PROJECT – 2

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For 1D sampling rate conversion for x2 conversion, find the interpolation filters for sample-and-hold, linear interpolation, and cubic convolution interpolation (a=-0.5). Plot the impulse and magnitude responses of the filters.Chart, box and whisker chart

Description automatically generatedChart, line chart

Description automatically generatedChart

Description automatically generatedChart, line chart

Description automatically generatedChart

Description automatically generatedChart, line chart

Description automatically generated

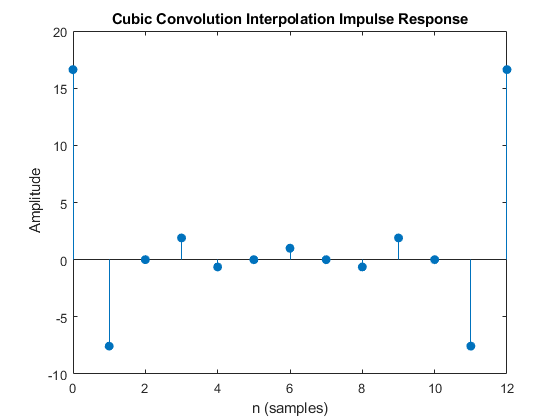
For 1D sampling rate conversion for x3 conversion, find the interpolation filters for sample-and-hold, linear interpolation, and cubic convolution interpolation (a=-0.5). Plot the impulse and magnitude responses of the filters.

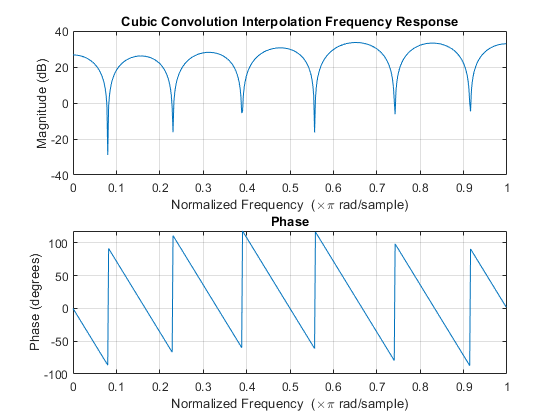
Chart, box and whisker chart

Description automatically generatedChart, line chart

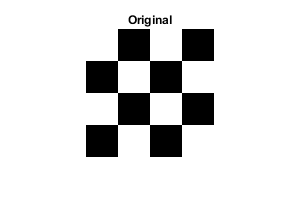
Description automatically generatedChart, histogram

Description automatically generatedChart, line chart

Description automatically generated



Using double for-loops, implement the filter by h=ones(5,5); (the center is the (0,0)th sample) with zero, repeated, and periodic boundary conditions. Show the original, filtered, and difference images. (The size of the filtered image is the same as the original.)

Qr code

Description automatically generatedA picture containing graphical user interface

Description automatically generatedQr code

Description automatically generated with low confidence

A picture containing graphical user interface

Description automatically generatedQr code

Description automatically generated with medium confidenceA picture containing square

Description automatically generated

Scale the image by 3/2 by i) upsample the image by 3, ii) interpolate with a third band filter iii) anti-alias with a half band filter, iv) and downsample by 2. Display the result.

A picture containing text, person

Description automatically generatedA person sitting on a chair

Description automatically generated with low confidenceA person sitting on a chair

Description automatically generated with low confidence

Scale the result by 2/3 by i) upsample the image by 2, ii) interpolate with a half band filter, iii) anti-alias with a third band filter, iv) and downsample by 3. Display the result.

A person sitting on a chair

Description automatically generated with low confidenceA picture containing text, person

Description automatically generatedA person sitting on a chair

Description automatically generated with low confidence

For sample-and-hold interpolation MSE is 0.004212.

For linear interpolation MSE is 0.003165.

For cubic interpolation MSE is 0.003376.

A picture containing text

Description automatically generatedA picture containing text

Description automatically generatedText

Description automatically generated with low confidence

Compare the demosaicing performance. We can check the absolute error between the demosaiced and original images, check if there are any demosaicing artifacts, and also measure the mean square error (MSE) between the demosaiced and original images.

MSE for cubic interpolation (step 2) is 0.000570 and for interpolated (step 3) is 0.000570.

A picture containing background pattern

Description automatically generated

Show the original, compressed, and (absolute) error images. Measure the MSE between the original and compressed images.

MSE score is 2.6260e-04. A person wearing a hat

Description automatically generated

A person wearing a hat

Description automatically generatedShape

Description automatically generated with medium confidence

Collect the quantization results (indices, not quantized coefficients) of each block into a matrix b. Save it into a file by imwrite(abs(b),'comp\_qf.tiff'). Measure MSE between the compressed and original images. Plot MSE vs file size.

Chart

Description automatically generated

Download signal.mat, and show x. Apply 128 tap 2D fft to non-overlapping 128 ⇥ 128 sample blocks and plot the magnitude responses (absolute values of the 2D fft) using mesh.

A picture containing window, building, tiled

Description automatically generatedChart

Description automatically generatedChart

Description automatically generatedChart

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