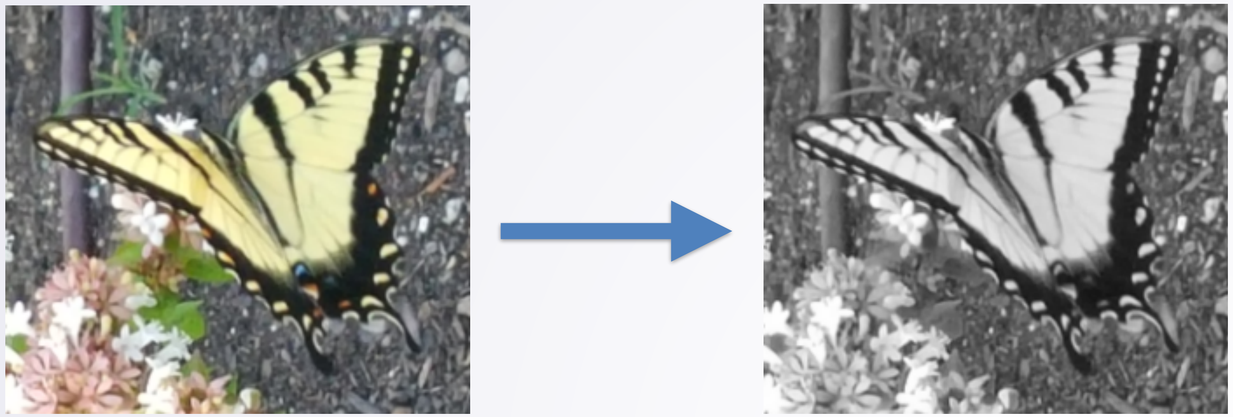
Grayscale Algorithm

Seven-Step Approach

Convert Image to Grayscale

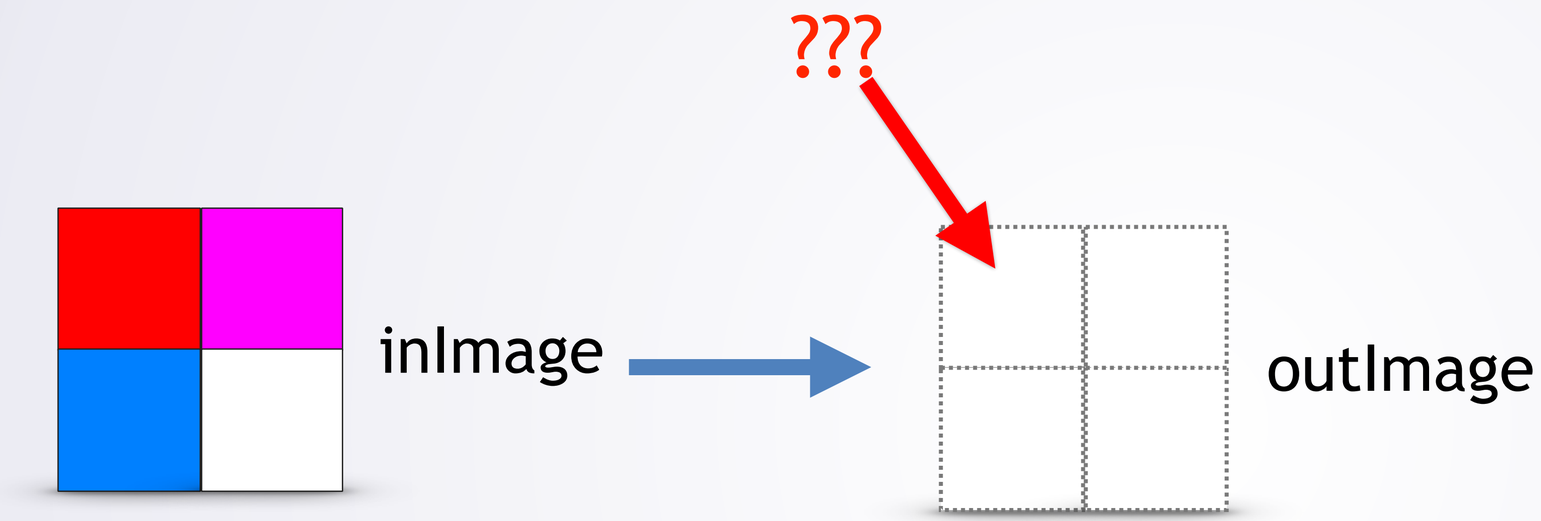
- Problem: grayscale

Convert Image to Grayscale



- Problem: grayscale
  - Color image ⇨ shades of gray
- 7 Steps

Step 1: Small Instance by Hand



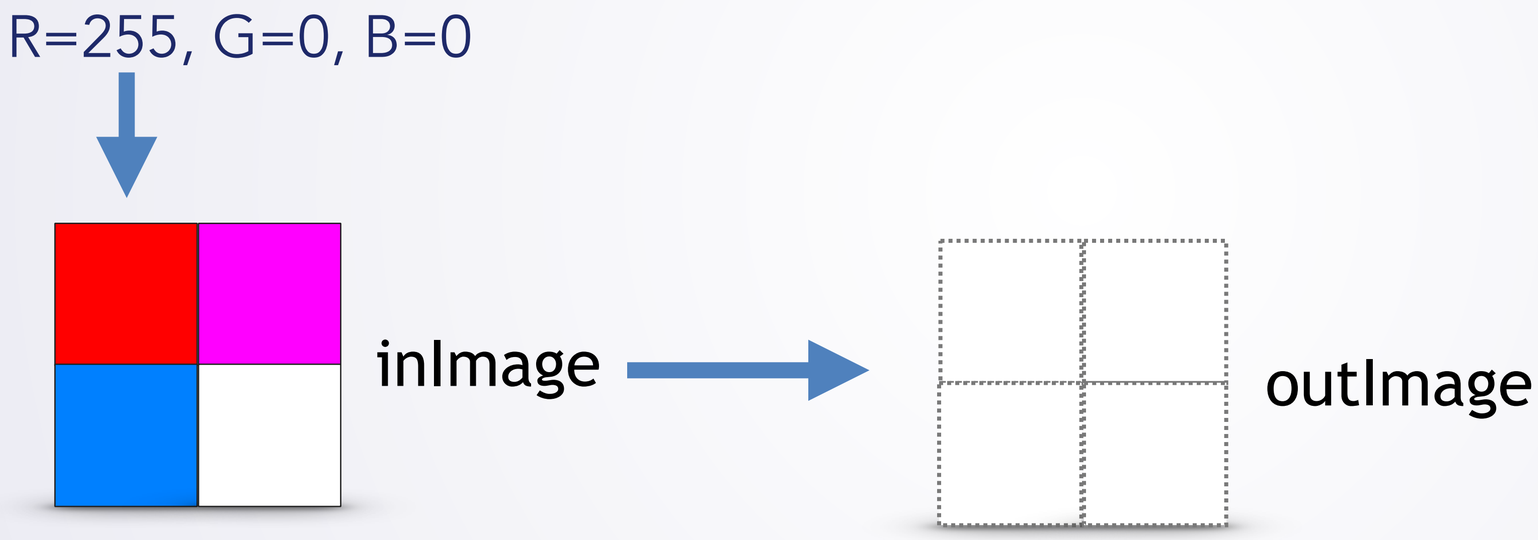
- Work with a 2x2 image
- Need **domain knowledge**

Domain Knowledge

- What is gray?
  - Red = Green = Blue
- How to convert RGB to gray?
  - Average?  Simple, works for us
  - Weighted Average?
  - More complex formula?

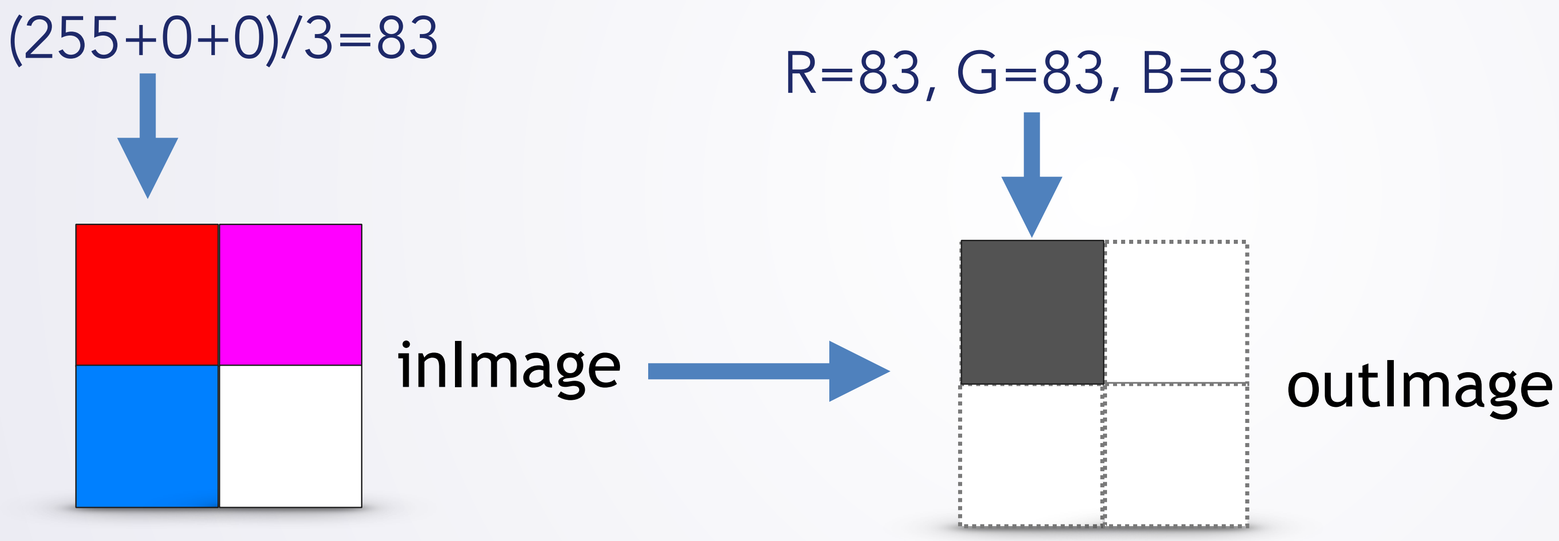
Step 1: Small Instance by Hand

- Work with a 2x2 image
- Now have domain knowledge



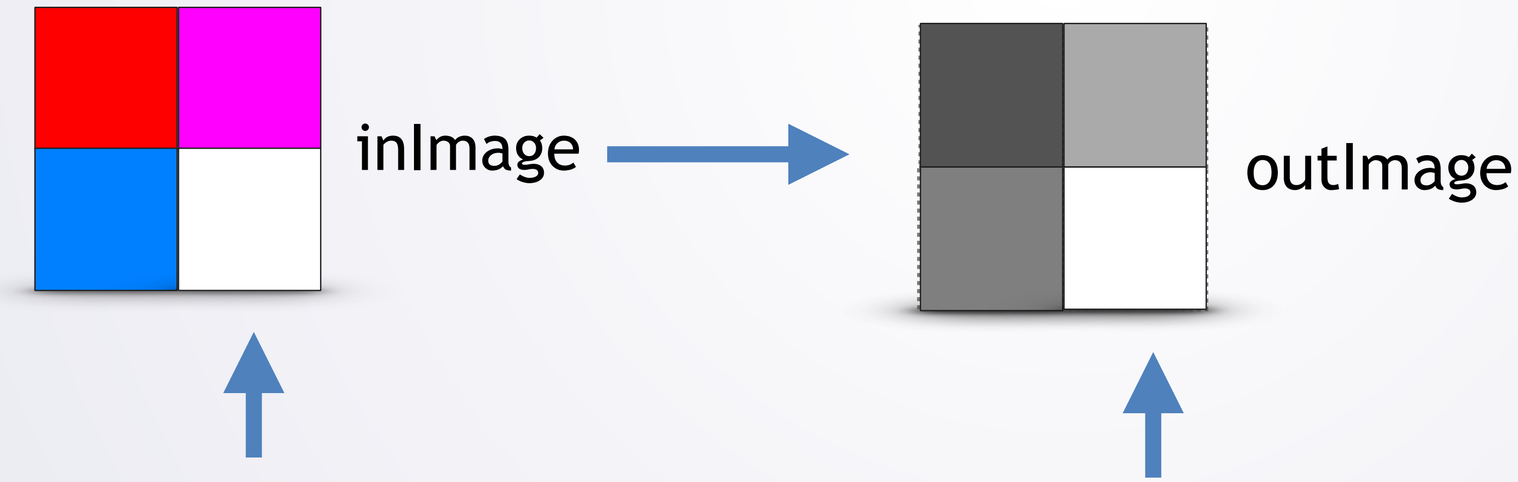
Step 1: Small Instance by Hand

- Work with a 2x2 image
- Now have domain knowledge

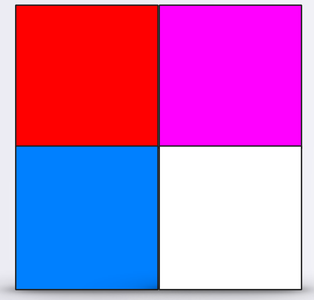


Step 1: Small Instance by Hand

- Work with a 2x2 image
- Now have domain knowledge

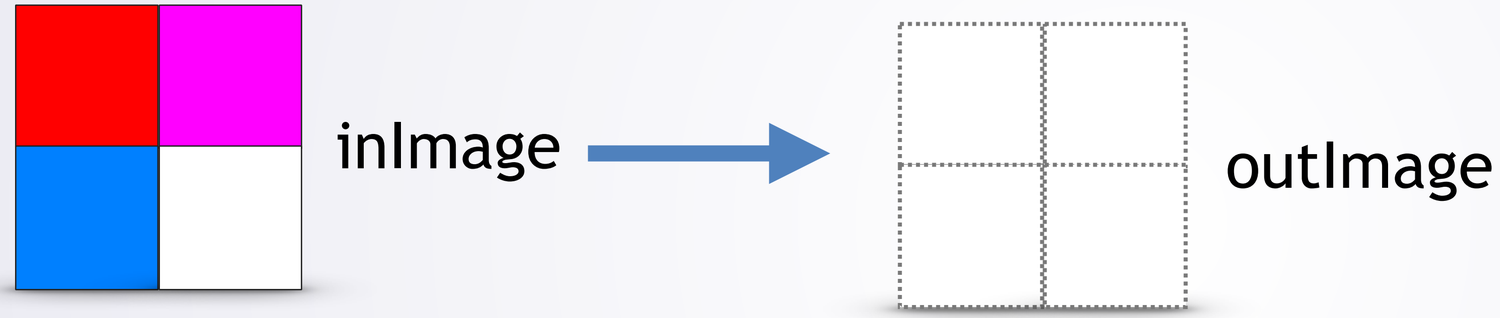


Step 2: Write Down Steps



1. I started with the image I wanted (inImage)

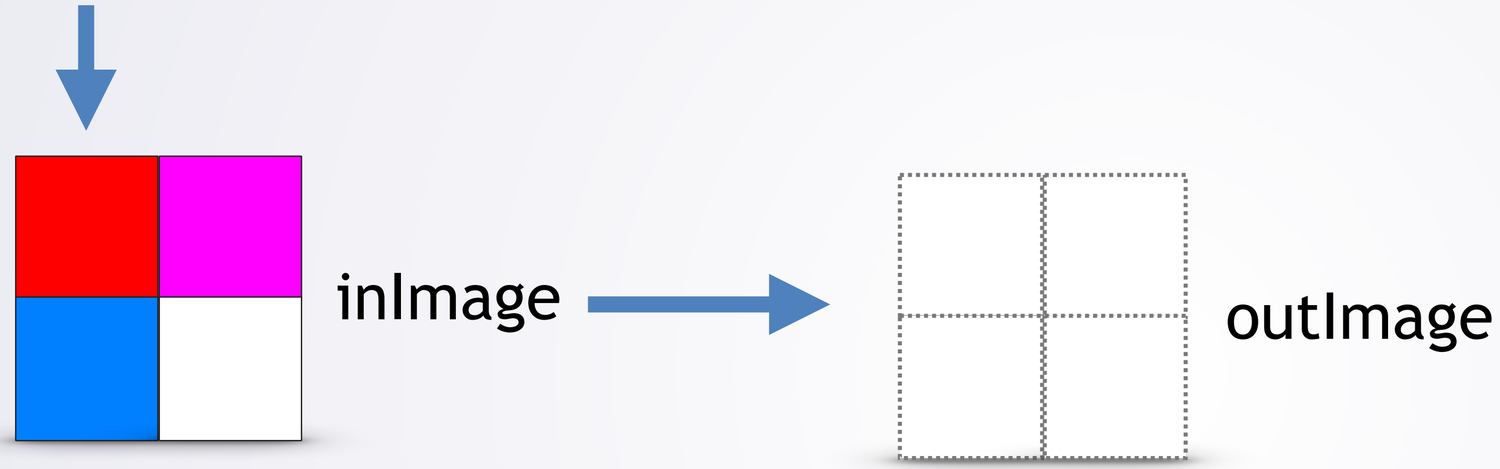
Step 2: Write Down Steps



2 I made a blank image of the same size (outImage)

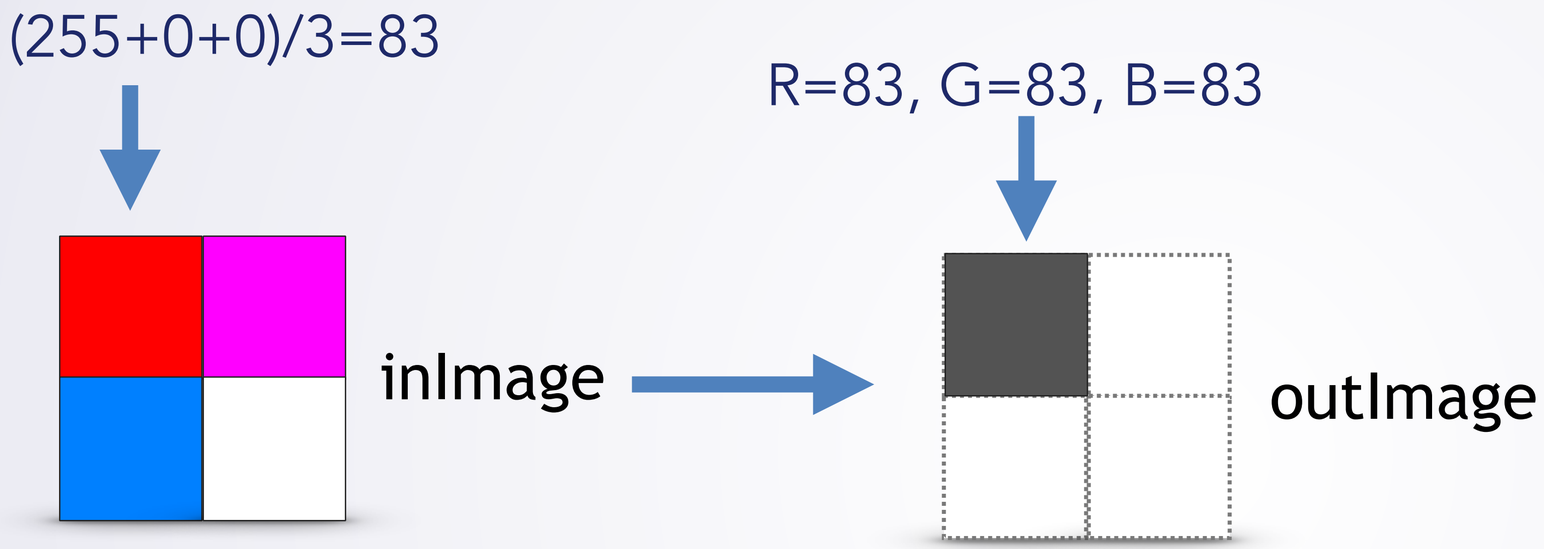
Step 2: Write Down Steps

(255+0+0)/3=83



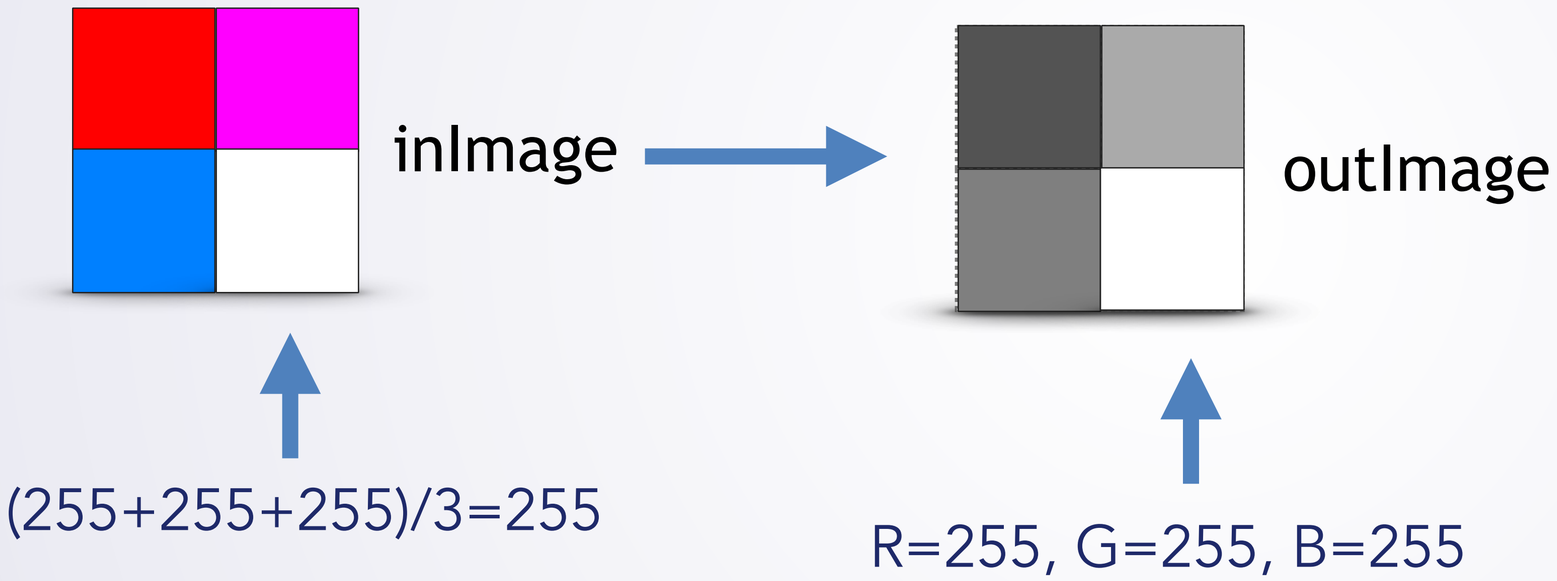
3 I computed (255+0+0)/3=83

Step 2: Write Down Steps



4 I made the first pixel of outImage
R=83, G=83, B=83

Step 2: Write Down Steps



10 **I made the fourth pixel of outImage**
R=255, G=255, B=255

Step 2: Write Down Steps

1. I started with the image I wanted (inImage)
2. I made a blank image of the same size (outImage)
3. I computed (255+0+0)/3=83
4. I made the first pixel of outImage R=83, G=83, B=83
5. I computed (255+0+255)/3=170
6. I made the second pixel of outImage R=170, G=170, B=170
7. I computed (0+128+255)/3=127
8. I made the third pixel of outImage R=127, G=127, B=127)
9. I computed (255+255+255)/3=255
10. I made the fourth pixel of outImage R=255, G=255, B=255

Step 3: Find Patterns

Look for repetitions and patterns

(255+0+0)/3=83 Why 255 here?

(255+0+255)/3=170

(0+128+255)/3=127 Why 0?

(255+255+255)/3=255

Step 3: Find Patterns

Look for repetitions and patterns

Corresponding pixel in inImage's red

(255+0+0)/3=83

(255+0+255)/3=170

(0+128+255)/3=127

(255+255+255)/3=255

Step 3: Find Patterns

Look for repetitions and patterns

(255+0+0)/3=83 Why 0 here?

(255+0+255)/3=170

(0+128+255)/3=127 Why 128?

(255+255+255)/3=255 Why 255?

Step 3: Find Patterns

Look for repetitions and patterns

Corresponding pixel in inImage's green

(255+0+0)/3=83

(255+0+255)/3=170

(0+128+255)/3=127

(255+255+255)/3=255

Step 3: Find Patterns

Look for repetitions and patterns

Corresponding pixel in inImage's blue

(255+0+0)/3=83

(255+0+255)/3=170

(0+128+255)/3=127

(255+255+255)/3=255

Step 3: Find Patterns

Look for repetitions and patterns

We need to give a name.

(255+0+0)/3=83

(255+0+255)/3=170

(0+128+255)/3=127

(255+255+255)/3=255

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Step 3: Find Patterns

Look for repetitions and patterns

(R+G+B)/3 is always “average”

(255+0+0)/3=83

(255+0+255)/3=170

(0+128+255)/3=127

(255+255+255)/3=255

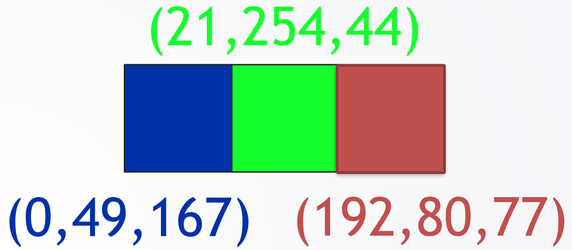
Step 3: Find Patterns

1. I started with the image I wanted (inImage)
2. I made a blank image of the same size (outImage)
3. For each pixel in outImage
    a. Look at the corresponding pixel in inImage (inPixel):
    b. Compute inPixel's red + inPixel's green + inPixel's blue
    c. Divide that sum by 3 (call it average)
    d. Set pixel's red to average
    e. Set pixel's green to average
    f. Set pixel's blue to average
4. outImage is your answer

Step 4: Test Algorithm

1. I started with the image I wanted (inImage)
2. I made a blank image of the same size (outImage)
3. For each pixel in outImage
   a. Look at the corresponding pixel in inImage (call it inPixel)
   a. Compute inPixel's red + inPixel's green + inPixel's blue
   b. Divide that sum by 3 (call it average)
   c. set pixel's red to <u>average</u>
   d. Set pixel's green to <u>average</u>
   e. set pixel's blue to <u>average</u>
4. outImage is your answer

Now it's your turn.
Think about if your answer is right



Yes. Answer is right!

Now let's write code