Section 4

May 13, 2021

Katherine Michel, Section Leader, Stanford Code in Place, 2021

Today’s Agenda

- Social Time (5 minutes)
- Recap/New (10 minutes)
- Section Filter problem (15 minutes)
- Trim Crop problem (15 minutes)
- Questions/comments/discussion (5 min)

Where We Are At

- Images lectures began last Friday
- Text processing began yesterday
- Assignment 3 will be released Monday
- Lessons 1-10 have been published

Social Time

- How was your week?
- Triumphs? Challenges?
- Any aha moments?
- Any new ideas for how to use Python?

Python Standard and Third-Party Libraries

- In addition to the official docs...
- Automate the Boring Stuff with Python (free online)
- Python Crash Course (includes cheat sheets)

Automate the Boring Stuff with Python

- In addition to Python fundamentals...
- File manipulation
- Web scraping
- Working with Excel, Google Sheets, PDFs, Word Docs, CSV, and JSON data
- Task scheduling
- Sending emails and text messages
- Image manipulation
- Controlling keyboard/mouse through GUI manipulation

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Python Crash Course

- In addition to Python fundamentals...
- Game project
- Data Science project
- Web Development project
- Plus cheat sheets

Recap: Image Manipulation

- Images (pixels, axis, RGB)
- SimpleImage library
- Iteration: for-each loop
- Iteration: for-each loop versus nested for loop
- getting/setting pixels
- Handy tips/commands

Recap: Pixels and Axis

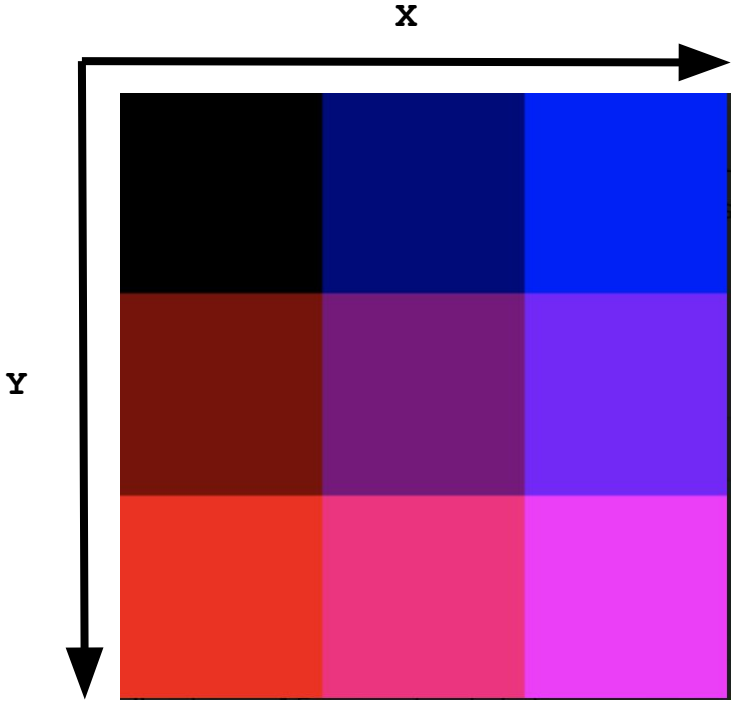
An image is a grid of square pixels.

We can draw an x and y axis along our image.

An image has a height and a width:

```
image.height
image.width
```

Adapted from a walkthrough by Akshay Jaggi!



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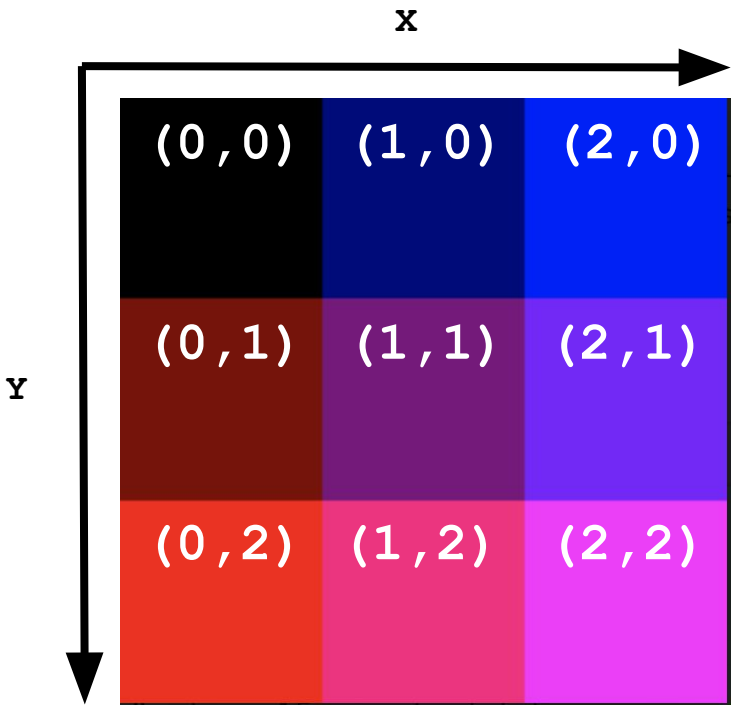
Recap: x and y Coordinates

This means that every pixel has x and y coordinates:

pixel.x
pixel.y

y increases going down
x increases going right

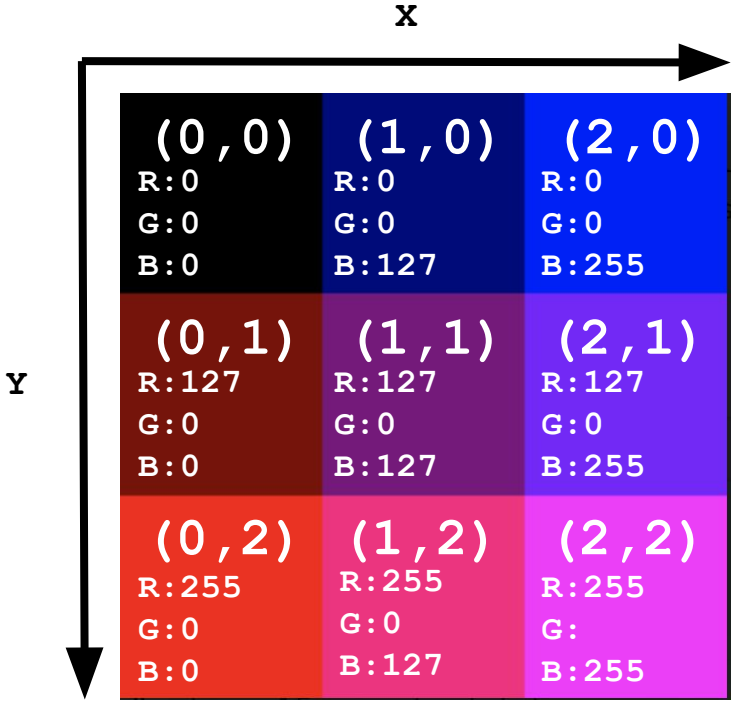


Recap: RGB

Along with a location, every pixel has 3 RGB values which represent the brightness of that color:

pixel.red
pixel.green
pixel.blue

The values of each color are represented as integers between 0 and 255



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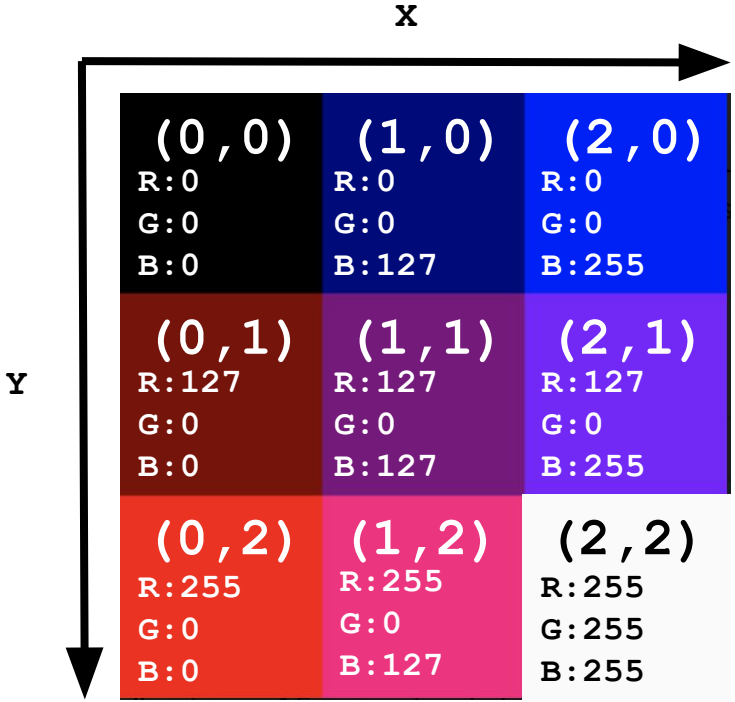
Recap: RGB

The effect of adding green to the final square results in white (presence of all color)



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SimpleImage Library: Accessing Data

Dimension: image.height

image.width

Color: pixel.red

pixel.green

pixel.blue

Location: pixel.x

pixel.y

Image and pixel data can be accessed using "dot notation"... this is common Python

Recap: for-each Loop

Common Python syntax

```
for item in items:
    # do something
```

Used to iterate through items in an iterable/sequence (list, tuple, string)

SimpleImage for-each loop

```
from simpleimage import SimpleImage

image = SimpleImage("image.jpg")
for pixel in image:
    # iterate through each pixel
```

Recap: for-each Loop Versus Nested for loop

for-each Loop

```
for px in image:
    do_something(px)
```

Use this if you don't need to access the coordinates

Nested for loop

```
for x in range(image.width):
    for y in range(image.height):
        px = image.get_pixel(x, y)
        do_something(px)
```

Use this if you need to access the coordinates

Recap: for-each Loop Versus Nested for loop

for-each Loop

```
for lala in image:
    do_something(lala)
```

Nested for loop

```
for x in range(image.width):
    for y in range(image.height):
        lala = image.get_pixel(x, y)
        do_something(lala)
```

“pixel” variable can actually be anything
Python recognizes that “for” “something” “in”... means iterate
Similar to parameters (Python understands position)

Recap: Getting/Setting Pixels

You can reset the color value:

```
for pixel in image:
    pixel.red = pixel.red // 2
```

Locations cannot be reset. *If you want to move a pixel:* Create a blank image and set pixels in new image.

Access a pixel from coordinates:

```
pixel = image.get_pixel(x, y)
```

You can set the value of a pixel:

```
image.set_pixel(x, y, pixel)
```

Recap: Integer Division

- We are dealing with integers, not floats
- We need to use floor division (//) not (/)
- With floor division, we get an integer

Right

```
px.red = pix.red // 2
```

Wrong

```
px.red = pix.red / 2
```

Recap: Handy Commands

Import module:	from simpleimage import SimpleImage
Read an image **from a file**:	image = SimpleImage(“image.jpg”)
Create a blank image:	image = SimpleImage.blank(width, height)
Resize to target image:	image.make_as_big_as(target_image)
Show image:	image.show()

Norak Filter Problem

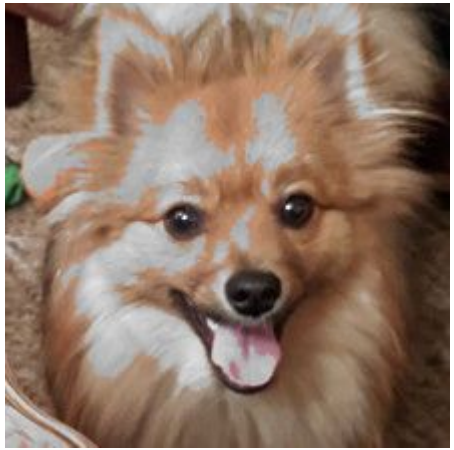
Replace each bright pixel in an image with its grayscale equivalent. A bright pixel in an image is defined as a pixel whose average component is greater than 153 (which is 60% of 255). All non-bright pixels in the image should remain unchanged.

To make a pixel grayscale, set each of its red, green and blue components to be equal to its average component.

Tip! Define a function to get the average component of a pixel (this is a repeated task).

Before

After



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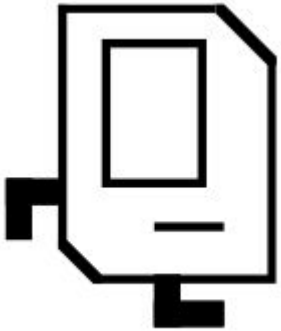
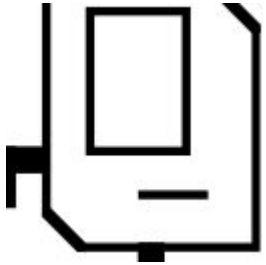
Trim Crop Problem

Write a function trim_crop_image which removes trim_size amount of pixels from each side of the image.

Before: call trim_crop_image on this picture of Karel



After: remove trim_size = 30 pixels from all sides



Both width and height have been reduced by 60 pixels

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Add Border Problem

Add a black border to an image.

Before:

add a border of size
border_size = 10

After

Both width and height have been reduced by 20 pixels

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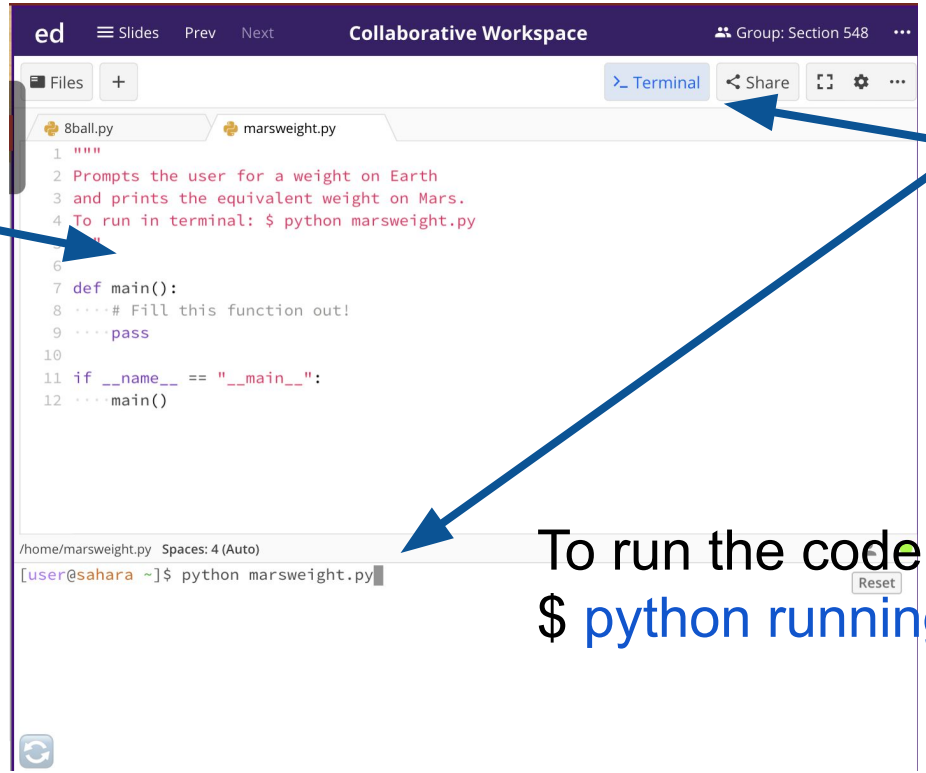
Closing… Thoughts, Questions, Discussion?

Collaborative Workspace

Everyone can see the same code and edit collaboratively



The “Terminal” button can be used to open a terminal…

To run the code type file name
$ python running.py

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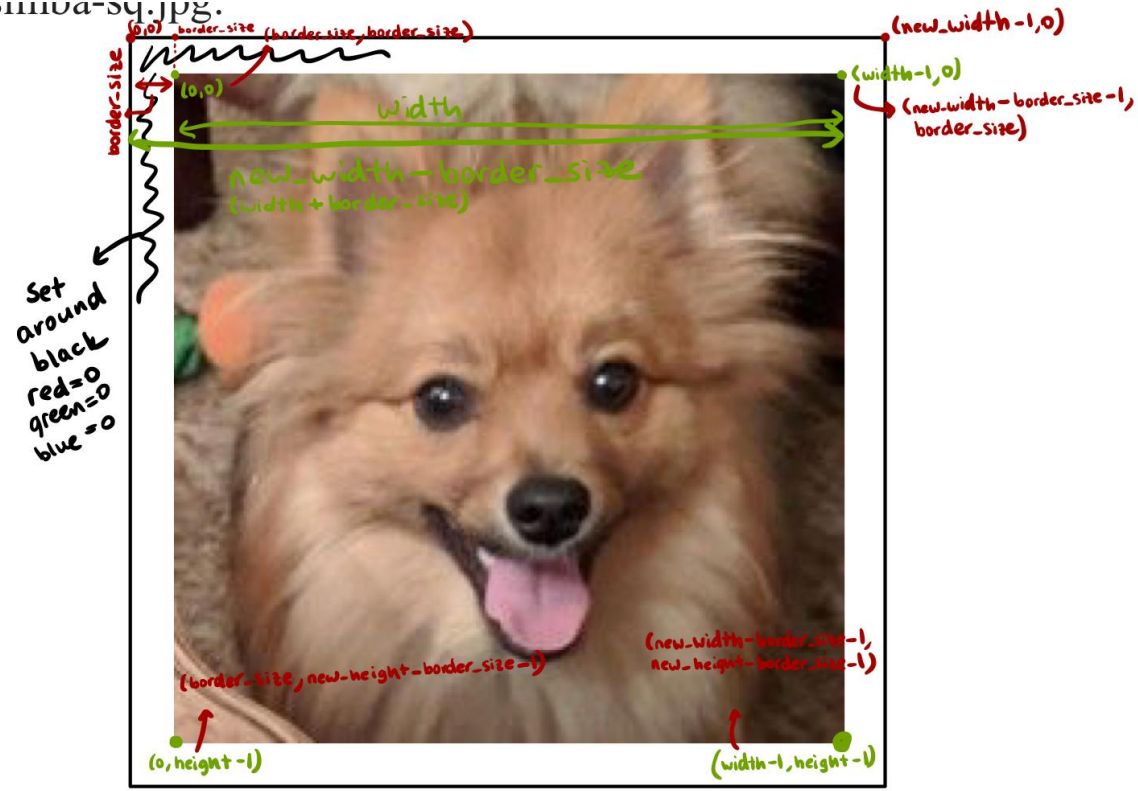
Add Border Problem

simba-sq.jpg:



Drawing by Aybüke!

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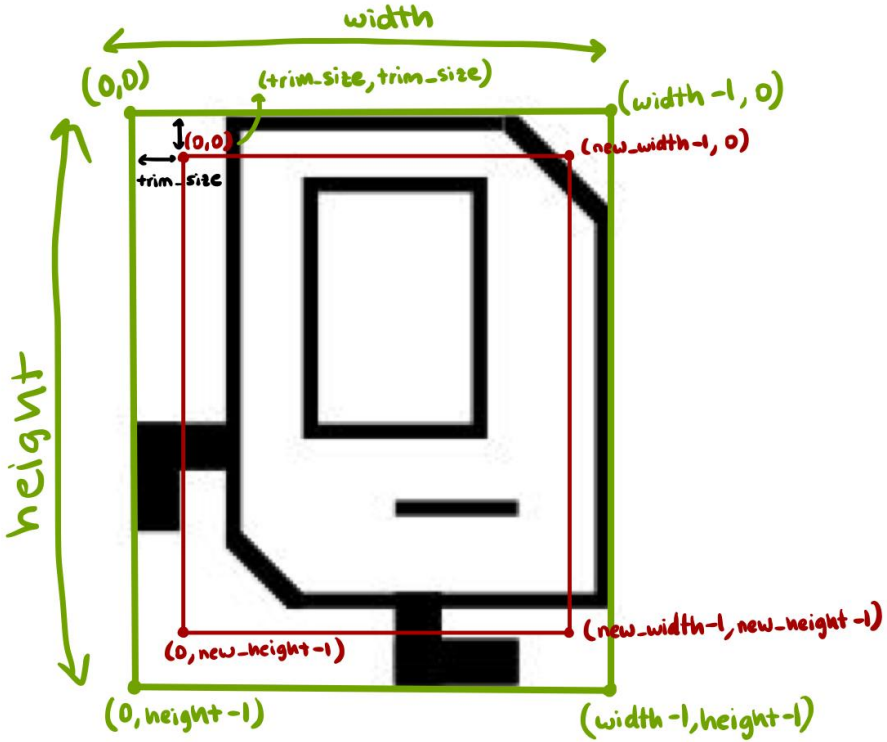
Trim Crop Problem



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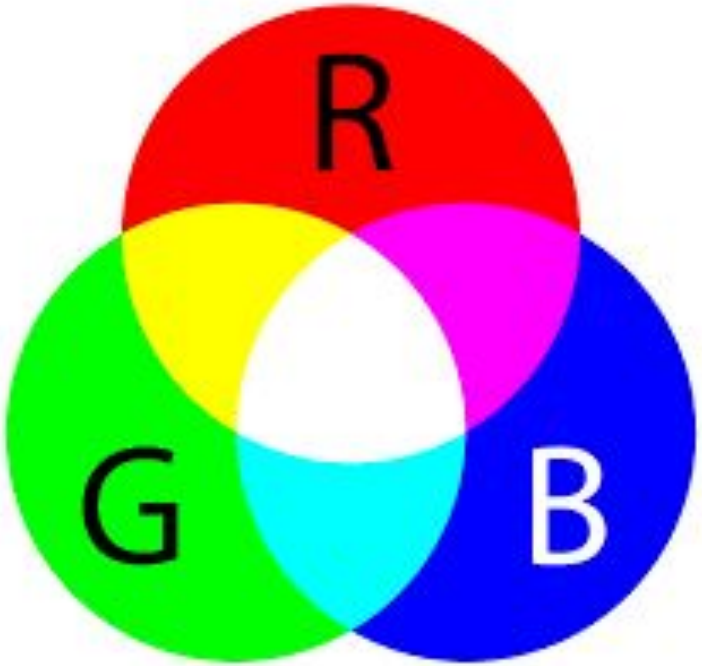
Recap: RGB

Each pixel color has 3 RGB values which represent the brightness of that color

R = Red
G = Green
B = Blue

The values of each color are represented as integers between 0 and 255



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