

EECS 442 Discussion

09/13/2017

Siyuan Chen

Announcement

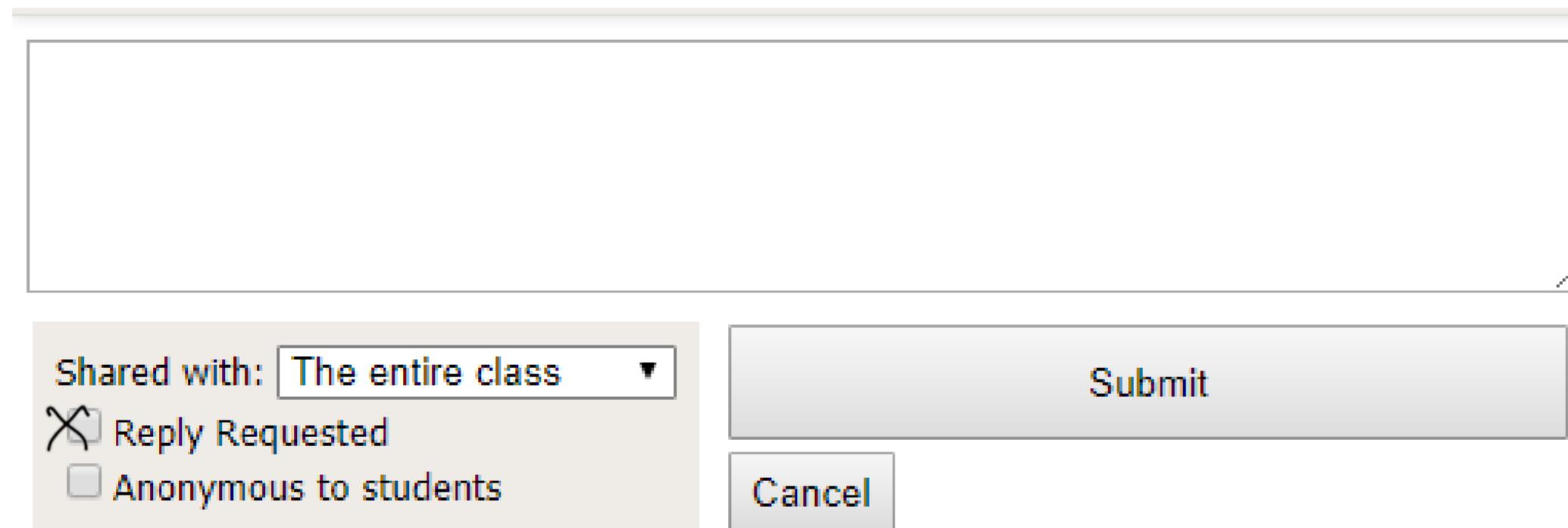
- HW1 will be out today. Due on Thursday, Sept. 28.
- Quiz tomorrow.

Topics

- Nota Bene usage
- Image interpolation
- Bayer demosaicking

How to use NB

- Mark your question as Reply Requested if you hope others to help you answer the question.



- Circle the specific area where you have questions or comments.
Don't circle a half page and ask what it means...
- Amortize the work throughout the week.

What makes a good annotation

- Comments, questions or answers to comments and questions posted by others.
- Aim to demonstrate the substantive and thoughtful reading of the material.

=> Show your thoughts

monochromatic?

Better: I didn't understand the meaning of "monochromatic". According to xxxx, it actually means xxxx. But I am still confused about xxx. Could anyone explain a little bit?

https://en.wikipedia.org/wiki/Lambertian_reflectance

Better: summarize or rephrase the explanation by your own words.

Why is this sign equal?

Better: I am confused about the sign here. I thought it shouldn't be equal because xxxx. Any comments?

What makes a good annotation

- Comments, questions or answers to comments and questions posted by others.
- Aim to demonstrate the substantive and thoughtful reading of the material.

=> Show your thoughts

Still confused what's the difference between digital and discrete image?  ...

Is the main difference that: a digital image pixel is a natural number, while a discrete image pixel is an integer?

Why we can not sample the perfect images?  ...

A perfect image is the continuous image generated by a physical process and as said in 1.2 digital image is a sampled and quantized perfect image. ("In doing so, it will sample and quantize these perfect images to yield digital images")

I think it just means that when we sample a perfect image into a digital image, the digital image we get is not a perfect image anymore. Is that right?

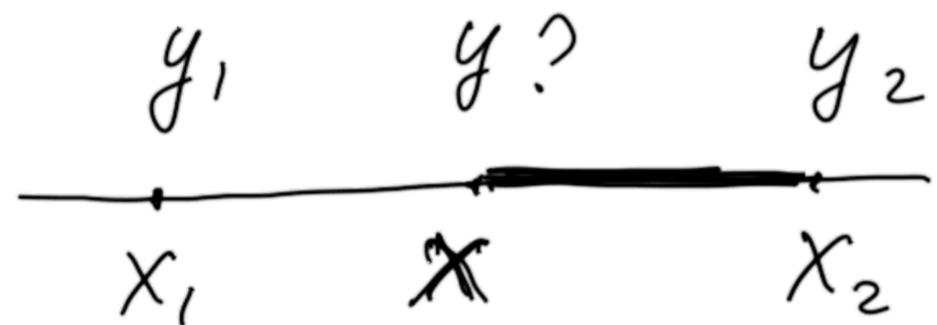
What makes a good annotation

- However, there is no “silly” questions!

We won’t grade your annotations based on how professional they are.

Bilinear Interpolation

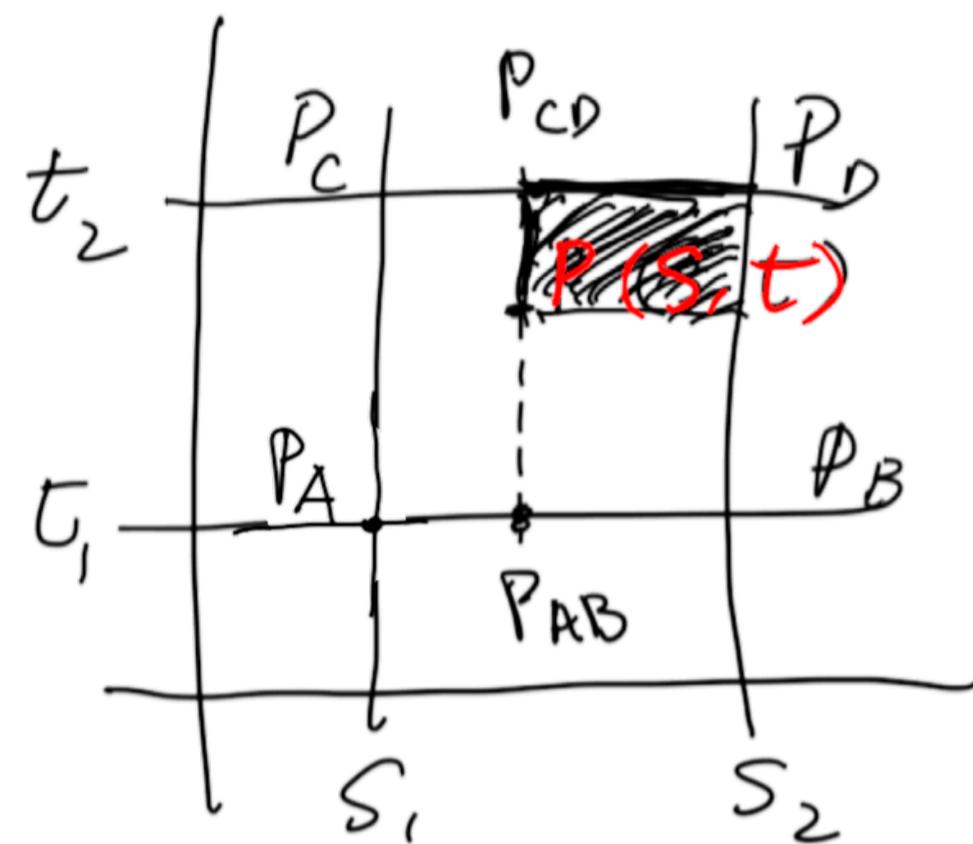
Linear interpolation



$$\frac{y_2 - y}{x_2 - x} = \frac{y - y_1}{x - x_1}$$

$$\Rightarrow y = \frac{x_2 - x}{x_2 - x_1} y_1 + \frac{x - x_1}{x_2 - x_1} y_2$$

Bilinear Interpolation



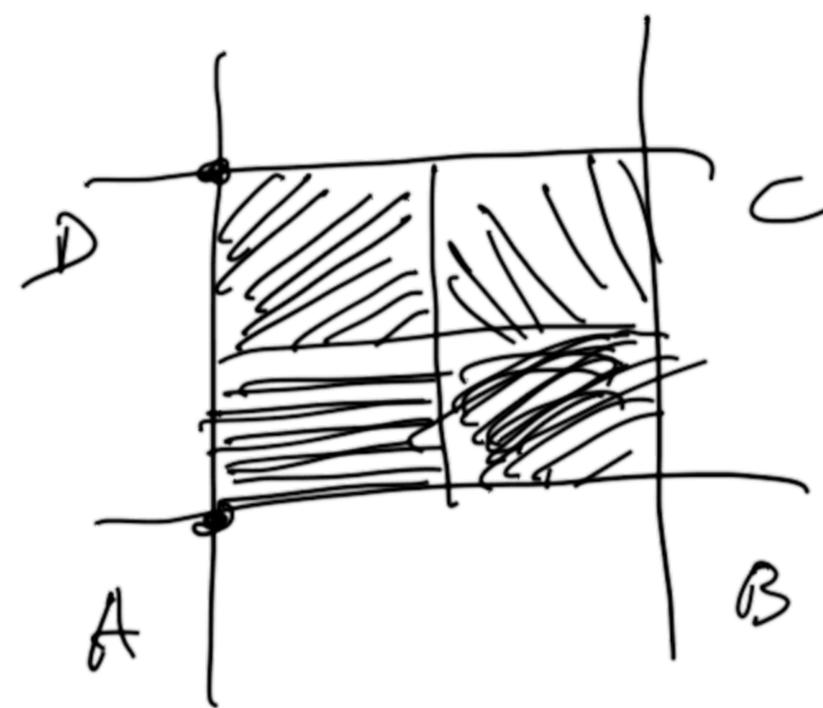
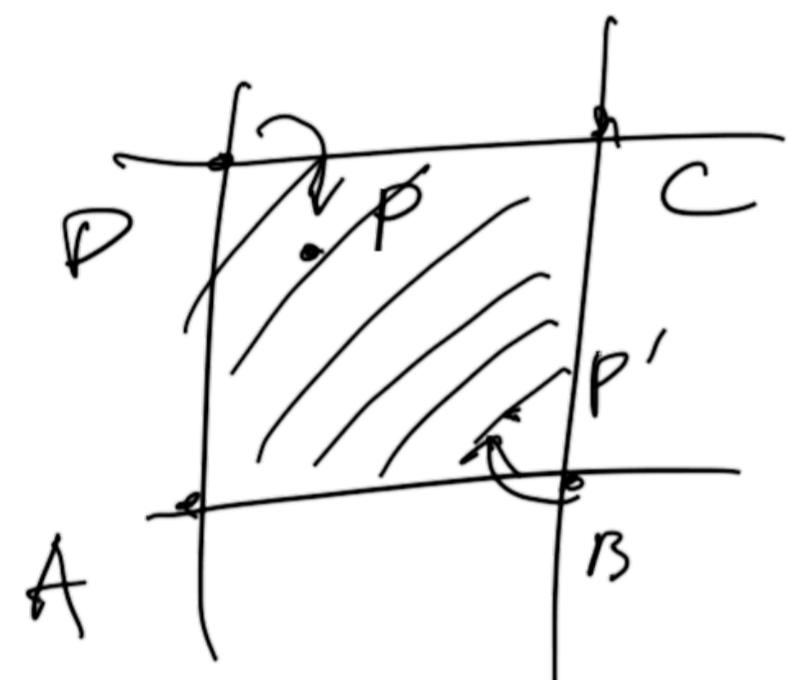
$$I(P_{CD}) = \frac{s_2 - s}{s_2 - s_1} I(P_C) + \frac{s - s_1}{s_2 - s_1} I(P_D)$$

$$I(P_{AB}) = \frac{s_2 - s}{s_2 - s_1} I(P_A) + \frac{s - s_1}{s_2 - s_1} I(P_B)$$

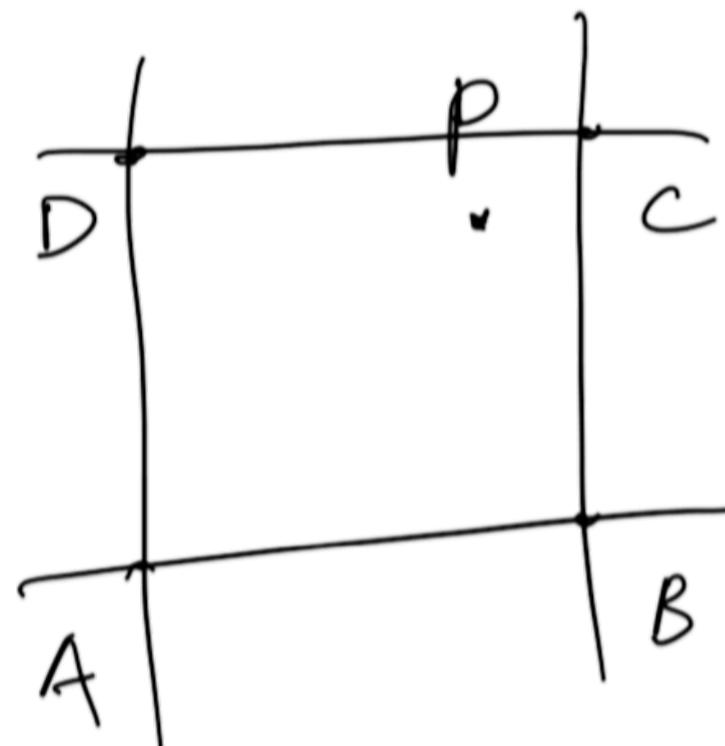
$$I(P) = \frac{t - t_1}{t_2 - t_1} I(P_{CD}) + \frac{t_2 - t}{t_2 - t_1} I(P_{AB})$$

$$I(P) = \underbrace{\frac{(s_2 - s)(t_2 - t)}{(s_2 - s_1)(t_2 - t_1)} I(P_A) + \frac{(s - s_1)(t_2 - t)}{(s_2 - s_1)(t_2 - t_1)} I(P_B)}_{+ - -} + - - I(P_C) + - - I(P_D)$$

Nearest Neighbor Interpolation



Bicubic Interpolation



$$I(x, y) = \dots$$

$$I(x), \quad x = A, B, C, D$$

$$I_x(x), \quad x = A, B, C, D$$

$$I_y(x), \quad x = A, B, C, D$$

$$I_{xy}(x), \quad x = A, B, C, D$$

$$I(x, y) = \underbrace{\sum_{i=0}^3 \sum_{j=0}^3 a_{ij} x^i y^j}$$

Assume we know
these values

Bicubic Interpolation

$$I(x, y) = \sum_{i=0}^3 \sum_{j=0}^3 a_{ij} x^i y^j \Rightarrow 16 \text{ unknown vars } \{a_{ij}\}$$

We know I, I_x, I_y, I_{xy} at 4 corner points A, B, C, D .

Each value can be used to form an equation.

$$\text{e.g., } I(x_A, y_A) = \sum_{i=0}^3 \sum_{j=0}^3 a_{ij} x_A^i y_A^j$$

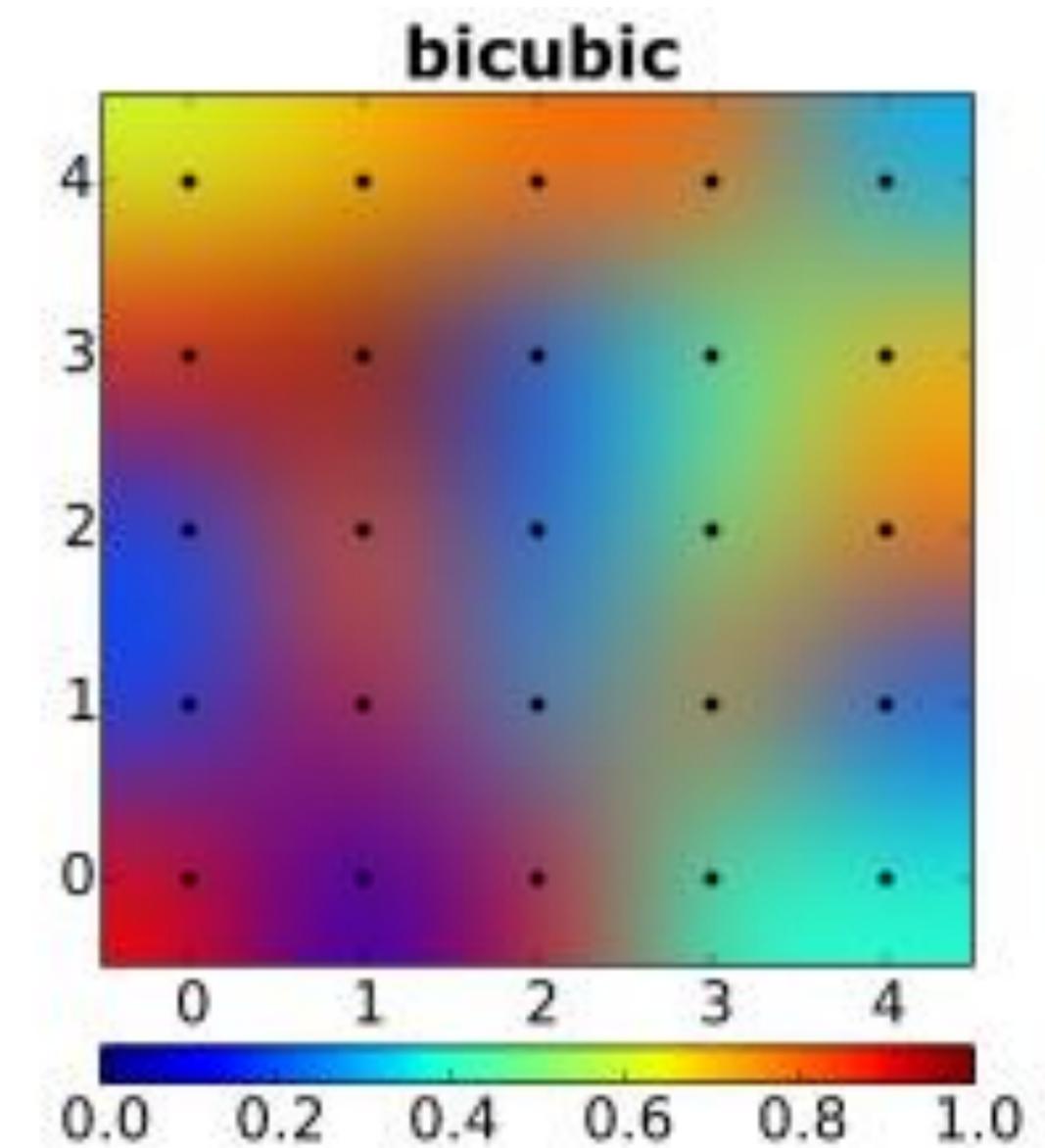
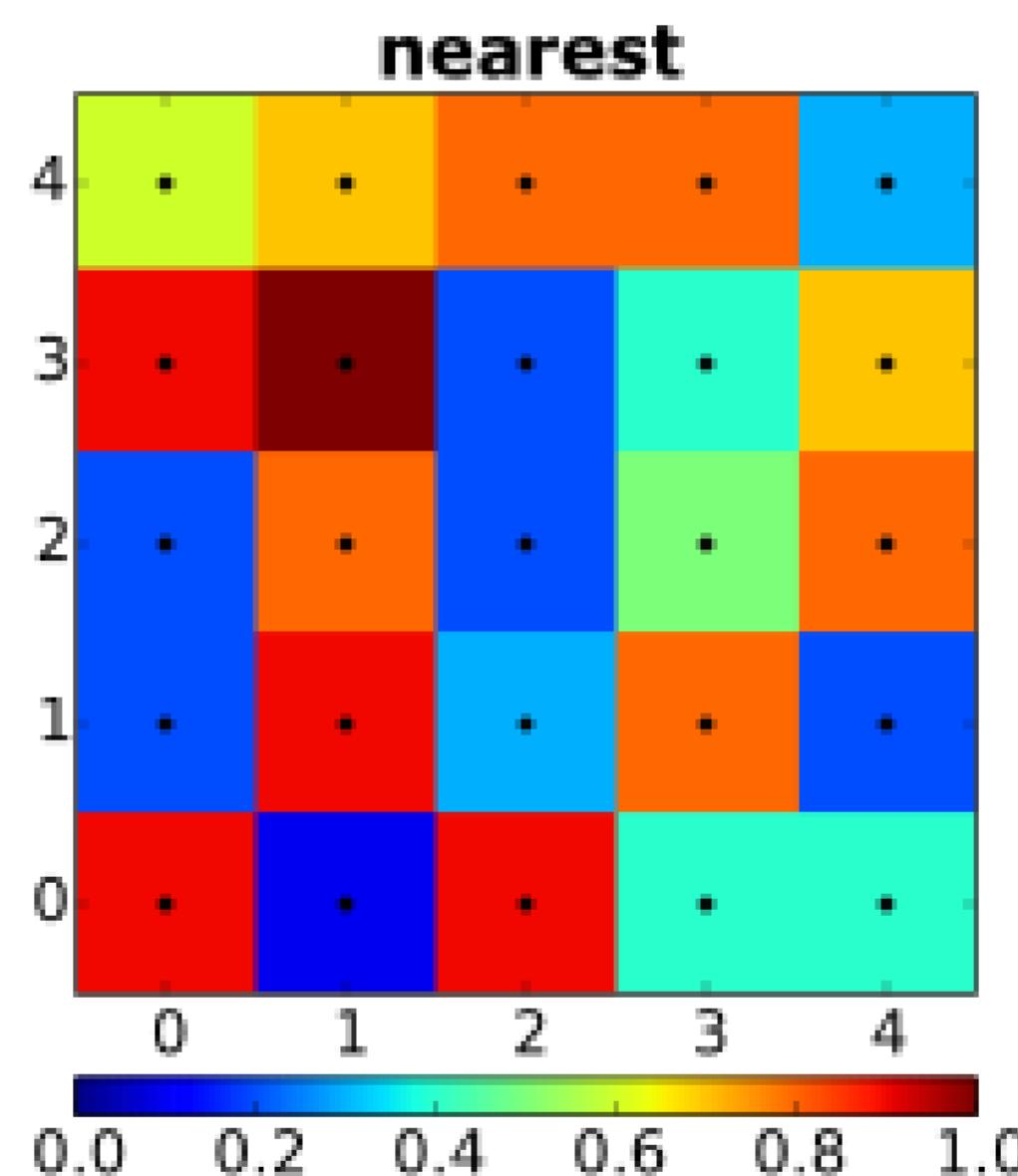
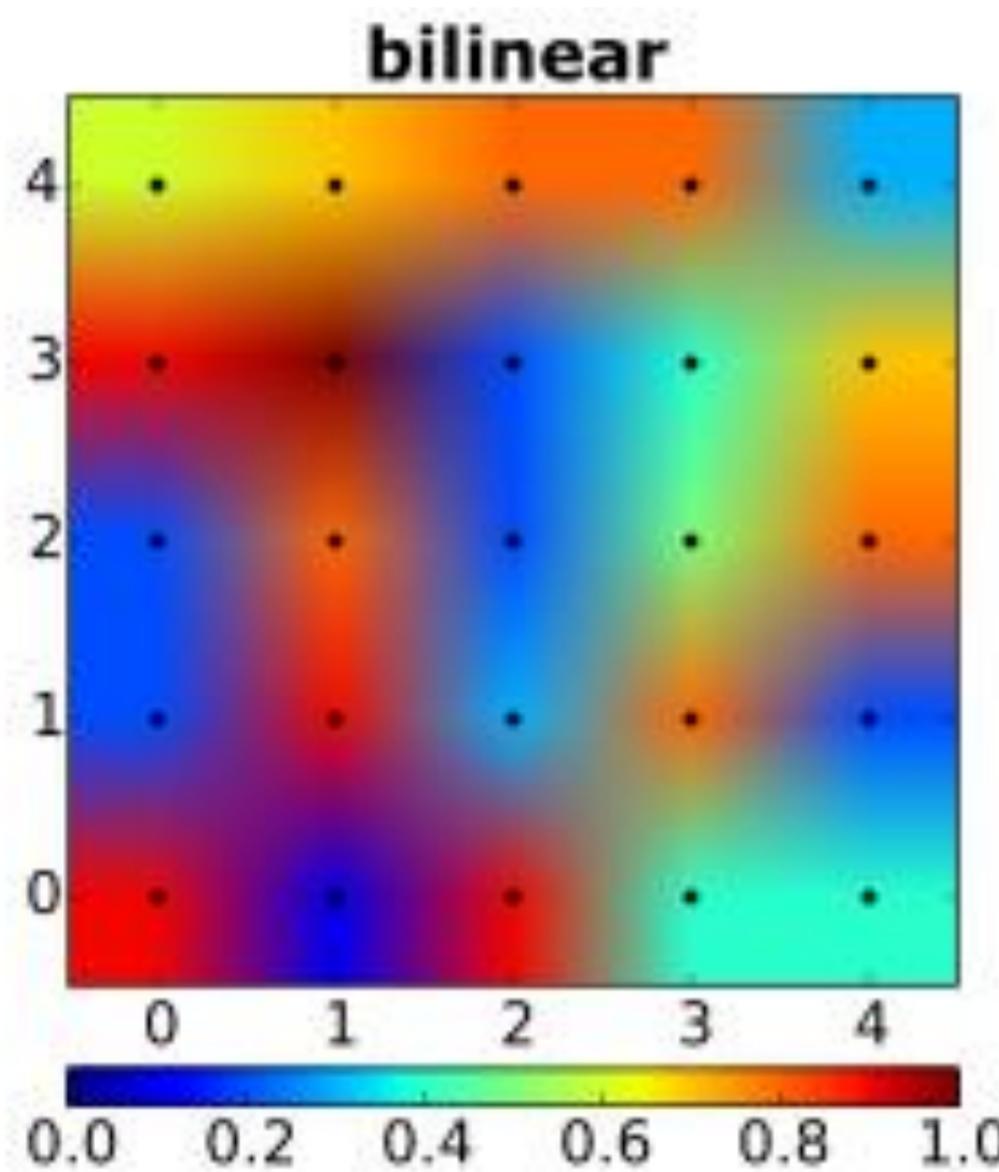
$\Rightarrow 16$ equations \Rightarrow solve $\{a_{ij}\}$

$I_x, I_y, I_{xy} ?$

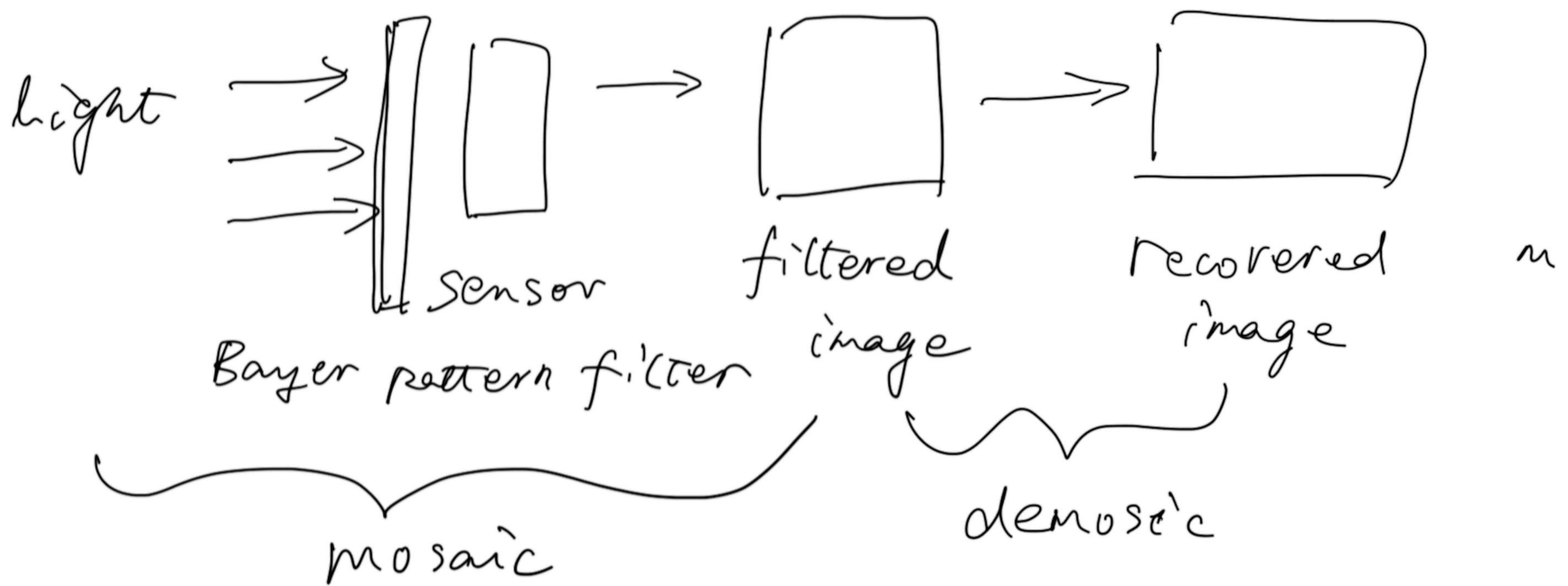
$$I_x(s, t) = \frac{1}{2}(I(s+1, t) - I(s-1, t)) \quad I_y(s, t) = \frac{1}{2}(I(s, t+1) - I(s, t-1))$$

$$I_{xy}(s, t) = \frac{1}{2}(I_x(s, t+1) - I_x(s, t-1))$$

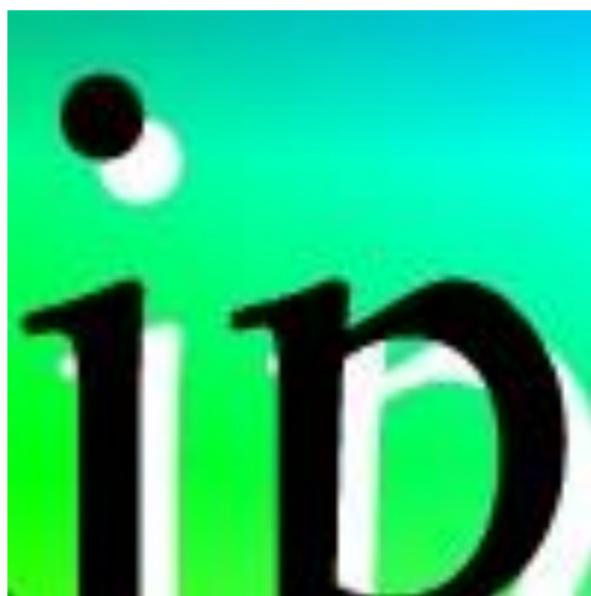
Examples



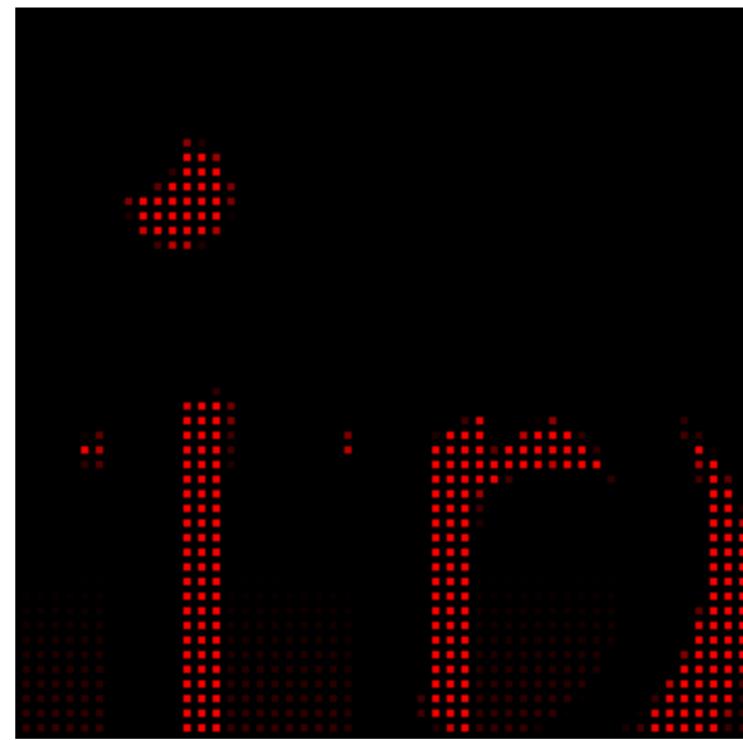
Bayer Demosaicking



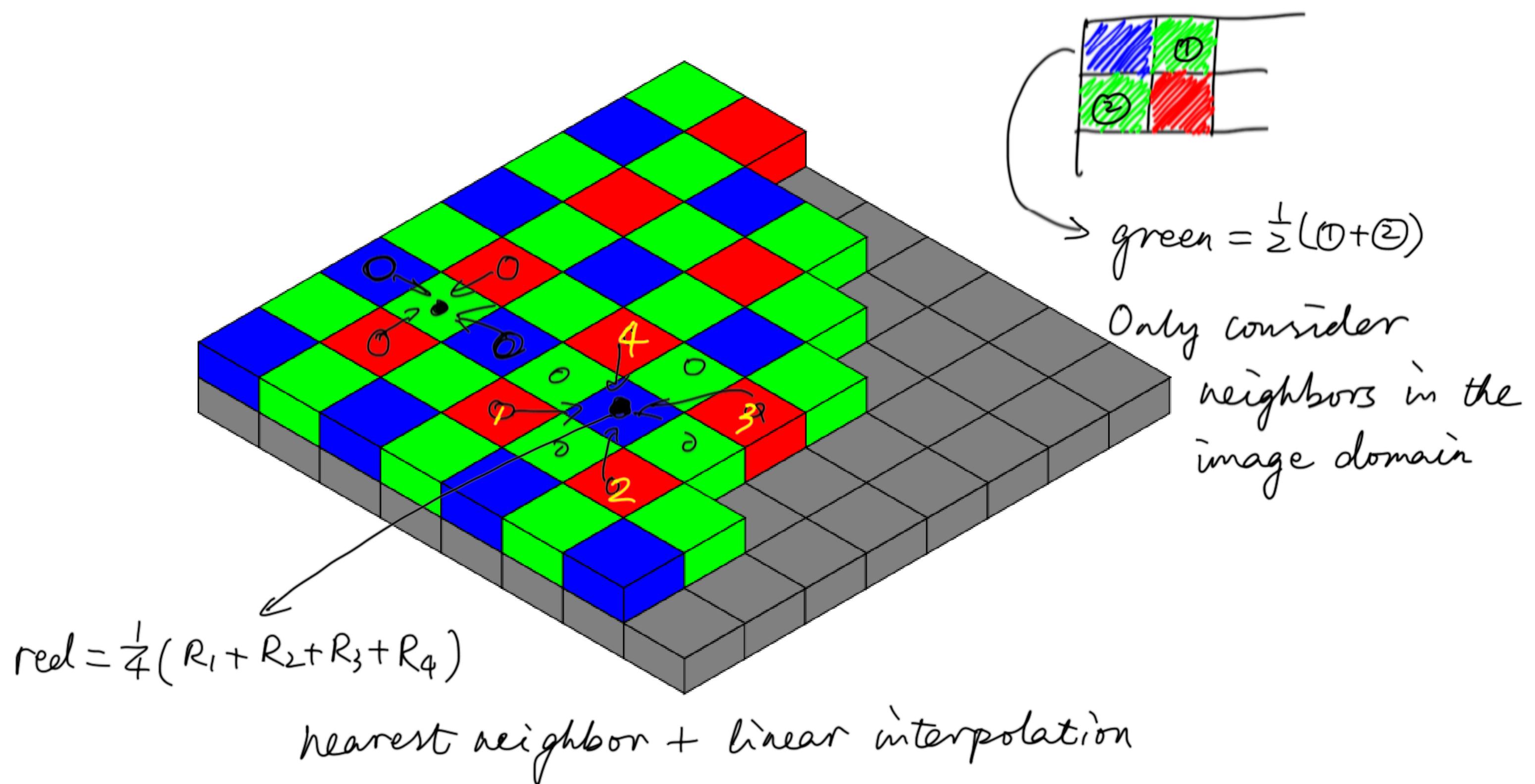
Bayer Demosaicking



original image



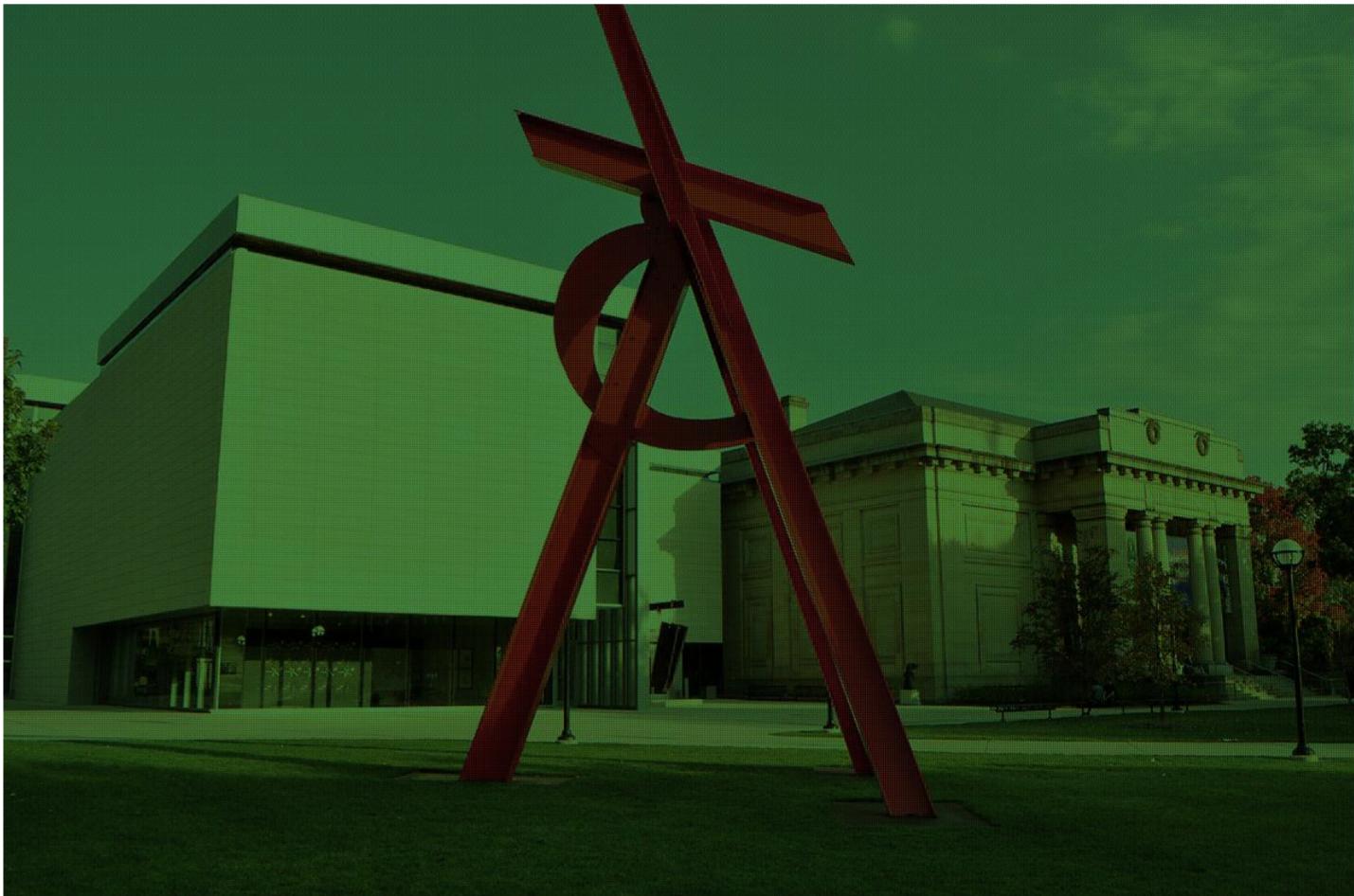
Bayer Demosaicking



Bayer Demosaicking



original



filtered

Bayer Demosaicking



↑
gray scaled



↑
reconstructed

- Matlab function demosaic
- Implement this in your homework!