TUTORIAL 8 – MULTIMEDIA SIGNAL PROCESSING

1. What are the two major type of data compression?

2. How does the sampling rate affect multimedia data?

3. How does data compression work?

4. Why do data compression?

5. Define Compression Ratio.

6. What are the typical range of compression ratio for lossless and lossy compression?

7. Briefly describe Huffman coding

8. Briefly describe LZW coding

9. Give some coding schemes under both lossless and lossy compression?

10. Explain why in certain situation, lossy data compression is preferred over lossless?

11. For GIF image representation use lossless or lossy compression? What is the coding scheme used?

12. List down 4 types of data redundancy?

13. Determine the memory storage requirement for a 320 x 240 8-bit grayscale.

14. Describe the 4 important building blocks of JPEG encoder.

15. Why do we prefer DCT instead of DFT for compression?

16. Given a 3x3 grey-scale image given by the following matrix, f(x,y) denotes the intensity.

$$\begin{matrix} 2 & 4 & 3 \\ 1 & 5 & 2 \\ 4 & 4 & 4 \end{matrix}$$

Construct the Huffman codeword, average code length, source entropy and code efficiency.

17. During MPEG compression, a video frame has the following block of frequency domain values.

125	126	21	139
30	18	126	193
22	74	75	190
76	79	135	132

a. Using a constant quantisation value of 64, what is the MPEG quantization?
b. Zig-Zag scanning?
c. Run length encoding?

18. Compute the Discrete Cosine Transform, DCT for one-dimensional array, m=[5, 4, 3, 2, 1] using the following formula. What will be DCT values both DC coefficient and AC coefficients, if m = [5, 5, 5, 5, 5]? Why?

DCT(Forward Transform) for N data samples

$$X_{DCT}(k) = \sqrt{\frac{2}{N}} C(k) \sum_{n=0}^{N-1} x(n) \cos\left[\frac{(2n+1)k\pi}{2N}\right] \qquad k = 0,1,\cdots,N-1$$

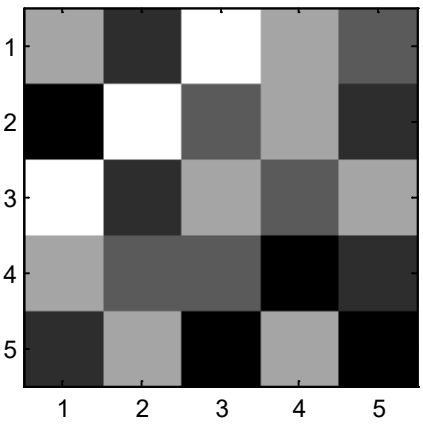
- IDCT(Inverse transform)

$$x(n) = \sqrt{\frac{2}{N}} \sum_{k=0}^{N-1} C(k) X_{DCT}(k) \cos\left[\frac{(2n+1)k\pi}{2N}\right] \qquad n = 0,1,\cdots,N-1$$

$$C(k) = \begin{cases} \frac{\sqrt{2}}{2} & k = 0 \\ 1 & otherwise \end{cases}$$

19. Given the image segment and the intensity's value, compute the DC coefficient of the image. If all the coefficients are 65, what is the DC coefficient, the 24 AC coefficients and the entropy of the image?

Image segment



Pixel values

65	25	95	65	40
10	95	40	65	25
95	25	65	40	65
65	40	40	10	25
25	65	10	65	10

Figure 19: 5x5 Image patch