# Feedback — Homework 4

Help Center

You submitted this quiz on **Sat 2 May 2015 8:03 PM PDT**. You got a score of **10.00** out of **10.00**.

## Question 1

Check all the applications where motion estimation can be employed to improve the results:

| Your Answer | | Score | Explanation |
|---|---|---|---|
| ☑ Object tracking | ✔ | 0.20 | |
| ☑ Human-computer interaction | ✔ | 0.20 | |
| ☐ Still image inpainting | ✔ | 0.20 | |
| ☑ Video compression | ✔ | 0.20 | |
| ☐ Segmentation of a single image | ✔ | 0.20 | |
| Total | | 1.00 / 1.00 | |

## Question 2

We want to increase the frame rate of a video sequence by inserting a new frame between every two existing consecutive frames. Denote by $y$ the new frame formed via linear interpolation of motion vectors between frames $x_{t-1}$ and $x_t$ in the original video. Assuming that a circular object is centered at pixel $(i,j)$ in $x_{t-1}$ and at pixel $(p,q)$ in $x_t$, where will it be centered in $y$?

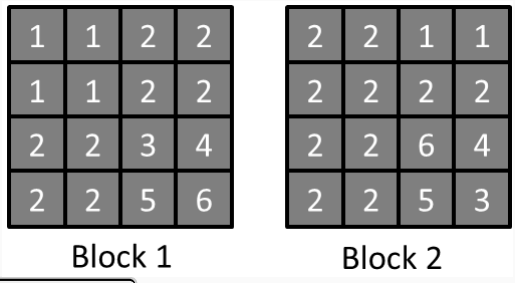
| Your Answer | | Score | Explanation |
|---|---|---|---|
| ○ $(p+i, q+j)$ | | | |
| ◉ $((p+i)/2, (q+j)/2)$ | ✔ | 1.00 | |

- $(p-i, q-j)$
- $((p-i)/2, (q-j)/2)$

| Total | 1.00 / 1.00 |
|---|---|

# Question 3

Calculate the Mean Square Error (MSE) between the two given image blocks (enter your answer to at least one decimal point):




**You entered:**

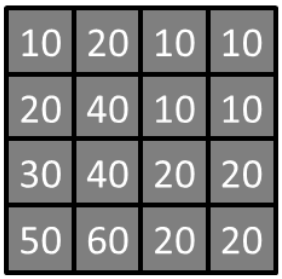
1.5

Preview Help

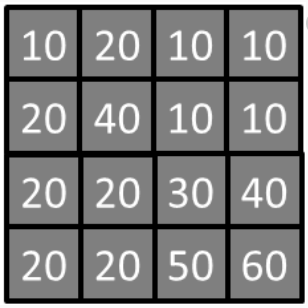
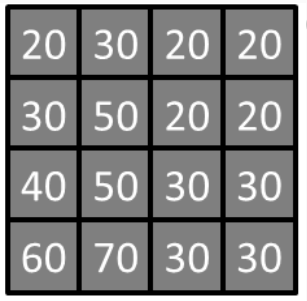
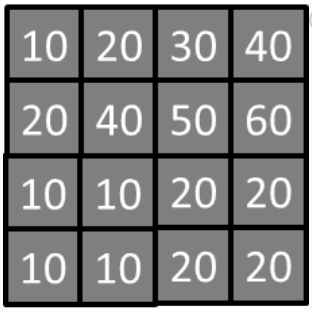
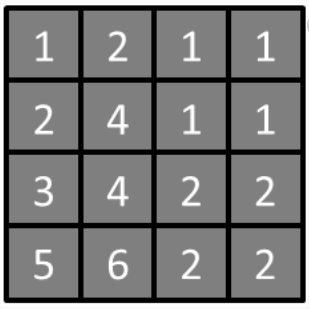
| Your Answer | | Score | Explanation |
|---|---|---|---|
| 1.5 | ✔ | 1.00 | |
| Total | | 1.00 / 1.00 | |

# Question 4

Assume that we want to perform block matching for the image block $x$ given below. Which of the following image blocks is a better match in the Mean Absolute Error (MAE) sense?




Block $x$

| Your Answer | | Score | Explanation |
|---|---|---|---|
|  | | | |
|  | ✔ | 1.00 | |
|  | | | |
|  | | | |
| Total | | 1.00 / 1.00 | |

# Question 5

(True or False) Sub-pixel motion estimation is used in applications where a faster and hence less accurate estimation of motion is needed.

| Your Answer | | Score | Explanation |
|---|---|---|---|
| ○ True | | | |
| ◉ False | ✔ | 1.00 | |
| Total | | 1.00 / 1.00 | |

# Question 6

Refer to the RGB cube shown in the video lecture for this problem. Color magenta can be obtained by 1:1 mixing red and blue; yellow can be obtained by 1:1 mixing red and green; cyan can be obtained by 1:1 mixing blue and green. If magenta, yellow, and cyan are mixed at 1:1:1 proportion, what is the resulting color?

| Your Answer | | Score | Explanation |
|---|---|---|---|
| ○ red | | | |
| ○ green | | | |
| ○ blue | | | |
| ◉ white | ✔ | 1.00 | |
| ○ black | | | |
| Total | | 1.00 / 1.00 | |

# Question 7

(True or False) Intensity in HSI color space is exactly the same as the Y-channel in YCbCr color space, as both represent the "brightness" of an image.

| Your Answer | | Score | Explanation |
|---|---|---|---|
| True | | | |
| False | ✔ | 1.00 | |
| Total | | 1.00 / 1.00 | |

# Question 8

In this problem you will perform block matching motion estimation between two consecutive video frames. Follow the instructions below to complete this problem. (1) Download the two video frames from frame_1 and frame_2. The frames/images are of height 288 and width 352. (2) Load the frame with file name "frame_1.jpg" into a $288 \times 352$ MATLAB array using function "imread", and then convert the array type from 8-bit integer to real number using function "double" or "cast" (note that the range of intensity values after conversion is between 0 and 255). Denote by $I_1$ the converted MATLAB array. Repeat this step for the frame with file name "frame_2.jpg" and denote the resulting MATLAB array by $I_2$. In this problem, $I_2$ corresponds to the current frame, and $I_1$ corresponds to the previous frame (i.e., the reference frame). (3) Consider the $32 \times 32$ target block in $I_2$ that has its upper-left corner at $(65, 81)$ and lower-right corner at $(96, 112)$. Note this is MATLAB coordinate convention, i.e., the first number between the parenthesis is the row index extending from $1$ to $288$ and the second number is the column index extending from $1$ to $352$. This target block is therefore a $32 \times 32$ sub-array of $I_2$. (4) Denote the target block by $B_{target}$. Motion estimation via block matching searches for the $32 \times 32$ sub-array of $I_1$ that is "most similar" to $B_{target}$. Recall in the video lectures we have introduced various forms of matching criteria, e.g., correlation coefficient, mean-squared-error (MSE), mean-absolute-error (MAE), etc. In this problem, we use MAE as the matching criterion. Given two blocks $B_1$ and $B_2$ both of size $M \times N$, the MAE is defined as $MAE(B_1, B_2) = \frac{1}{M \times N} \sum_{i=1}^{M} \sum_{j=1}^{N} |B_1(i,j) - B_2(i,j)|$. To find the block in $I_1$ that is most similar to $B_{target}$ in the MAE sense, you will need to scan through all the $32 \times 32$ blocks in $I_1$, compute the MAE between each of these blocks and $B_{target}$, and find the one that yields the

smallest value of MAE. Note in practice motion search is only performed over a certain region of the reference frame, but for the sake of simplicity, we perform motion search over the entire reference frame $I_1$ in this problem. When you find the matched block in $I_1$, enter the following information: (1) the coordinate of the upper-left corner of the matched block in MATLAB convention. This requires two integer numbers; (2) the corresponding MAE value, which is a floating-point number. Enter the last number to two decimal points. As an example for format of answer, suppose the matched block has upper-left corner located at $(1,1)$, and the corresponding MAE is 10.12, then you should enter 1 1 10.12 (the three numbers are separated by spaces).

**You entered:**

65 81 22.9854

| Your Answer | | Score | Explanation |
|---|---|---|---|
| 65 | ✔ | 1.00 | |
| 81 | ✔ | 1.00 | |
| 22.9854 | ✔ | 1.00 | |
| Total | | 3.00 / 3.00 | |