
HW SET #6 (DUE BEFORE CLASS ON MAR 31, WED)

(with automatic extension to April 2, Fri, if necessary)

Problem 1 (50 points) Write a program for half-pel motion estimation based on the code you wrote for integer-pel motion estimation in HW SET #4. Use the same test input sequences. The range for motion vectors in both directions is $[-16, 15.5]$. Use exhaustive search for all possible (dx, dy) in this range. Break a tie by choosing the motion vector that has the smaller magnitude. Store the motion vectors (dx, dy) in a text (ASCII) file in the same format as in HW SET #4.

Please compute the average MAD for each frame in each sequence and compare the result with integer-pel motion estimation in HW SET #4. In addition to putting your code and the motion vector files into `/afs/ece/class/ece796/handin/[your userID]/hw6`, please also put a `result.txt` file (in ASCII format please) detailing the average MAD for each frame in each sequence, both for the integer-pel case and for the half-pel case.

Problem 2 (25 points) Consider the coding of intra DC coefficients for MPEG-1. First, the difference between the current DC coefficient and the DC coefficient of the previous block is computed. Then, the difference is coded with a combination of VLC and VLI as we discussed in class. Assume that the difference is uniformly distributed between -255 to 255 . In other words, if X denotes the difference, then $\text{prob}(X = x_i) = 1/511$, for all $-255 \leq x_i \leq 255$. What is the average number of bits (including both the VLC and the VLI parts) for the difference in luminance? How about the chrominance? Note that the VLC part for the luminance is different from the VLC part for the chrominance.

Problem 3 (25 points) Repeat **Problem 2** for the probability distribution given below:

$$\text{prob}(X = x_i) = \begin{array}{ll} 1/2 & \text{for } x_i = 0 \\ 1/8 & \text{for } |x_i| = 1 \\ 1/32 & \text{for } 2 \leq |x_i| \leq 3 \\ 1/128 & \text{for } 4 \leq |x_i| \leq 7 \\ 1/512 & \text{for } 8 \leq |x_i| \leq 15 \\ 1/2048 & \text{for } 16 \leq |x_i| \leq 31 \\ 1/8192 & \text{for } 32 \leq |x_i| \leq 63 \\ 1/32768 & \text{for } 64 \leq |x_i| \leq 127 \\ 1/65536 & \text{for } 128 \leq |x_i| \leq 255 \end{array}$$

Seminar Abstract

By the time this homework is due, please email me the title and a one-paragraph abstract of your seminar. HTML preferred, but ASCII is fine too. You should form groups of 2 or 3 people, and each group only needs to email me one abstract. I will provide feedback as how suitable each topic

is for the course. If too many groups choose the same topic, I will ask these groups to emphasize on different aspects of the topic.