CS3570 Introduction to Multimedia

Homework #3

Due: 11:59pm, 05/04/2018

Write a program for motion estimation (ME) using the block matching methods on the given video sequence. You have to implement two search algorithms to find motion vectors, the **full search** and the **2D logarithmic search method**. The search range is $\pm \boldsymbol{p}$ pixels along horizontal and vertical directions. In this implementation, you should apply the ME to all non-overlapping macroblocks to evaluate the motion vectors, and the block matching measure is defined as **sum of absolute differences (SAD)**, which is described in the slide (p.43).

1. **(70%)** 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 **frame437.jpg**, and the target image is **frame439.jpg**.
   a. Show the predicted images by using the block matching with all the above combinations**. (8 images)**
   b. Show the motion vectors images for all the above combinations**. (8 images)**
   c. Show the residual images for all the above combinations**. (8 images)**
   d. Plot the total SAD values and PSNR for all the results. Discuss the relation between SAD and PSNR.
2. **(10%)** Try the full search method with search range **p=8** and macroblock sizes = **8x8**. The reference image is **frame432.jpg**, and the target image is **frame439.jpg**. Show the PSNR of the result. Compare and discuss the PSNR with the result of same search range and macroblock in question 1.
3. **(20%)** Analyze the time complexity
   a. Measure the execution time required for the two search algorithms with the two different search range sizes **(p=8 and p=16)**.
   b. 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 **(predicted images, motion vectors images, residual images, total SAD, PSNR)** mentioned in the problem, how you implement the methods, the **discussion** about the output results, and reference.
- [-5%] Save the report as **“[YourID]_report.pdf”**.
- [-5%] Please compress all your codes, output images and report into .zip and name it **“HW3_[YourID].zip”**.
- [-5%] Your package should also contain a **README file** about how to execute your program.