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% Created by Vipul Pawar
% Performing DWT (Discrete Wavelet Transform) without built-in commands

clear;
close all;
clc;

% Read the image
url
= 'https://imgs.search.brave.com/eUt9huxzUVB-nq3XQzMSqGXdVSY5-wENGENFU1VE8-0/
rs:fit:500:0:0:0/g:ce/aHR0cDovL2xlbm5h/Lm9yZy9sZW5fc3Rk/LmpwZw';
img_color = imread(url);

% Convert to grayscale for DWT processing
img_gray = rgb2gray(img_color);
img_gray = double(img_gray);

% Define Haar wavelet filters
LPF = [1/sqrt(2), 1/sqrt(2)]; % Low-pass filter
HPF = [-1/sqrt(2), 1/sqrt(2)]; % High-pass filter

% Row-wise Convolution and Downsampling
low_rows = conv2(img_gray, LPF, 'same');
high_rows = conv2(img_gray, HPF, 'same');

low_rows_ds = low_rows(:, 1:2:end);
high_rows_ds = high_rows(:, 1:2:end);

% Column-wise Convolution and Downsampling
LL = conv2(low_rows_ds, LPF', 'same'); % Approximation
LH = conv2(low_rows_ds, HPF', 'same'); % Horizontal details
HL = conv2(high_rows_ds, LPF', 'same'); % Vertical details
HH = conv2(high_rows_ds, HPF', 'same'); % Diagonal details

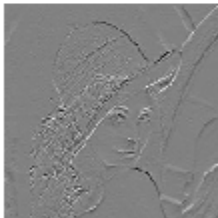
LL = LL(1:2:end, :);
LH = LH(1:2:end, :);
HL = HL(1:2:end, :);
HH = HH(1:2:end, :);

% Display results
figure;
subplot(2,3,1), imshow(img_color), title('Original Image (Color)');
subplot(2,3,2), imshow(img_gray, []), title('Grayscale Image');
subplot(2,3,3), imshow(LL, []), title('LL (Approximation)');
subplot(2,3,4), imshow(LH, []), title('LH (Horizontal)');
subplot(2,3,5), imshow(HL, []), title('HL (Vertical)');
subplot(2,3,6), imshow(HH, []), title('HH (Diagonal)');
```

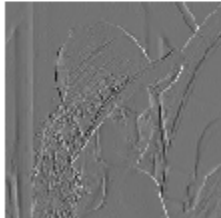
Original Image (Color) Grayscale Image LL (Approximation)



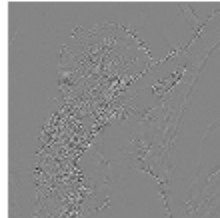
LH (Horizontal)



HL (Vertical)



HH (Diagonal)



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