

# Manual Wavelet Transform

Anubhav Rathore

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## Defaults

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```
clear all;  
close all;  
clc;
```

## Image

---

```
I = imread("ironman.jpg");  
figure, subplot(2,4,[1 2]), imshow(I), title("Original Image");  
Ig = rgb2gray(I);  
subplot(2,4,[3 4]), imshow(Ig),title("Grayscale Image");
```

## Function

---

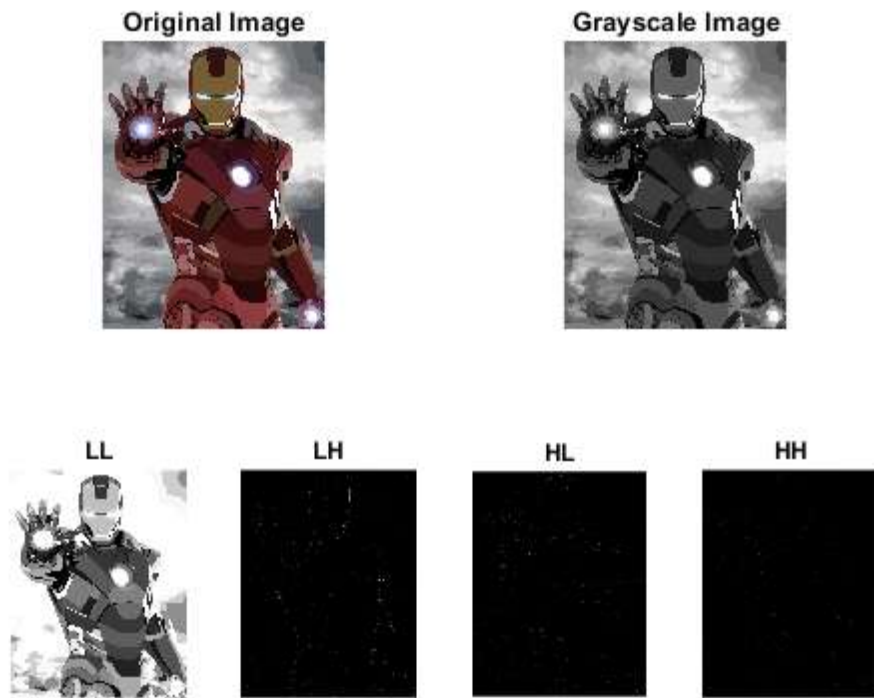
```
function [LL, LH, HL, HH] = haar_wavelet_transform_single(img)  
    img = double(img);  
    [rows, cols] = size(img);  
    rows = rows - mod(rows, 2);  
    cols = cols - mod(cols, 2);  
    img = img(1:rows, 1:cols);  
  
    LL = zeros(rows/2, cols/2);  
    LH = zeros(rows/2, cols/2);  
    HL = zeros(rows/2, cols/2);  
    HH = zeros(rows/2, cols/2);  
  
    for i = 1:2:rows  
        for j = 1:cols  
            avg = (img(i, j) + img(i+1, j)) / sqrt(2);  
            diff = (img(i, j) - img(i+1, j)) / sqrt(2);  
            img(i, j) = avg;  
            img(i+1, j) = diff;  
        end  
    end  
  
    for j = 1:2:cols  
        for i = 1:rows  
            avg = (img(i, j) + img(i, j+1)) / sqrt(2);  
            diff = (img(i, j) - img(i, j+1)) / sqrt(2);  
            img(i, j) = avg;
```

```

        img(i, j+1) = diff;
    end
end

LL = img(1:2:rows, 1:2:cols);
HL = img(2:2:rows, 1:2:cols);
LH = img(1:2:rows, 2:2:cols);
HH = img(2:2:rows, 2:2:cols);
end

```



## Results

```

[LL, LH, HL, HH] = haar_wavelet_transform_single(Ig);
LLs = uint8(LL);
subplot(2,4,5), imshow(LLs),title("LL");
LHs = uint8(LH);
subplot(2,4,6), imshow(LHs), title("LH");
HLs = uint8(HL);
subplot(2,4,7), imshow(HLs),title("HL");
HHs = uint8(HH);
subplot(2,4,8), imshow(HHs),title("HH");

```