EE 569 Discussion

Yao Zhu, Zhiruo Zhou

02/26/2020

Midterm1 logistics

- Next Monday (8:00 am – 10:00 am)
- Open book (paper-based resources only, such as textbook, lecture notes written on a notebook, or cheatsheet)
- Usages of computer, mobile phone, Internet, calculator are NOT allowed

- Online exam using Respondus LockDown Browser
- No Q&A for exam content during the test
  - We have made question descriptions as clear as possible and there is no typo.
  - If you need some assumptions which are not stated in the problem description, write them down in your answer and continue on the problem.
- Make sure your have a stable Internet connection!

Midterm1 logistics

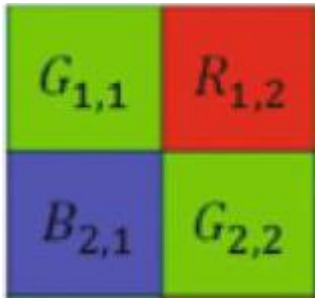
- Exam range
  - Topic #1 ~ Topic#4
  - What you need to review
    - Algorithms you implemented (understand how they work)
    - Lecture notes
- Question types
  - Matching problem (or multi-choice)
  - Written response question (no extensive calculation)
- Make sure you have finished all problems before submission
  - There are multiple pages
  - Check the question answering state listed
  - You can only submit once

Demosaicing

A CFA image of size 5x5 is shown in Fig. 1.1 (b) and its corresponding Bayer pattern is shown in Fig. 1.1(a).

(a) Estimate the missing red and green values at pixel at the image center location with (x,y)= (2, 2) using bilinear interpolation. Show the formula in obtaining your solution. (4 pts.)

(b) Estimate the missing blue and red values at pixel at the image center location with (x,y)= (3, 2) using bilinear interpolation. Show the formula in obtaining your solution. (4 pts.)



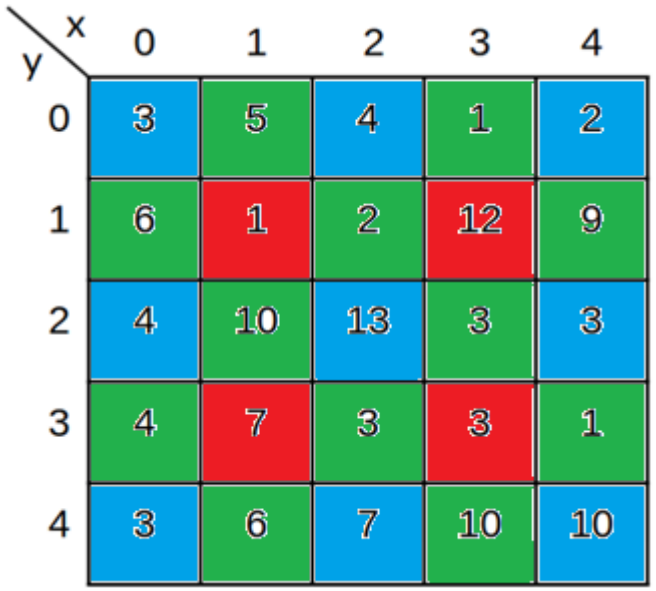
Different from the pattern in homework!

(a) Bayer pattern

y \ x	0	1	2	3	4
0	3	5	4	1	2
1	6	1	2	12	9
2	4	10	13	3	3
3	4	7	3	3	1
4	3	6	7	10	10

(b) A CFA image

Figure 1.1



y \ x	0	1	2	3	4
0	3	5	4	1	2
1	6	1	2	12	9
2	4	10	13	3	3
3	4	7	3	3	1
4	3	6	7	10	10

(a)

$$R_{2,2} = \frac{1}{4}\left(R_{1,1} + R_{1,3} + R_{3,1} + R_{3,3}\right)$$
$$= \frac{1}{4}(1 + 12 + 7 + 3) = \frac{23}{4} = 5.75\ (or\ 5\ or\ 6)$$

$$G_{2,2} = \frac{1}{4}\left(G_{2,1} + G_{2,3} + G_{1,2} + G_{3,2}\right)$$
$$= \frac{1}{4}(10 + 3 + 2 + 3) = 4.5\ (or\ 4\ or\ 5)$$

(b)

$$R_{3,2} = \frac{1}{2}\left(R_{3,1} + R_{3,3}\right) = \frac{1}{2}(7 + 3) = 5$$

$$B_{3,2} = \frac{1}{2}\left(B_{2,2} + B_{4,2}\right) = \frac{1}{2}(13 + 7) = 10$$

Histogram Manipulation

Tommy Trojan applied various transfer functions to the *cameraman* image and produced different results. Please match each specific transfer function labeled by (1)-(5) to five possible output images labeled by (A)-(E). Justify your answer.

Original image

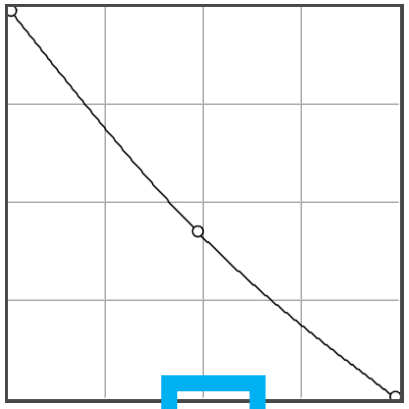
A

B

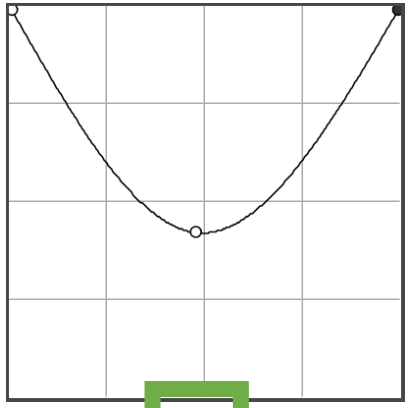
C

D

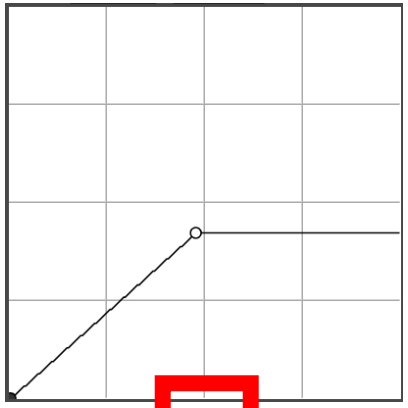
E



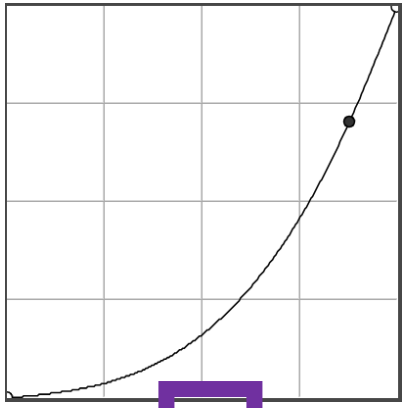
1



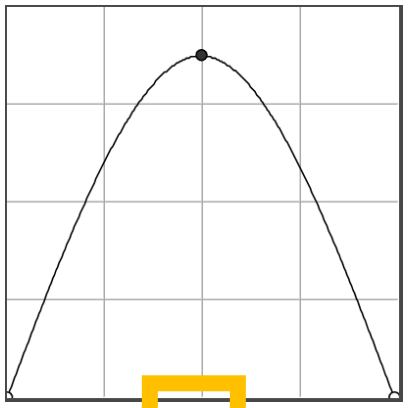
2



3



4



5

Solution

- A-2: Those very dark parts (coat) become very bright, and the original bright parts (base of the camera) are still bright.
- B-3: Lower overall intensity compared to the original image, and no very bright pixels (easy to observe on the bars supporting the camera).
- C-4: Lower overall intensity, and gray parts (sky and river) are darker now, but there are still very bright pixels (camera base).
- D-1: Totally reversed color, like the coat and the bars supporting the camera.
- E-5: Pixels that are originally of low intensity now become brighter, and the original super white part on the camera (camera base) now is nearly total black.

Poor answers – example 1

- A-2
- B-3
- C-4
- D-1
- E-5

Poor answers – example 2

- A-2: Those very dark parts (coat) become very bright, and the original bright parts (base of the camera) are still bright.
- B-3: Lower overall intensity compared to the original image, and no very bright pixels (easy to observe on the bars supporting the camera).
- C-4: That's the only one left :P 
- D-1: Totally reversed color, like the coat and the bars supporting the camera.
- E-5: Pixels that are originally of low intensity now become brighter, and the original super white part on the camera (camera base) now is nearly total black.

Poor answers – example 3

- A-2: very dark and very bright colors are now bright, middle colors are not as bright
- B-3: dark and middle colors doesn't change, bright colors now have middle value
- C-4: the dynamic range is still from 0 to the maximum, it's just that those colors are not as bright as before
- D-1: dark colors become bright, bright colors become dark
- E-5: very dark and very bright colors are now dark, middle colors are now bright

True or False

- “A low-pass filter can sharpen the image while reducing noises.”

  False.

  Weighted average can only blur the edges. Different denoising methods have different extent of blur.

- “Bilateral filter can help keep the edges while denoising.”

  True.

  Bilateral filter applied Gaussian filter not only according to the pixel’s geometric closeness, but it also considers the closeness between the pixel values. Thus, it is good at preserving edges.


Q
A