Video Compression – HW2 (05/9/2021)

Instructions – Follow these carefully:

1. Please upload your work to Moodle. The zip file must have the source code and a PDF report where you explain and display the outputs for each problem.
2. You can use either C, Python, or Matlab to do the homework.
3. Please feel free to read related materials available in the official Matlab/Python documentation.
4. The due date is 5/25 before 11:59 pm.

This assignment will use the block-based encoding approach, where the macroblock (MB) size is 16x16. Only the Luma components are considered for the following questions.

1. (40%) Motion Estimation
   Please apply the full-search block-matching algorithm to the luma component of "foreman_qcif_1_rgb.bmp" with the reference frame "foreman_qcif_0_rgb.bmp." The collocated position in the reference frame of the top-left pixel of each MB is the center of the search window. The search range is set to [-16, 15]. The similarity metric is SAD. Please show MVs for all the MBs in the video frame.
2. (10%) Following the previous question, please implement the diamond-search algorithm.

3. (50%) Intra Frame Prediction
   Please apply intra-prediction to the luma component of "foreman_qcif_0_rgb.bmp." You only need to implement the four modes (Mode 0, 1, 2, and 4) for the 16x16 luma MB. You do not make an intra-prediction to the top-left MB since there is no predictor for it. The similarity metric is also SAD. If any pixels are unavailable for a mode, you will not choose it. Please plot the mode for each MB using the example figure below.

x	1	…	2
4	1	…	2
…	…	…	…
0	0	…	4
0	0	…	4