**Fusion of Infrared and Visible Image using Wavelet:**

1. **Loading and Preprocess Infrared and Visible Image:**

Both infrared and Visible images were loaded and converted to gray scale and then to double for further processing.

**Code:**

% Read and preprocess images

IR = imread("manWalkIR.jpg");

VIS = imread("manWalkVB.jpg");

% original images

figure(1)

subplot(1,2,1); imshow(IR, []); title('Infrared Image');

subplot(1,2,2); imshow(VIS, []); title('Visible Image');

% Convert to grayscale if necessary

if size(IR,3)==3

IR = rgb2gray(IR);

end

if size(VIS,3)==3

VIS = rgb2gray(VIS);

end

% Resize to same size

[rows, cols] = size(IR);

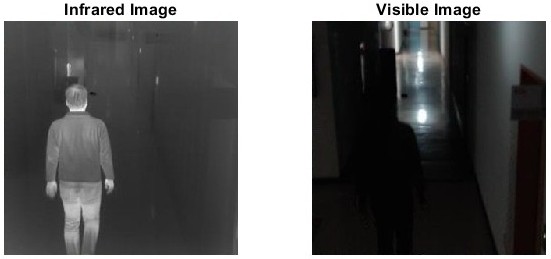
VIS = imresize(VIS, [rows cols]);

% Convert to double

IR = im2double(IR);

VIS = im2double(VIS);

**Output:**



**Fig. 1: Original Images**

1. **Applying single level Discrete Wavelet Transform:**

Here we applied the single level discrete wavelet transform to both the infrared and visible images. By doing so we got the Approximation, Horizontal, Vertical and Diagonal components of both the images. Here we used the ‘db2’ wavelet.

**Code:**

% Apply single-level DWT

[LL\_IR, LH\_IR, HL\_IR, HH\_IR] = dwt2(IR, 'db2');

[LL\_VIS, LH\_VIS, HL\_VIS, HH\_VIS] = dwt2(VIS, 'db2');

% infrared image components

figure(2)

subplot(2,2,1); imshow(LL\_IR, []); title('Approximation (LL)');

subplot(2,2,2); imshow(LH\_IR, []); title('Horizontal Detail (LH)');

subplot(2,2,3); imshow(HL\_IR, []); title('Vertical Detail (HL)');

subplot(2,2,4); imshow(HH\_IR, []); title('Diagonal Detail (HH)');

% visible image components

figure(3)

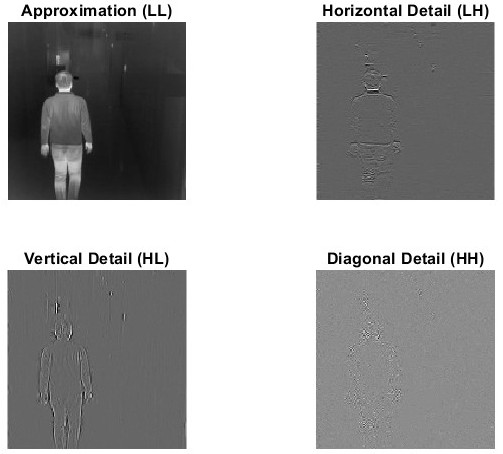
subplot(2,2,1); imshow(LL\_VIS, []); title('Approximation (LL)');

subplot(2,2,2); imshow(LH\_VIS, []); title('Horizontal Detail (LH)');

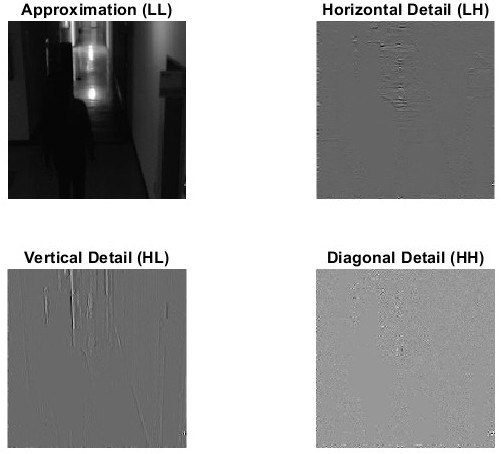
subplot(2,2,3); imshow(HL\_VIS, []); title('Vertical Detail (HL)');

subplot(2,2,4); imshow(HH\_VIS, []); title('Diagonal Detail (HH)');

**Output:**



**Fig. 2: Components of Infrared Image**



**Fig. 3: Components of Visible Image**

1. **Fusion of coefficients:**

Now we fused the components of both the images by taking the maximum among infrared and fused image components.

**Code:**

% Fuse coefficients

LL\_fused = (LL\_IR + LL\_VIS) / 2; % average of approximations

LH\_fused = max(LH\_IR, LH\_VIS); % max for detail coefficients

HL\_fused = max(HL\_IR, HL\_VIS);

HH\_fused = max(HH\_IR, HH\_VIS);

1. **Reconstruction of Fused image:**

Here we applied the inverse discrete wavelet transform to the fused components and combine them together to form the final fused image.

Code:

% Reconstruct fused image

Fused = idwt2(LL\_fused, LH\_fused, HL\_fused, HH\_fused, 'db2');

1. **Displaying the results:**

**Code:**

% Display results

% fused image

figure(4)

imshow(Fused, [])

title("Fused Image")

**Output:**



**Fig. 4: Final Fused Image**

1. **Evaluation Matrix**

|  |  |  |  |
| --- | --- | --- | --- |
| **Methods** | **EN** | **MI** | **SF** |
| STDFusionNet (Paper) | 7.1978 ± 0.4793 | 3.7416 ± 0.5181 |  |
| STDFusionNet (Self) | 5.6256 | 4.2588 |  |
| Wavelet | 6.8057 | 3.2315 |  |