CompE 565: Multimedia Communication Systems

Project 4: Video Codec

Due Date: May 4, 2014 at 11:59 pm

Learning Goal: Develop a basic MPEG Video encoder and decoder to understand the working principles of video coding.

Project Description: This project is an integration of the concepts implemented in Home Assignment Projects #2 and 3. You are advised to form teams of 4 students each. While two students will implement the encoder the other two will implement a decoder. You should submit a joint project report.

Problem Statement: Implement an MPEG like encoder and decoder for the first 5 frames of the walk_qcif video sequence. A simplified block diagram of the encoder is given in Figure 1.

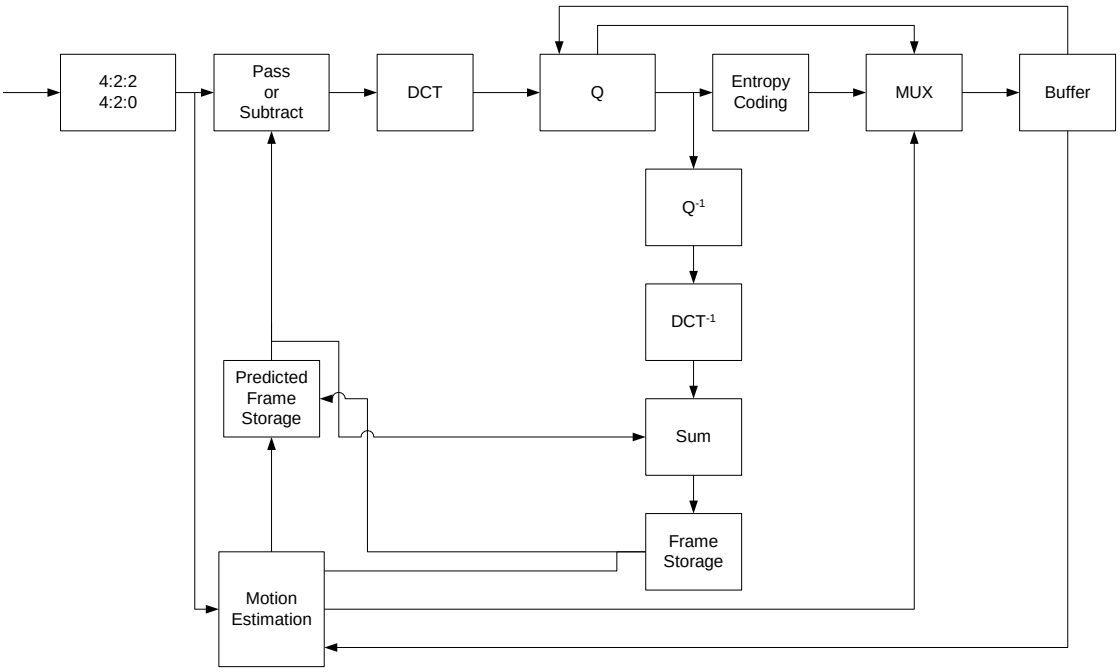

Figure 1: MPEG encoder diagram (ignore the Entropy coding, MUX, and buffer)

Although not shown in Figure 1, motion vectors and Q parameters will need to be transmitted to the decoder. If the motion estimation results in a motion vector of (0,0) and the prediction error (MAD) is less than 128, the block will not be transmitted. The decoder should be signaled to use the block from the reference image for this block.

Please note that we are not implementing the Entropy coding.

Encoder profile: Frame Size: 174 x 144 (show results for only first 5 frames), Format: 4:2:0, use a GOP of 10 frames (I + 9 P, with no B-frames), Macroblock size: 16 x 16 and Block Size: 8 x 8 pixels.

Do not transmit MBs in which MV = {0.0} and prediction error is less than 128.

The following data structure will be communicated between the encoder and decoder for each frame coded and transmitted.

The quantization parameters should be chosen to fit the quantized values into one byte regardless of the AC or DC coefficient.

Image Base Layer Data

Image Start: (1 bytes code = 0xEE)
Slice Start (1 bytes code = 0xDD) % You may decide not to use slice.
Macroblock1
(MacroBlock Type = 1 bytes -- set to 1 for I and 0 for P macroblock and 2 if macroblock is not transmitted)
If (Macroblock is transmitted then
(Qb = 1 Byte)
(MVx = 1 Byte)
(MVy = 1 Byte)
(DC coeff and 7 AC coeff) for top left block
(DC coeff and 7 AC coeff) for top right block
(DC coeff and 7 AC coeff) for bottom left block
(DC coeff and 7 AC coeff) for bottom right block
Macroblock2
Macroblock3
…
…
…
Slice End (1 bytes code = 0xDF)
Next Slice Start (1 bytes code = 0xDD)
Macroblock1
MacroBlock2
Macroblock3
…
…
…
Image End.

Question: Show the motion vectors, difference frames and the reconstructed frames for the first five video frames.