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An Intelligent Approach to Perform Image Fusion Using Segmentation

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Abstract

This paper deals with the clearance of images by the Fusion technique. The main objective of image fusion is to extract all the useful information from the source images. It does not introduce artifacts or inconsistencies which will distract human observers or any processing. Image fusion is reliable and robust to imperfections such as mis-registration. Fusion is a useful technique in image processing that permits the improvement of the visual appearance of the image or provides a transformed image that enables other image processing tasks such as image segmentation. This is used to normalize the Grey level of the input image with the purpose of avoiding abrupt changes in intensity among the different regions. The complete image processing is done using MATLAB simulation model.

Keywords: *Image Fusion, Artifacts, Inconsistencies, Robust, Segmentation, Gray level.*

1. Introduction

With the fast development of the technique of sensor, micro-electronic and communications, the technique of information fusion has been paid more and more attention to by people. In the application field of image processing, image fusion has a wide fore-ground. The aim of image fusion is to integrate complementary and redundant information from multiple images to create a composite that contains a better description of the scene than any of the individual source images. [1]

Sources of Data

The major requirement of any image processing application is the collection of proper images on which work can be performed as well as presented. In this present work we need two improper images that represent the same scene and having problem in different part of image. These images can be collected from some image respiratory, from Google search or from the work done by some earlier researchers. In this present work to show the actual work we have used 4 set of images.

Objectives

In this present paper, to achieve the work we had setup some milestones to work in a directed way. The objectives are achieved in this work

(i) Study and Analysis of Existing of Existing Approaches of Image Reconstruction
(ii) Study of Existing Approaches of Image Fusion
(iii) Design a Fuzzy Inspired Wavelet based Algorithm to perform the Image Fusion
(iv) Implementation of Algorithm using Matlab
(v) Analysis of Results using Graph

2. Significance of Work

The presented work is about to perform the image reconstruction by using two improper images. In this work we have used the concept of image fusion using

fuzzy logic and the wavelet decomposition. The present work will reconstruct the image and remove the noise from it. The work can be implementing on any jpg, gif or bmp image.

3. Wavelet Packet Decomposition

For the wavelet packet decomposition i do not limit the decomposition to the approximation sub band and allow further wavelet decomposition of all sub bands on all levels. In Fig. 3.8 show the system diagram for a complete two level wavelet packet decomposition.

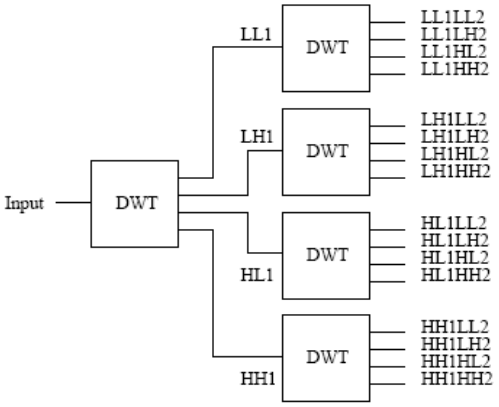


Fig 1: Two complete decomposition steps using wavelet packet decomposition

Fig 1 shows the resulting sub band structure. Here simple decomposition step as basic building block were used. The composition step is equal to the pyramidal case. All four sub bands on one level are used as input for the inverse transformation and result in the sub band on the higher level. This process is repeated until the original image is reproduced.

LL1LL2	LL1HL2	HL1LL2	HL1HL2
LL1LH2	LL1HH2	HL1LH2	HL1HH2
LH1LL2	LH1HL2	HH1LL2	HH1HL2
LH1LH2	LH1HH2	HH1LH2	HH1HH2

4. Present Work

Multifocus Image Fusion uSing SVM

Step 1. Decompose images into several blocks with size of N, M. Let Pi and Qi denote the *i*th blocks of image P and image Q

Step 2. Features of the corresponding blocks in the two original images are calculated and construct the normalized feature vector incident to neural networks. The features used to evaluate the clear level are spatial frequency, visibility, and edge .Let {SF Pi , EG Pi , V Pi} and {SF Qi , EG Qi , V Qi} are the feature vectors of these two block. Then features vector incident to fuzzy logic is normalization of {SF Pi – SF Qi, EG Pi - EG Qi, VPi - VQi}

Step 3. The decision rule is generated using fuzzification and on that basis the classification will be performed.

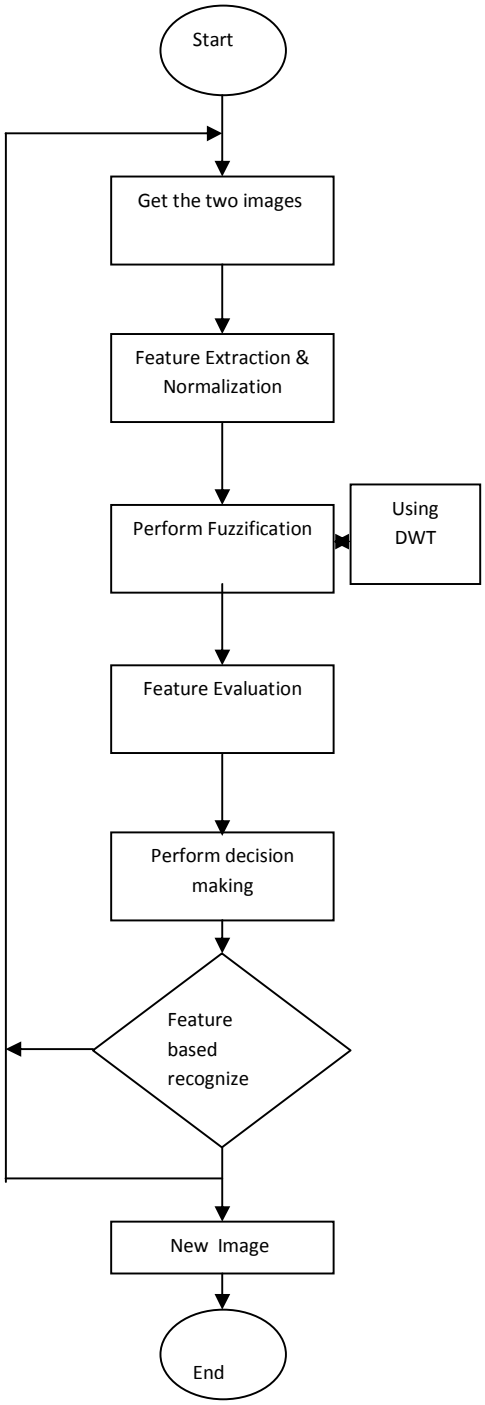
$$\text{Out}(i) = \begin{cases} 1 & (\text{If } P_i \text{ is clearer than } Q_i) \\ 0 & (\text{If } Q_i \text{ is clearer than } P_i) \end{cases}$$

Step 4. Use Feature based matching to recognize the clear level of other image blocks.

Step 5. Construct the fused image according the classification results of fuzzy logic. Let Ti is the ith block of the fused image. Then

$$T_i = \begin{cases} P_i & \text{if } \text{out}(i) > 0.5 \\ Q_i & \text{if } \text{out}(i) > 0.5 \end{cases}$$

Flow Chart



Implementation Results

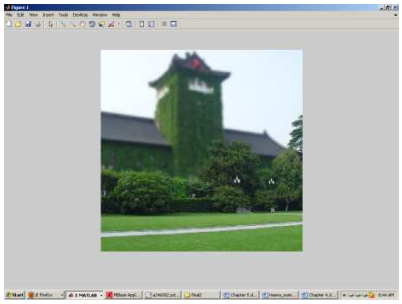


Fig 2: Input Image 1

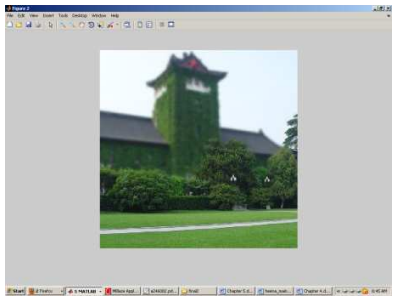


Fig 3: Input Image 2

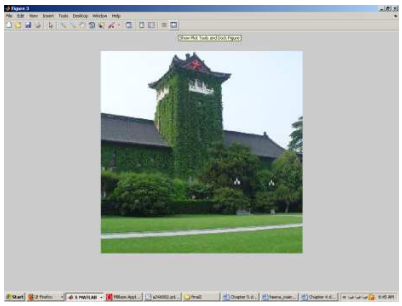


Fig 4: Output Image (From Image 1 & Image 2)

Comparison Analysis

For doing performance evaluation we have a criteria known as OPEC (Objective Performance Evaluation Criteria).After performing the wavelet decomposition, we can compare the results. Mainly we have four approaches by which we can do the comparison these are:

i. Std Deviation
ii. Entropy
iii. RMSE
iv. PSNR

We can define the comparisons by the following table:

OPEC	Wavelet	Contour let	SFLCT	FUZ-SFLCT	proposed method
STD	15.8297	15.983	15.996	16.5258	58.4279
Entropy	7.349	7.385	7.397	7.491	7.2922
RMSE	11.676	11.359	11.292	12.655	18.0625
PSNR	26.785	27.024	27.076	26.085	85.8659

All the above mentioned comparisons can be defined by the following graphs:

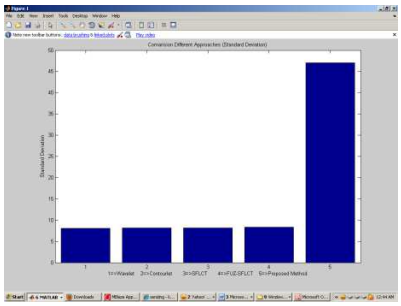


Figure 5: Comparison Analysis on Different Approaches (STD Deviation)

As we can see figure 5 is showing the comparison between different approaches of image fusion. The comparison is done respective to proposed approach. Here we can see the standard deviation of proposed approach is much higher than existing approaches.

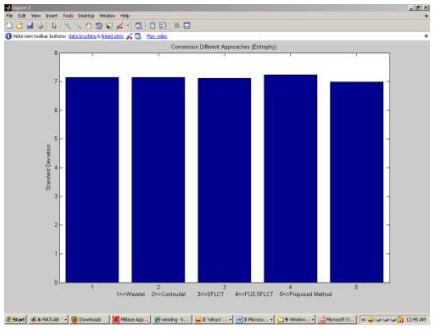


Figure 6: Comparison Analysis on Different Approaches (Entropy)

As we can see figure 6 is showing the comparison between different approaches of image fusion. The comparison is done respective to proposed approach. Here we can see the Entropy of proposed approach is much higher than existing approaches.

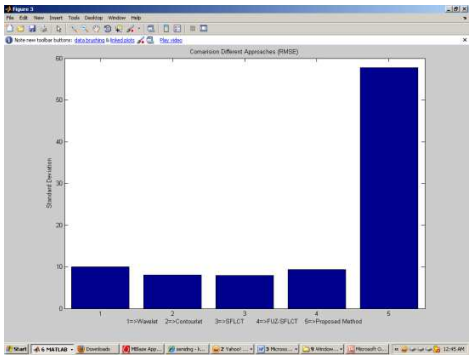


Figure 7: Comparison Analysis on Different Approaches (RMSE)

As we can see figure 7 is showing the comparison between different approaches of image fusion. The comparison is done respective to proposed approach. Here we can see the RMSE of proposed approach is much higher than existing approaches.

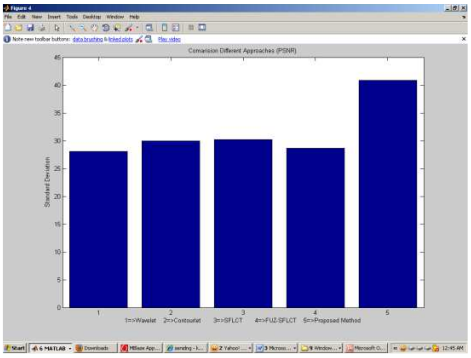


Figure 8: Comparison Analysis on Different Approaches (PSNR)

As we can see figure 8 is showing the comparison between different approaches of image fusion. The comparison is done respective to proposed approach. Here we can see the PSNR of proposed approach is much higher than existing approaches.

Conclusion

The proposed methodology in this paper is used to get clear image from source of different input images. The main technique we used for fusion is segmentation. In this paper firstly we give introduction about the fusion technique, then its objectives. After that we have define the wavelet transformation, fuzzy logic. Then, we provide implementation results of steps involved in proposed methodology. And finally, we provide the comparison between the images i.e. original image and contrast improved image by the help of graphs.

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