EE6427 Assignment

Deadline for submission of assignment in **hardcopy form**: **12 November 2018 (3:00pm)**
Venue: My office at S2-B2a-09
(**NO** late submission is allowed.
Please do NOT send me a softcopy of the assignment)

(1) Calculate two-dimensional transform of figure 1 by using row column decomposition method with the basis function in figure 2, please show all the intermediate steps to obtain the final result.

$$\begin{pmatrix} 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 \\ 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 \\ 20 & 20 & 20 & 20 & 20 & 20 & 20 & 20 \\ 20 & 20 & 20 & 20 & 20 & 20 & 20 & 20 \\ 40 & 40 & 40 & 40 & 40 & 40 & 40 & 40 \\ 40 & 40 & 40 & 40 & 40 & 40 & 40 & 40 \\ 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 \\ 100 & 100 & 100 & 100 & 100 & 100 & 100 & 100 \end{pmatrix}$$

Figure 1

$$\begin{pmatrix} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 & 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 & 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 & 1 & -1 & -1 & 1 \\ 1 & 1 & 1 & 1 & -1 & -1 & -1 & -1 \\ 1 & -1 & 1 & -1 & -1 & 1 & -1 & 1 \\ 1 & 1 & -1 & -1 & -1 & -1 & 1 & 1 \\ 1 & -1 & -1 & 1 & -1 & 1 & 1 & -1 \end{pmatrix}$$

Figure 2

if the quantization matrix in page 43 of the lecture note “compression fundamental” is used, calculate the quantization output. What is the one-dimensional output after zig-zag scanning.

(2) MPEG-4 video is supposed to be VOP-based. Describe the shape decoding implementation with some simple diagrams and examples.

(3) Plot the PSNR curve by changing the quantization value at an H.263 encoder.

- Use the "foreman_cif.yuv" (can be obtained from ntulearn site) sequence of first 100 frames.
- Use tmn.exe (Unzip from h263.zip. It is a DOS program which requires to execute on command prompt) to generate the result.
- Perform experiments with fixed quantization parameters, try at least 12 different QPs.

Discuss your results based on the reconstructed video quality and the PSNR obtained. You may need to write a simple program to implement calculate the overall PSNR, where x_i are the original pixels and $\hat{x}_i$ are the reconstructed pixels obtained from tmndec. Plot the PSNR against various different bitrate as shown in figure 3.

Figure 3

Fix the bitrate to different values (at least 5 different bitrates), plot the PSNR against frame number as shown in the following figure 4. Please comment your results.

Figure 4

(4) Use arithmetic coding method in page 23 of the lecture note “compression fundamental”. Show all the steps of the divisions of the interval during arithmetic encoding of YOUR FULL NAME (please exclude comma “,”) as appear in Matriculation Card, e.g. “BILL GATES”. Show the codeword produced by the encoding procedure. (If your name is longer than 8 letters, you only need to encode the first 8 letters of your name).

(5)
Use the first 16 ASCII code of YOUR FULL NAME (please exclude comma “,”) and YOUR Matriculation number as an input to fill up the following 4x4 matrix.
For example: “CHAN TAI MAN G1234567Q” the corresponding ASCII codes for the first 16 values are “67 72 65 78 32 84 65 73 32 77 65 78 32 71 49 50”

67	72	65	78
32	84	65	73
32	77	65	78
32	71	49	50

Apply two-stage Haar Wavelet Transform to the matrix. Show the coefficients output from each stage of decomposition.