Assignment #2

CS5262 Multimedia Networking and Systems

Department of Computing Science, National Tsing Hua University, Hsin Chu, Taiwan

Due at 10:00 a.m. on November 25, 2011.

1) (0.5%) For the following colors in RGB color space, determine their values in YCbCr color space:

   a) (255,255,255)

   b) (0, 255, 0)

   c) (255, 255, 0)

   d) (0, 128, 128)

   Hint:

$$\begin{bmatrix} Y \\ C_b \\ C_r \end{bmatrix} = \begin{bmatrix} 0.257 & 0.504 & 0.098 \\ -0.148 & -0.291 & 0.439 \\ 0.439 & -0.368 & -0.071 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} + \begin{bmatrix} 16 \\ 128 \\ 128 \end{bmatrix}$$

2) (0.5%) Explain what are 4:4:4, 4:2:2, 4:1:1, and 4:2:0 chrominance subsamping formats. Draw diagrams to illustrate them.

3) (0.5%) Explain the concept of profiles and levels in MPEG-4.

4) (0.5%) What kinds of scalability are supported by H.264/AVC and H.264/SVC standards?

5) (0.5%) What is drifting? When does it occur? Give two approaches to control drifting.

6) (0.5%) When and why do video bit streams contain start code?

7) (1%) Consider a discrete source with symbols $S = \{s_1, s_2, \ldots, a_L\}$. Compute the entropy of the source in the following two cases:

   a) The source is uniformly distributed among all L symbols.

   b) For a symbol s_a, $p(s_a) = 1$ and $p(s_x) = 0 \ \forall \ x \neq a$.

8) (1%) Encode and decode the following sequence using arithmetic coding. Use the occurrence frequency of each symbol in this sequence as the probability of the symbol. Input: c, b, a, a, a, c, b, a, b, a, c, c. What is the bit rate of the coded sequence? Compare the compression ratio against Huffman coding.