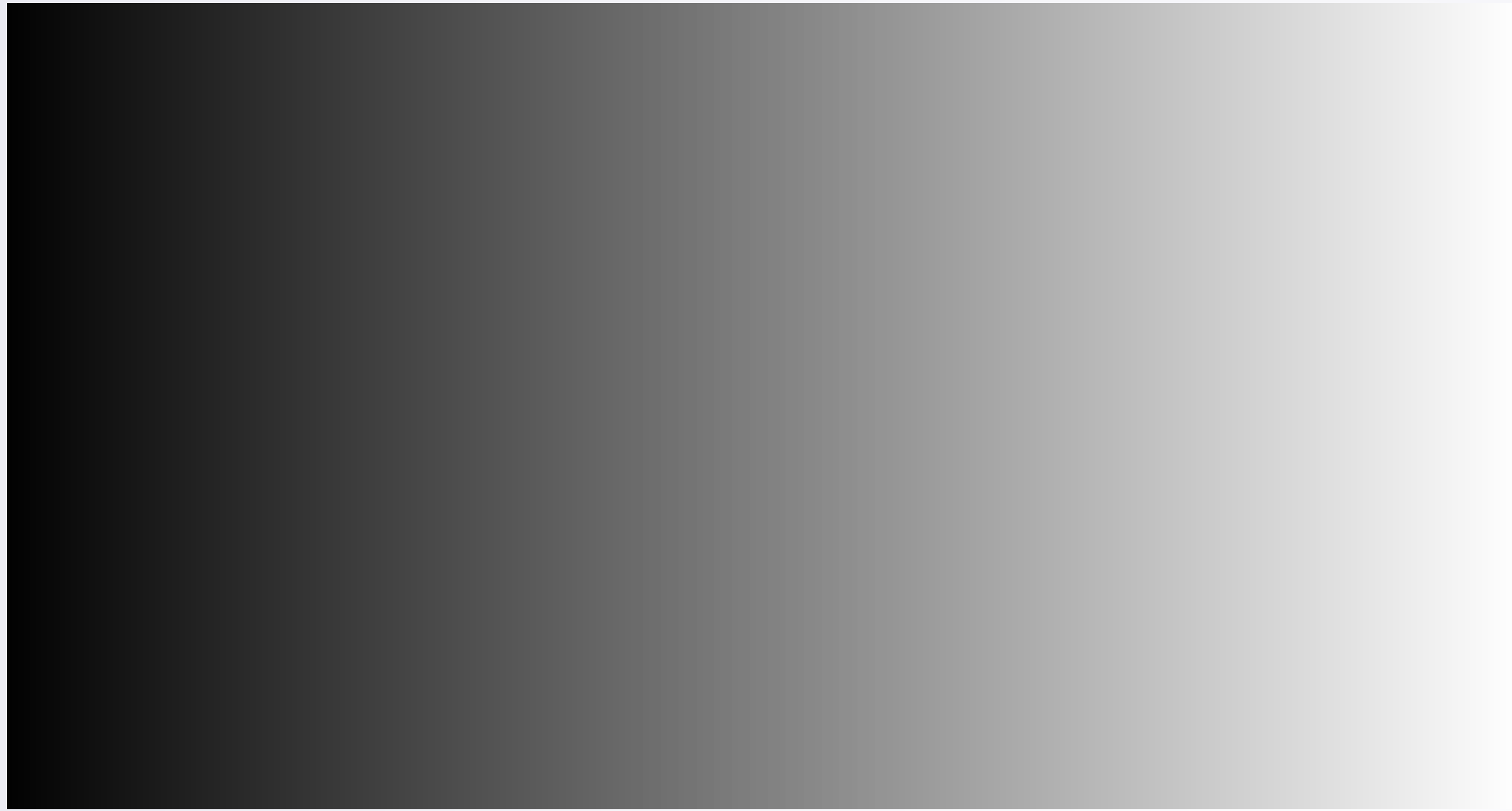


Grayscale Algorithm

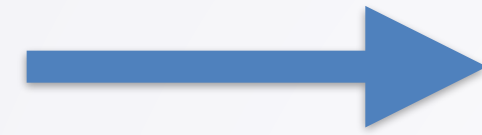
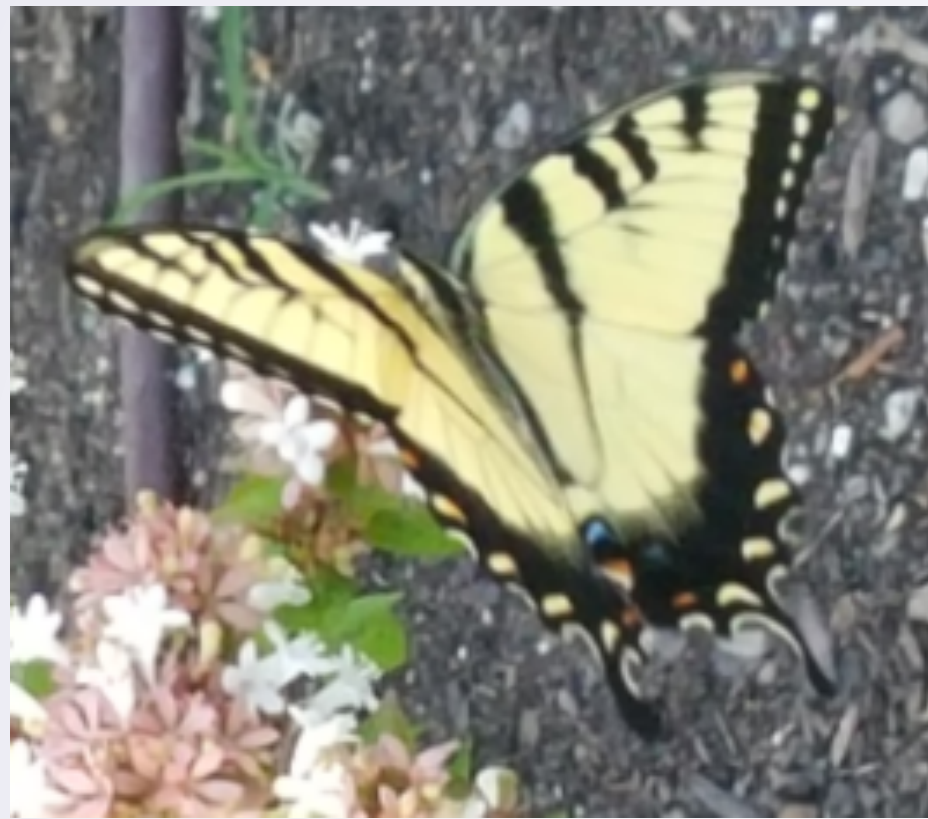
Seven-Step Approach

Convert Image to Grayscale



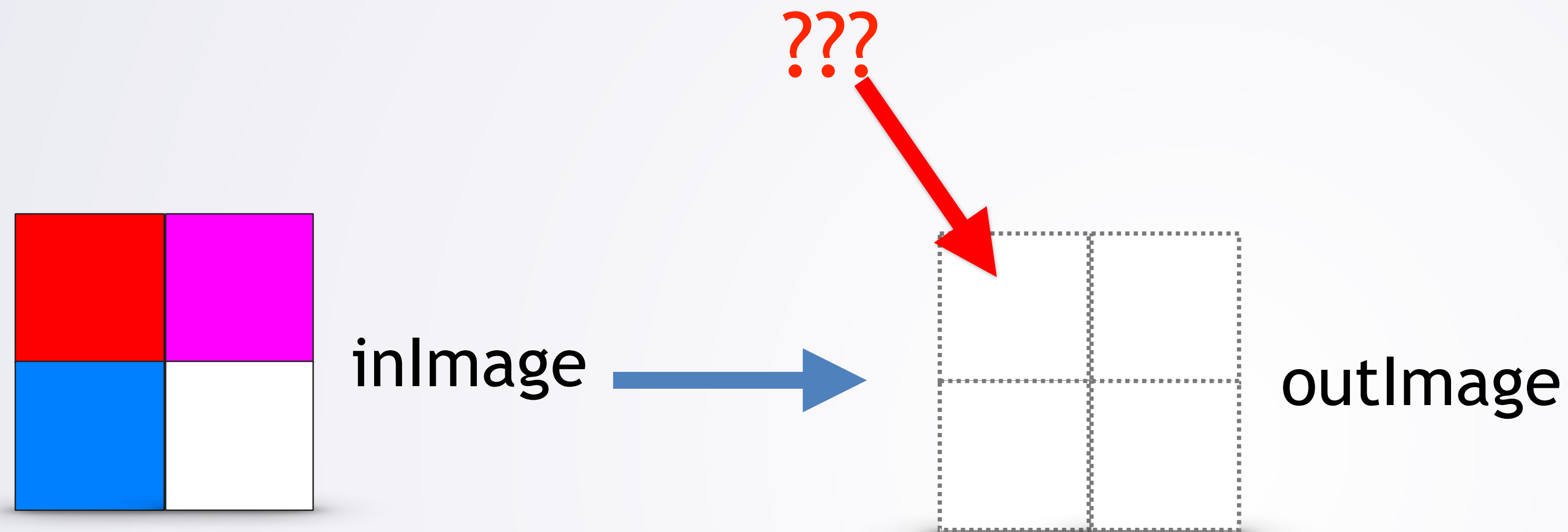
- Problem: grayscale

Convert Image to Grayscale




- Problem: grayscale
 - Color image \Rightarrow shades of gray
- 7 Steps

Step 1: Small Instance by Hand



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

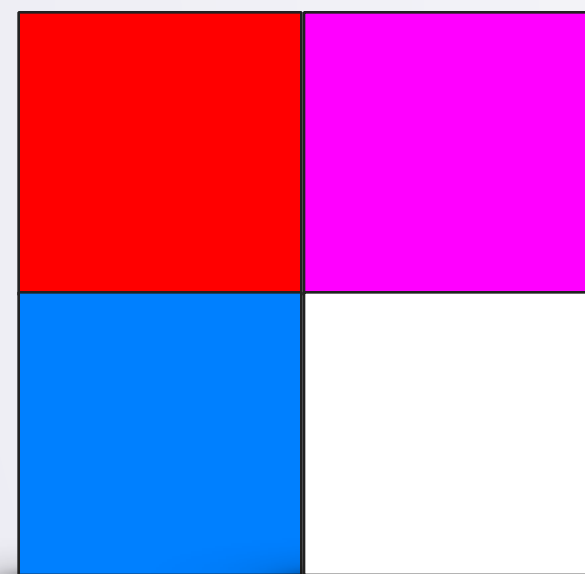
Domain Knowledge

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

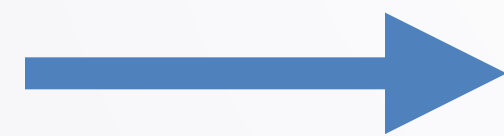
Step 1: Small Instance by Hand

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

R=255, G=0, B=0



inImage

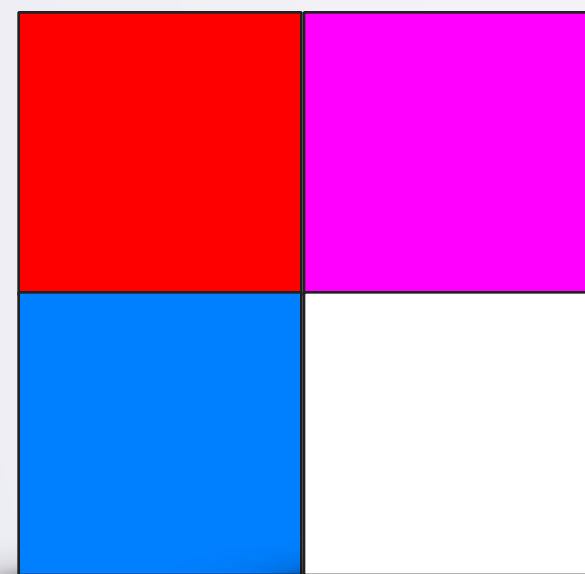


outImage

Step 1: Small Instance by Hand

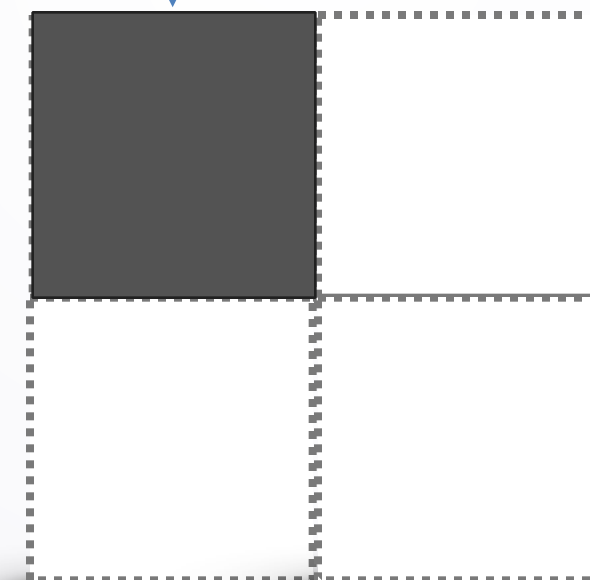
- Work with a 2x2 image
- Now have domain knowledge

$$(255+0+0)/3=83$$



inImage

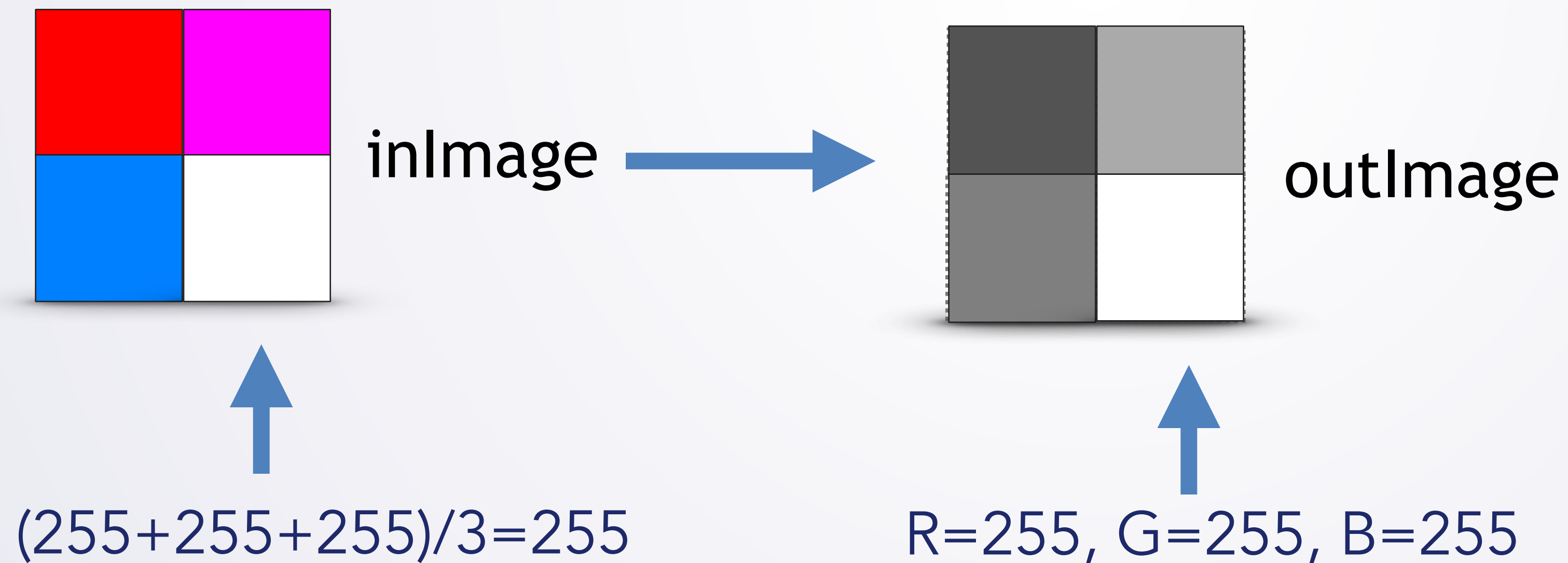
$$R=83, G=83, B=83$$



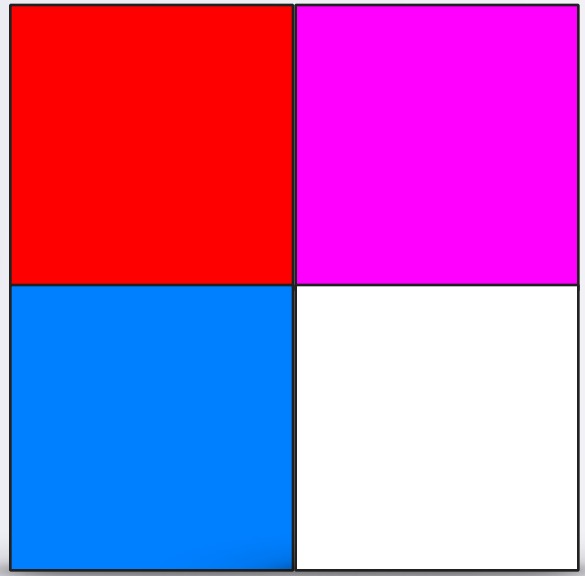
outImage

Step 1: Small Instance by Hand

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

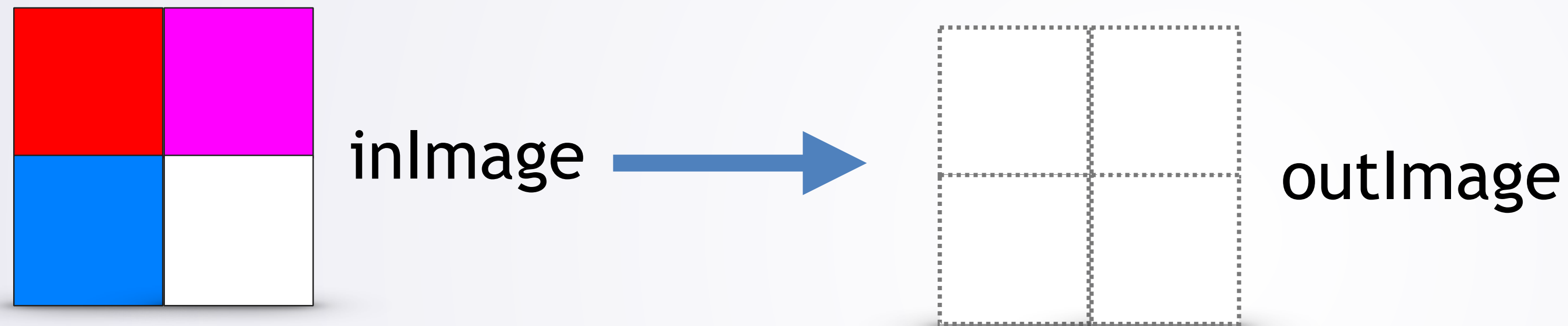


Step 2: Write Down Steps



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

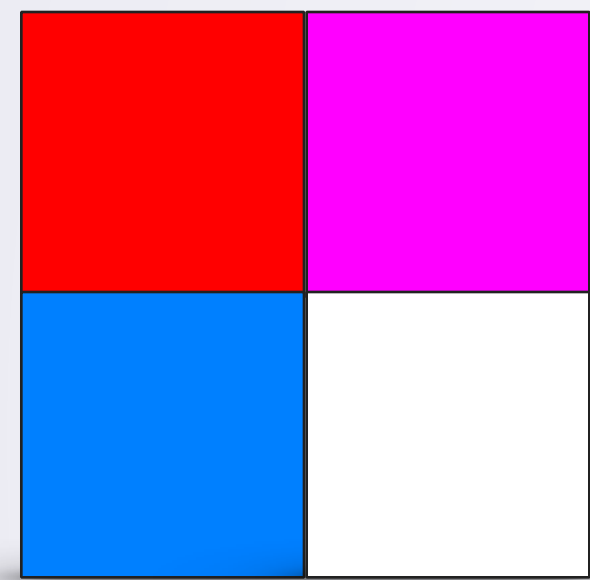
Step 2: Write Down Steps



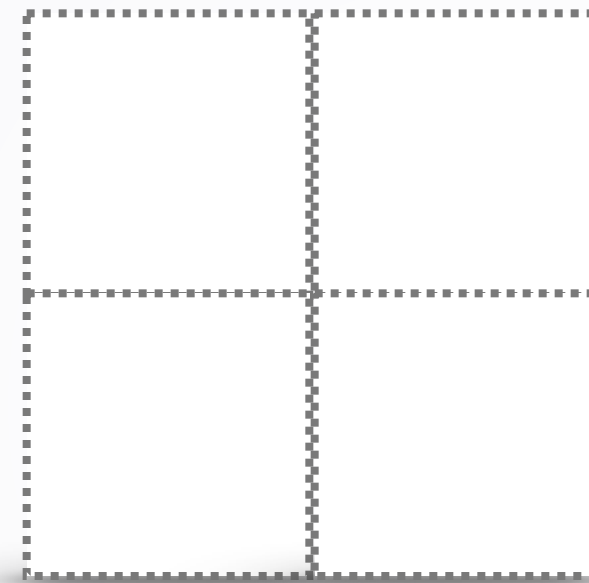
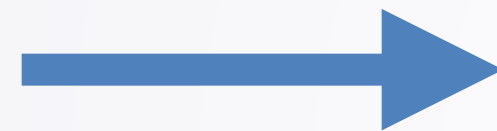
- 2 I made a blank image of the same size (outImage)

Step 2: Write Down Steps

$$(255+0+0)/3=83$$



inImage



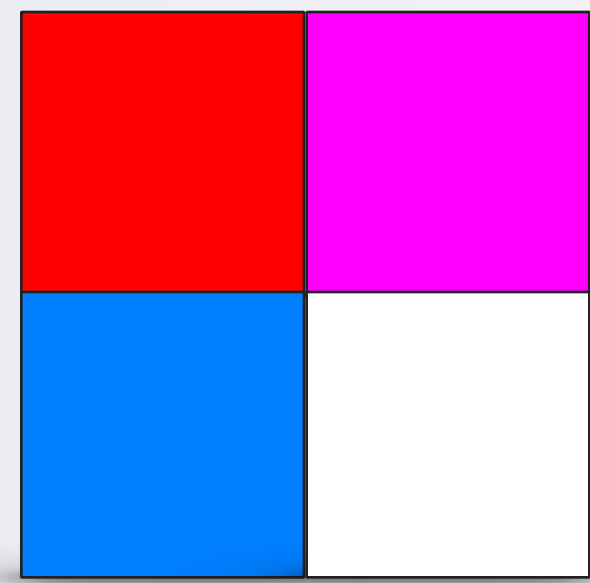
outImage

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

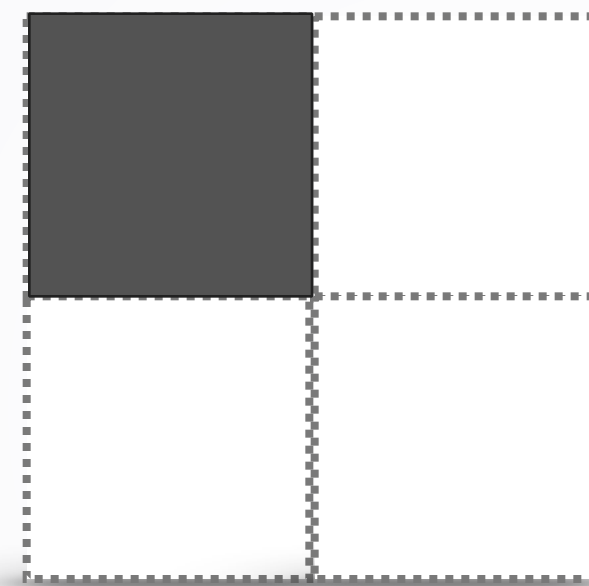
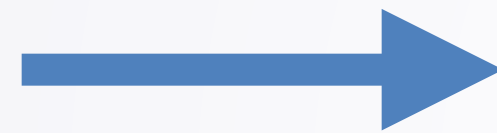
Step 2: Write Down Steps

$$(255+0+0)/3=83$$

$$R=83, G=83, B=83$$



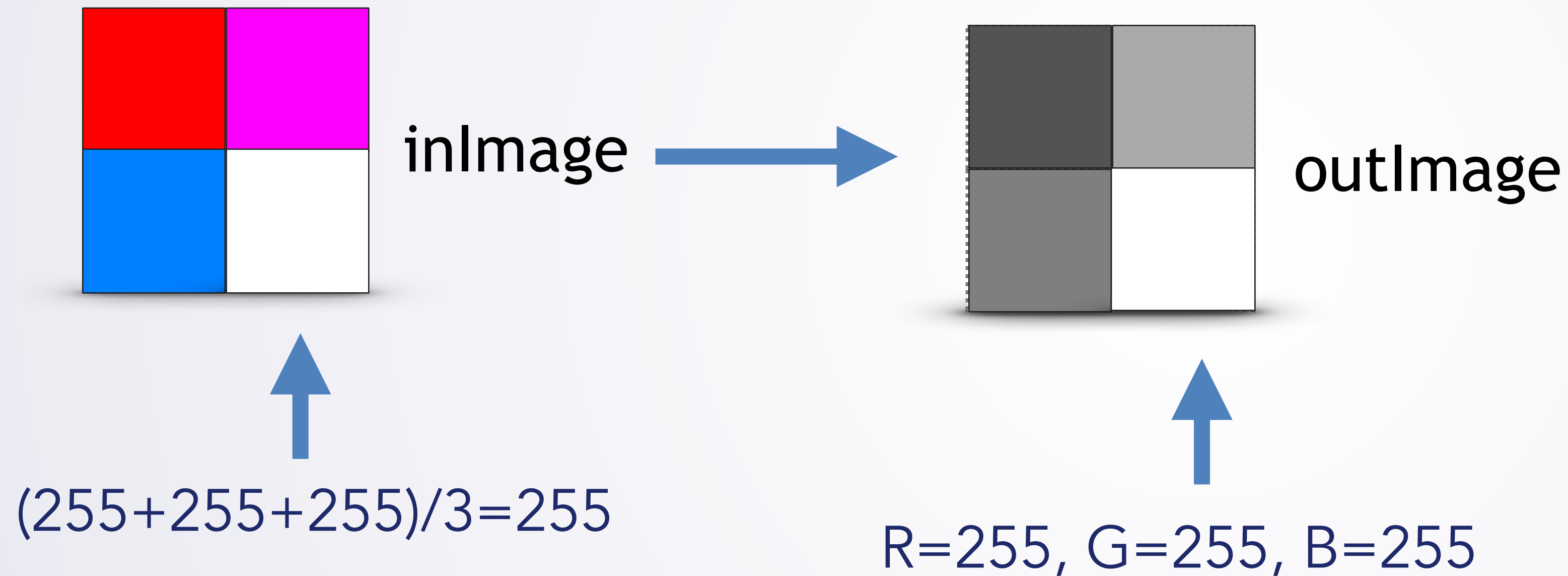
inImage



outImage

- 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

$$(255+0+0)/3=83 \quad \text{Why 255 here?}$$

$$(255+0+255)/3=170$$

$$(0+128+255)/3=127 \quad \text{Why 0?}$$

$$(255+255+255)/3=255$$

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

$$(255+0+0)/3=83 \quad \text{Why 0 here?}$$

$$(255+0+255)/3=170$$

$$(0+128+255)/3=127 \quad \text{Why 128?}$$

$$(255+255+255)/3=255 \quad \text{Why 255?}$$

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.

$$(255+0+0)/3=83$$

$$(255+0+255)/3=170$$

$$(0+128+255)/3=127$$

$$(255+255+255)/3=255$$

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 average
 - d Set pixel's green to average
 - e set pixel's blue to average
- 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

