(j0,k1,k2) = {}^{1}/_{\sqrt{N1N2}} \sum_{n1=0}^{N1-1} \sum_{n2=0}^{N2-1} s(n1,n2)\in_{j0,k1,k2}(n1,n2)$$

General process of image fusion using DWT:

Step1. Implement Discrete Wavelet Transform on both the info picture to make wavelet lower decomposition.
Step2. Combine each decomposed level by utilizing distinctive fusion rules and guideline.
Step3. Apply Inverse Discrete Wavelet Transform on fused decomposed level, which intends to rebuild the image, while the picture recreated is the fused image F.

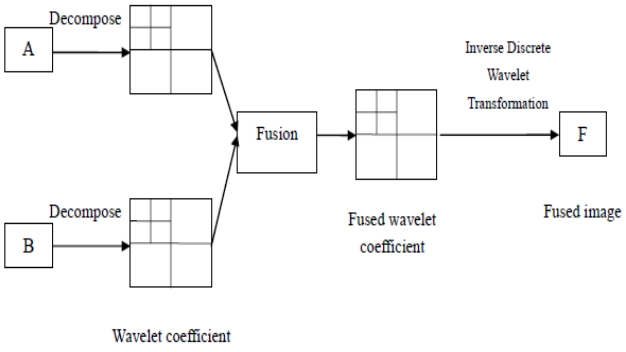

Figure 3: Wavelet Based image fusion

3. Image Quality Analysis

The evaluation measures that are utilized to assess the performance of fusion are PSNR, Mean Square Error (MSE), and Entropy.

a) Peak Signal to Noise Ratio (PSNR)

The peak signal to noise ratio frequently curtailed as PSNR, is defined as the ratio the maximum possible signal power and the tainting noise power that influences the constancy of its representation. Since numerous signals have a wide dynamic range, PSNR is typically communicated in terms of the logarithmic decibel scale (db). The PSNR is mostly utilized as a measure of quality of reconstructed image after fusion and its restoration. It can be characterized by means of the Mean Square Error (MSE). For 2d M×N monochrome imagery, the PSNR computation is given by equation (1).

$$\text{PSNR}=10log10\left(\frac{MAXi\hat{}2}{MSE}\right) \quad \ldots(1)$$

When the pixels are represented using 8 bits per sample, i.e. MAX= 255. Higher the PSNR better is the quality.

b) Mean Square Error

Mean Square Error (MSE) shows average error of the pixels all through the image. A meaning of a MSE does not show that the denoised image endures more errors rather it alludes to a more prominent distinction between the original and denoised image. This implies that there is a noteworthy noise decrease. The equation for the MSE count is given by Mathematical statement-2

$$MSE = \frac{\sum_i \sum_j \left(Y(i,j) - \hat{Y}(i,j)\right)^2}{M \times N} \quad ..(2)$$

Y represents the original image, bar y(i,j) denotes the fused image.

c) **Entropy (EN)**

Entropy is used to calculate the amount of information. Higher value of entropy indicates that the information increases and the fusion performances are improved.

$$\sum_{i=0}^{l-1} pi\log_2(p_i) \quad \ldots(3)$$

4. Conclusion

High spatial resolution can be achieved by spatial domain image fusion techniques but at the same time it also introduce blurring effect in the output image. Through Wavelet transforms technique we can get high quality spectral content. Image fusion quality can be greatly improved by Combination of DWT and PCA. But this system will be complex. To reduce the complexity and improve the image visual quality we will be using DTCWT technique for image fusion.

References

[1] Kirankumar Y., Shenbaga Devi S. " Transform-based medical image fusion" Int. J. Biomedical Engineering and Technology, Vol. 1, No. 1, 2007 101
[2] ShivsubramaniKrishnamoorthy, K P Soman "Implementation and Comparative Study of Image Fusion Algorithms" International Journal of Computer Applications (0975 – 8887) Volume 9–No.2, November 2010
[3] Sukhdipkaur, Kamaljitkaur "Study and Implementation of ImageFusion Methods" International Journal of Electronics and Computer Science Engineering ,2010
[4] YufengZheng, Edward A. Essock and Bruce C. Hansen, "An Advanced Image Fusion Algorithm Based on Wavelet Transform – Incorporation with PCA and Morphological Processing"
[5] Chetan K. SolankiNarendra M. Patel, "Pixel based and Wavelet based Image fusion Methods with their Comparative Study". National Conference on Recent Trends in Engineering & Technology. 13-14 May 2011
[6] Anjali Malviya, S. G. Bhirud ." Image Fusion of Digital Images" International Journal of Recent Trends in Engineering, Vol 2, No. 3, November 2009
[7] V.P.S. Naidu and J.R. Raol, "Pixel-level Image Fusion using Wavelets and Principal Component Analysis". Defence Science Journal, Vol. 58, No. 3, May 2008, pp. 338-352 Ó 2008, DESIDOC
[8] Chetan K. SolankiNarendra M. Patel, "Pixel based and Wavelet based Image fusion Methods with their Comparative Study". National Conference on Recent Trends in Engineering & Technology. 13-14 May 2011
[9] M .Chandana,S. Amutha, and Naveen Kumar, " A Hybrid Multifocus Medical Image Fusion Based on Wavelet Transform". International Journal of Research and Reviews in Computer Science (IJRRCS) Vol. 2, No. 4, August 2011, ISSN: 2079-2557
[10] Hong ZHENG ,Dequan ZHENG, Yanxiang Sheng " Study on the Optimal Parameters of Image Fusion Based on Wavelet Transform" Journal of Computational Information Systems6:1(2010) 131-137,January 2010.
[11] Dr. M. Sumathi , R. Barani "Qualitative Evaluation of Pixel Level Image Fusion Algorithms" IEEE transaction on Pattern Recognition, Informatics and Medical Engineering, March 21-23, 2012