An Improved Image Fusion Technique based on Texture Feature Optimization using Wavelet Transform and Particle of Swarm Optimization (POS)

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ABSTRACT
Image fusion technique applied in various field of medical science for diagnose of serious medical disease. The brain stroke detection in head is very difficult task because the tissues of head are important factor. Now the detection process used high intensity multimedia camera for gathering brain stroke image for analysis of stroke. In this paper proposed a feature optimisation technique for brain stroke detection. The proposed technique based on wavelet transforms function and particle of swarm optimisation technique. The proposed algorithm performs better in compression of previous method such as WT and IWT transform method.

Keyword
Image fusion, feature optimization, POS

1. INTRODUCTION
The term image fusion usually implies the integration of images acquired by multiple sensors with the intention of providing a better perspective of a scene that contains more content. For merging remotely sensed images, particularly one multi-spectral image and one panchromatic image, fusion algorithms should aim to integrate information from images of different spectral and spatial resolution [1,2], leading to obtain a single image that includes the best features of each one. The applicability of image fusion are increases due to diversity of image used in different field such as medical science, military surveillance. Fusion process area increase in the field of video processing [8, 9]. In last decade the process of image fusion are improves due to certain reason such method image fusion process used high intensity multimedia camera for gathering brain stroke image for analysis of stroke. In this paper proposed a feature optimisation technique for brain stroke detection. The proposed technique based on wavelet transforms function and particle of swarm optimisation technique. The proposed algorithm performs better in compression of pervious method such as WT and IWT transform method.

Feature Extraction
Feature extraction is important phase in image fusion process. Feature extraction process raw image converted into frequency domain and process of sampling using wavelet transform function. Wavelet transform function gives the texture value of extracted feature in the form of horizontal, vertical and diagonal transform vector. Combined all these texture value and create feature matrix. For the extraction of feature used integer wavelet transform function value. Integer wavelet transform function is a family of wavelet transform function. The value of transform always produces the value of filter is whole number [14]. The wavelet transform function process in following derivative of equation.

2. FEATURE EXTRACTION
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∀n: D^{i+1}(n) = A^i(2n + 1)

where [x] represents the integer part of x, j is the number of scales, A^i(n) and D^i(n) denote, respectively, the approximation and the detail of the original signal calculated at the scales (i+1), 0≤L≤j[15]. The integer part of transform function gives the better encoding technique. The encoded transform value creates the number of packet and the randomly assigned packet in give dimension for search space

3. PARTICLE OF SWARM OPTIMIZATION
Particle of swarm optimization designed for the process of optimization. The basic principle of particle of swarm
optimization is dynamic population and bird fork property. By virtue of bird fork algorithm of particle of swarm optimization work. In the process of feature optimization of image fusion [20]. In the process of fusion used two different set of optimization. All feature value of image treat as particle. In amalgamation, the particle’s feature value, Pid and its near value of particle, Pgd is a velocity value of optimization feature space. The random values rand1 and rand2 are used for the local and global value selection of particle, that is, to make the optimal solution. The values of c1 and c2 manage the value of velocity of Pid and Pgd in deciding the particle’s next movement velocity. At that each iteration change the velocity of swarm and create new feature subset for selection of feature. The derivation of equation in (c) and (d) 

\[ V_{id} = W \times V_{id} + c1 \times rand \times (P_{id} - x_{id}) + c2 \times rand \times 2 \times (P_{gd} - x_{id}) \] ……..(c)

where w denotes the value of feature matrix; pid is the position of particle value, pgd is the position of global value best fitness value, c1 and c2 are constants and are known as acceleration coefficients; d denotes the dimension of the problem space; rand1, rand2 are random values in the range of (0, 1).

4. PROPOSED METHODOLOGY

In this section discuss the proposed algorithm for image fusion. The proposed algorithm based on feature selection and feature optimization technique. The process of proposed algorithm work in two modes in first mode performs feature extraction technique and in second phase performs feature optimization process. The feature optimization process is done by IWT transform function. The extracted feature generates feature matrix for the processing of feature optimization. The process of feature optimization and selection is done by particle of swarm optimization. Particle of swarm optimization is dynamic population based searching technique. After the process of optimization the feature selection process is performed and finally the value of feature of both image are maximized the image fusion are performed.

Steps perform for proposed algorithm in detail.

1. step for proposed algorithm
   a. input the both image original image and reference image
   b. apply separately IWT transform function for feature extraction

\[ F(x) = I(x, y) \] is original image
\[ F1(x) = I1(x1, y1) \] is reference image

\[ M(F) = F(x) \times W(x) \]

The convolution is perform in original image through transform function here M(F) stored the texture feature matrix of original image.

Then a feature vector is constructed using v1, v2, v3 as feature components:

\[ f = [v_1, v_2, v_3, \ldots \ldots \ldots \ldots, v_n] \] ...........(1)

We obtain a numerical vector of lower band of integer wavelet transform function. The all feature matrix is calculated as

\[ N(F) = F1(x) \times W(x) \]

The convolution is perform in original image through transform function here (F) stored the texture feature matrix of original image.

Then a feature vector is constructed of feature components:

\[ f = [v_1, v_2, v_3, \ldots \ldots \ldots \ldots, v_n] \] ...........(2)

2. We obtain a numerical vector feature value of lower band of integer wavelet transform function. The all feature matrix is calculated.
3. Both the feature matrix convert into feature vector and pass through particle of swarm optimization.
4. Step two used here particle of swarm optimization for feature optimization.
6. Searching process are done in both image
7. Searching take place for best feature
8. Select best feature
9. fusion process is done
10. Calculate MSER value of fusion image.

![Figure 1: proposed model for feature based image fusion.](image)
5. EXPERIMENTAL RESULT ANALYSIS

In this section discuss the experimental result analysis of proposed algorithm and pervious algorithm. The pervious and proposed algorithm implement in mat lab 7.8.0. For the input image used medical image database such as CT and MRI image of head. For the calculation of parameter used some standard formula such as PSNR, MSER and IQI[14].

Evaluation parameter
Equation of root mean square (RMSE)

\[ E_1 = \sqrt{\frac{1}{MN} \sum_{i=1}^{M} \sum_{j=1}^{N} (I(i,j) - F(i,j))^2} \]  \hspace{1cm} (1)

\[ E_2 = \sqrt{\frac{1}{MN} \sum_{i=1}^{M} \sum_{j=1}^{N} (I_2(i,j) - F(i,j))^2} \]  \hspace{1cm} (2)

\[ RMSE = \frac{(E_1 + E_2)}{2} \]

If the value of RMSE is low show that better image fusion technique

The peak to signal noise ratio estimated a

\[ PSNR = 20 \log_{10} \left( \frac{L^2}{MSE} \right) \]  \hspace{1cm} (3)

Here L is a level of gray scale image and MSE is mean square error rate.

Image quality index

\[ IQI = \frac{M_{ab} \cdot \frac{2xy}{m_a m_b} \cdot \frac{2m_{ab}m_{a_b}}{x^2 + y^2}}{m_a^2 m_b^2} \]  \hspace{1cm} (4)

Image quality index measure the similarity of both image fused image and original image. If both images are equal value of this is 1.

![Figure 2](image2.png)
Figure 2: shows that two input image of abdomen in same mode of initial and final area of stroke and fused both stroke with WT technique

![Figure 3](image3.png)
Figure 3: shows that two input image of brain in same mode of initial and final area of stroke and fused both stroke with IWT technique

![Figure 4](image4.png)
Figure 4: shows that two input image of brain in same mode of initial and final area of stroke and fused both stroke with HBT technique

Performance table:
Table 1: shows that value of fused image and reference image of abdomen (Fig.2)

<table>
<thead>
<tr>
<th>METHOD</th>
<th>MSER</th>
<th>PSNR</th>
<th>IQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT</td>
<td>11.64</td>
<td>17.94</td>
<td>.95</td>
</tr>
<tr>
<td>IWT</td>
<td>23.55</td>
<td>26.59</td>
<td>.93</td>
</tr>
<tr>
<td>IWT-POS</td>
<td>23.75</td>
<td>30.59</td>
<td>.94</td>
</tr>
</tbody>
</table>

Table 2: shows that value of fused image and reference image of brain. (Fig.3)

<table>
<thead>
<tr>
<th>METHOD</th>
<th>MSER</th>
<th>PSNR</th>
<th>IQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT</td>
<td>4.44</td>
<td>13.7</td>
<td>.96</td>
</tr>
<tr>
<td>IWT</td>
<td>18.34</td>
<td>21.62</td>
<td>.94</td>
</tr>
<tr>
<td>IWT-POS</td>
<td>18.54</td>
<td>25.62</td>
<td>.93</td>
</tr>
</tbody>
</table>

Table 3: shows that value of fused image and reference image of brain (Fig.4)

<table>
<thead>
<tr>
<th>METHOD</th>
<th>MSER</th>
<th>PSNR</th>
<th>IQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>WT</td>
<td>4.0</td>
<td>12.6</td>
<td>.96</td>
</tr>
<tr>
<td>IWT</td>
<td>18</td>
<td>21.0</td>
<td>.94</td>
</tr>
<tr>
<td>IWT-POS</td>
<td>18</td>
<td>25.4</td>
<td>.93</td>
</tr>
</tbody>
</table>

![Figure 5](image5.png)
Figure 5: shows that comparative result analysis of all three Parameter for two different images of abdomen (Fig 2), here our hybrid method IWT-POS shows the better result in the form of such as MSER, PSNR and IQI
6. CONCLUSION AND FUTURE WORK
In this paper proposed an optimized feature based image fusion technique. The proposed method used wavelet based feature extraction technique, wavelet provide lossless feature extraction. The extracted feature used new born optimization algorithm particle of swarm optimization. Our experimental result shows that better performance in compression of pervious image fusion technique. The proposed image fusion technique improved the value of PSNR and value of image quality index value. In future further explored this method and increase the value of PSNR and image quality index.

7. REFERENCES