**ECE 418 Lab 6**

Aahan Thapliyal

aahant2

In this lab we use interpolation and decimation in the time domain to change images to display a video using MATLAB. This lab was used to get us familiarized with MATLAB and interpolation and decimation techniques for video processing.

Part A:

In part A of the lab we used start and end image in the video sequence and filled in-between frames by filling them with the interpolated results of the two images. This gave a faded effect between image X and image Y when the images were shown as videos using MATLAB.

Q5. Intensity interpolation is only good for recovering video if the missing frames are not really large. Since we can see using the part A of lab, when we only have one missing frame the interpolated image sequence is not that different from the original image sequence. However, as we increase the number of missing frames, intensity interpolation is not that effective for recovering missing frames as when we decimate and interpolate by a factor of 4 the output image sequence looks a lot blurry and unlike the original video.

Part B:

In part B we decimated the image sequence by 4 and then used interpolation to fill in the frames of the video. The MSE for decimation and interpolation by 2 and 4 is:

MSE\_2 = 166.9541

MSE\_4 = 359.4466

Q1. Comparing the interpolated images in the synthesized sequence to the corresponding frames of the real football sequence we have found that they differ by a factor of ½ when decimating by 2 and by a factor of ¼ when decimating by 4. There is a difference between the original and generated images because the generated images uses images before and images after to linearly predict what the image produced should look like which is not the same as the original image.

The difference was more noticeable for decimation and interpolation by 4 because we are removing 3 original frames and predicting 3 frames which is more compared to decimation and interpolation by 2 where we only remove 1 original frame and predict that so the difference is not that noticeable.

Part C:

In part C we use pyramid decomposition algorithm in time domain to reconstruct video frames with zero error. As predicted the MSE of part C was 0.

Q2.We can apply pyramid decomposition in spatial domain by following the same algorithm as we followed in the part but instead of working with a bunch of images we use only one image.

1. We first downsample the image by a factor of 2. We then interpolate the downsampled image and store difference between original pixel and interpolated pixels as difference image.
2. We then downsample the downsampled image by a factor of 2 and then interpolate this image and store the difference between the original pixel and interpolated pixel as a difference image.
3. For reconstruction procedure, we first interpolate the downsampled image by factor of 4 and then add the pixels from difference image from step 2 to it.
4. We then interpolate this image by factor of 2 and add the pixels from difference image in step 1.

Following are the additions and multiplication required by each steps:

1. Addition: 8x486x486; Multiplication: 4x486x486
2. Addition: 4x486x486; Multiplication: 2x486x486
3. Addition: 4x486x486; Multiplication: 2x486x486
4. Addition: 8x486x486; Multiplication: 4x486x486

Q3. Addition/pixel for compression = (8+4) = 12

Multiplication/pixel for compression = (4+2) = 6

Q4. Addition/pixel for decompression = (4+8) = 12

Multiplication/pixel for decompression = (2+4) = 6

In this lab we got familiarized with MATLAB programming and used interpolation and decimation in each part to see what the effects would be like in a video. We also learned pyramid coding method to decompose an image without any error.