Mathematical Methods and Techniques in Signal Processing - I

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Lecture – 62
Demo on Wavelet Decomposition

So, let us have some interactive problem solving sessions by my students who have taken this course. So, you will see some illustrations and examples into problem solving which is useful to understand and digest the concepts learnt during the lectures.

Hi all. I am Zita, a PhD student at IISC. In this session, we will be seeing a MATLAB demonstration for Wavelet Decomposition of images. So, let us start with the demo.

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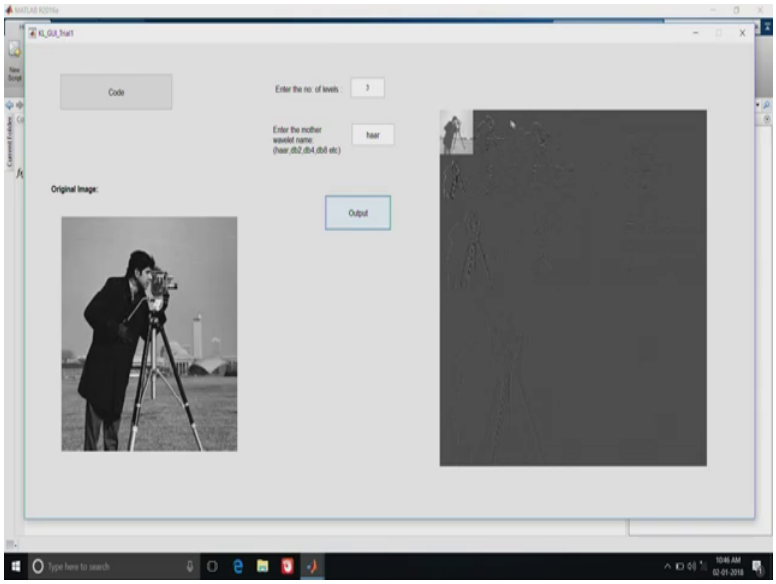

So, before going to the demo, I will just go through the code first.

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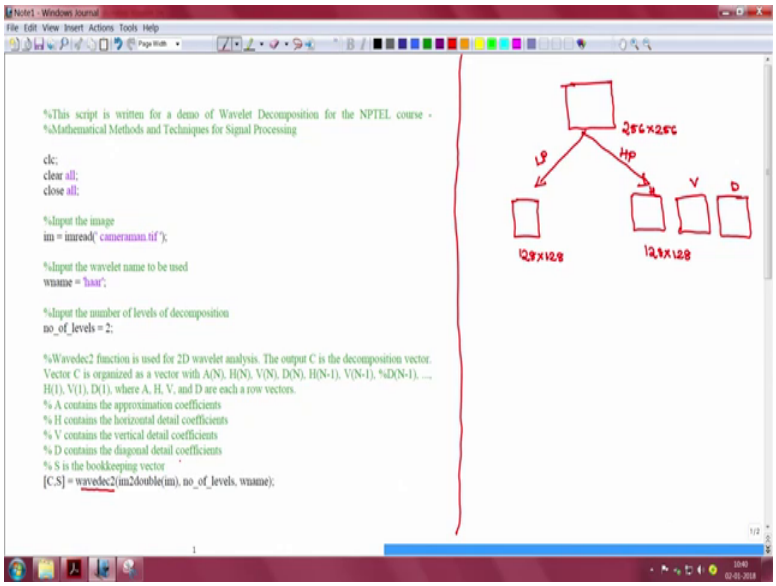

So in for the image that we have to use, then specify the wavelet that we are going to use, then input the number of levels of decomposition. So, the next step is to do the Wavelet Decomposition. The function wavedec2 in MATLAB is it used for 2-D wavelet analysis.

So what it does is, we have an original image, they are going for a dyadic decomposition. Consider this as a 256 closed 50, 256 image, then this is the output from the low pass filter and this is the output from the high pass filter which will be of size 128 cross 128. In case of images, the high pass filter outputs will give for 3 different orientations that is for this will be for horizontal orientation, the other one will be for vertical orientation and the other one for the diagonal orientation.

So, the C vector in the result is decomposition vector and the S vector will be the bookkeeping vector which contains a length of the decomposition vector.

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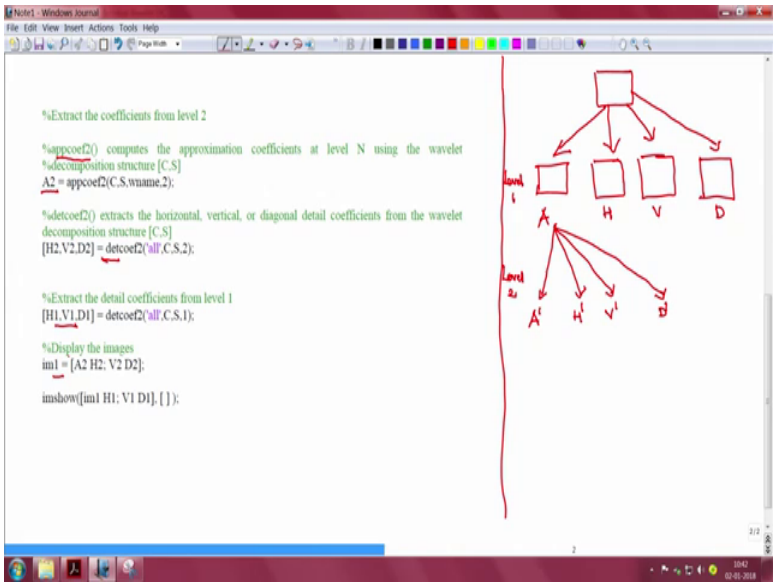

So, the next step is to extract these coefficients. So, this function computes the approximation coefficients at the level n using the wavelet decomposition structures C and S. So, from this, we will get the approximation coefficients in the level 2. So, I will represent it like this. So now, we have one image. We are getting one set of approximation coefficients, then horizontal detail coefficients, vertical detail coefficients and diagonal detail coefficients. This is for level 1.

So, in level 2, the approximation coefficient from the first level is again decomposed into 4 new vectors, A dash, H dash, B dash and D dash. So, this is what is happening here. So, from this, one this step they will get the approximation coefficient from the level 2 and from this step, we will get the detail coefficients from the level 2 itself and then we will extract the detail coefficients from the level 1 and display the results. So, this is the original image that we are using.

So, let us specify the number of levels. First, we will go with one then give the mother wavelet name as Haar or db 2 or db 4 whatever we want, then show the output. So, the output from the output, we can see that the first image is output from the low pass filter that is a approximation coefficients and the other three are from the high pass filter. So, this corresponds to the horizontal coefficients, this corresponds to the vertical detail coefficients and the third fourth one, diagonal detail coefficients. Now in, will go to the level 2 decomposition using the same wavelet, see the output. So, it is taking the

approximation coefficient from the level 1 and it is again decomposed into four different images.

Next we will change it to 3 and see the result. So, from the approximation coefficients from the level 2 is being decomposed again into four and we can see the results here.

Thank you.