CS3570 Introduction to Multimedia

Homework #3

Due: 11:59pm, 05/02/2017

Write a program for motion estimation (ME) using the block matching methods on the video sequence. You have to implement two search algorithms in the ME, the **full search** and the **2D logarithmic search method**. The search range is $\pm p$ pixels along horizontal and vertical directions. In this implementation, you should apply the ME to all non-overlapping macroblocks to evaluate the motion vector, and the block matching measure is defined as **sum of absolute differences (SAD)**, which is described in the slide.

1. **(50%)** Try the two search ranges (**p=8 and p=16**) and two macroblock sizes (**8x8 and 16x16**) by using the **two search methods**. The reference image is **frame05072.jpg**.
   a. Show the residual images when the target image is **frame05073.jpg** for all the above combinations. **(8 images)**
   b. Show the residual images when the target image is **frame05081.jpg** for all the above combinations. **(8 images)**
   c. Show and compare the total SAD values for all the results in (a) and (b).
   d. Show the PSNR of all the results in (a) and (b), and discuss the relation with the SAD.
2. **(25%)** Use bi-directional prediction to estimate motion vector when reference images are **frame05072.jpg** and **frame05085.jpg**.
   a. Show the residual images and total SAD value when the target image is **frame05081.jpg** in search range **p=8**, **8x8** macroblock size and **2D logarithmic search method**. **(1 image)**
   b. Discuss the results from (a) with the problem 1 of the same settings (p=8, 8x8 macroblock size, 2D logarithmic search method).
3. **(25%)** Analyze the time complexity
   a. Analyze the theoretical time complexity for the two search algorithms.
   b. Measure the execution time required for the two search algorithms with the two different search range sizes **(p=8 and p=16)**.
   c. Compare and discuss the execution time with the theoretical time complexity.

Reminder

- You cannot use Matlab build-in function “imabsdiff ”, “psnr”.

- Your code should work correctly and generated results (display or output files) must be consistent to your results in report.
- In report, should contain at least all the results **(residual images, PSNR values, total SAD values)** mentioned in the problem, how you implement the methods, the **discussion** to the output results, and reference.
- Pack **"[YourID]_report.pdf"**, the output result images, and codes in **"HW3_[YourID].zip"**. Your package should also contain a README file about how to execute your program.