Algorithmic Approaches for Biological Data, Lecture #12

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City University of New York
American Museum of Natural History

2 March 2016

Outline

- File Overview:

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  - Standard I/O

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  - CSV reader

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  - Standard I/O
  - CSV reader
  - matplotlib's imread()
  - The `urllib` reader
- Structured Data files: CSV, PNG (Image), SQL, FASTA & friends

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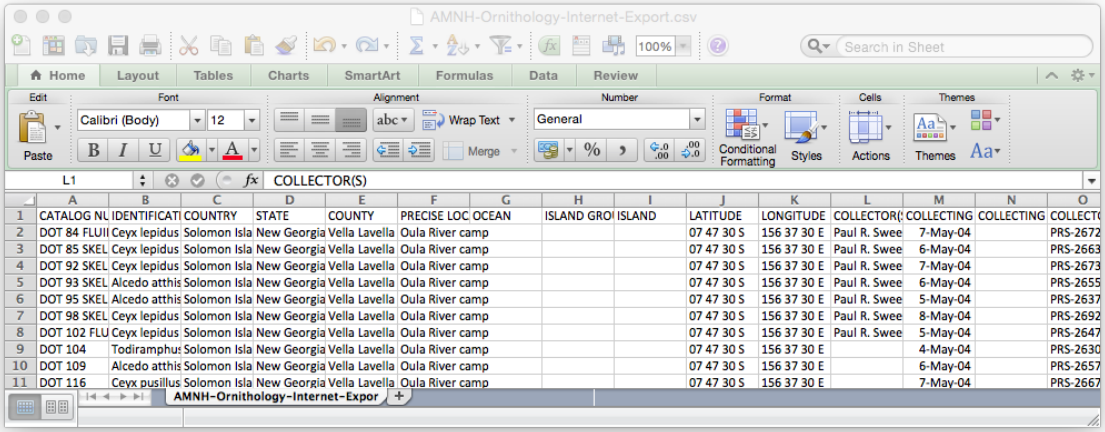
- Writing to a file:
  `outfile.write(s)`

CSV Files



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1	CATALOG NU	IDENTIFICATI	COUNTRY	STATE	COUNTY	PRECISE LOC	OCEAN	ISLAND GRO	ISLAND	LATITUDE	LONGITUDE	COLLECTOR(S	COLLECTING	COLLECTING	COLLECT
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- Very structured– the columns and rows matter.

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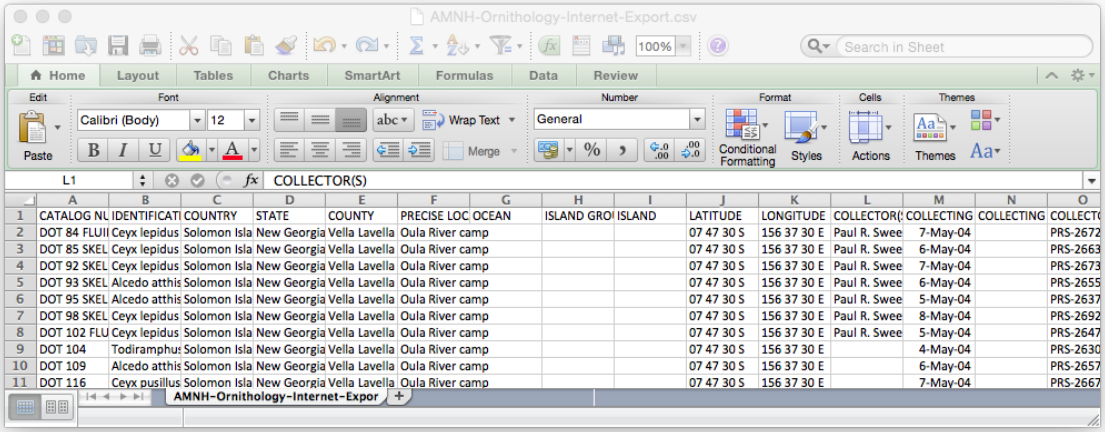

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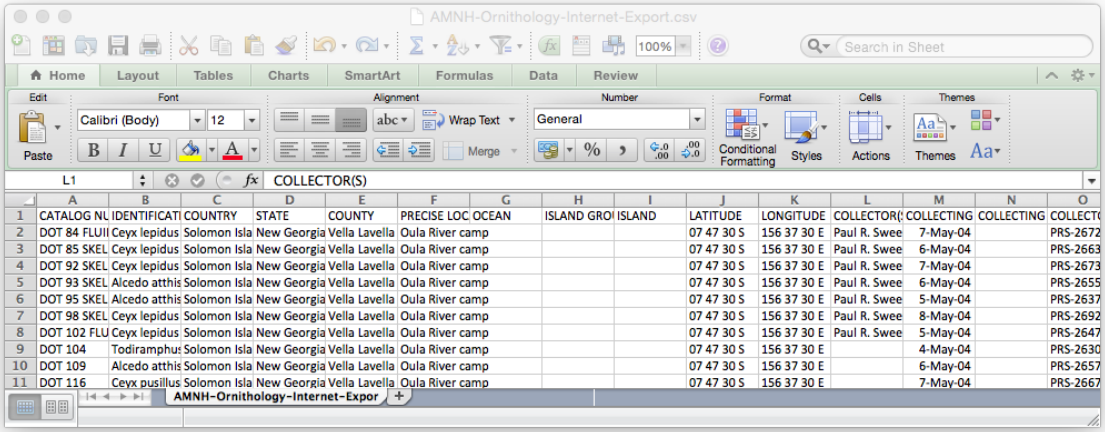

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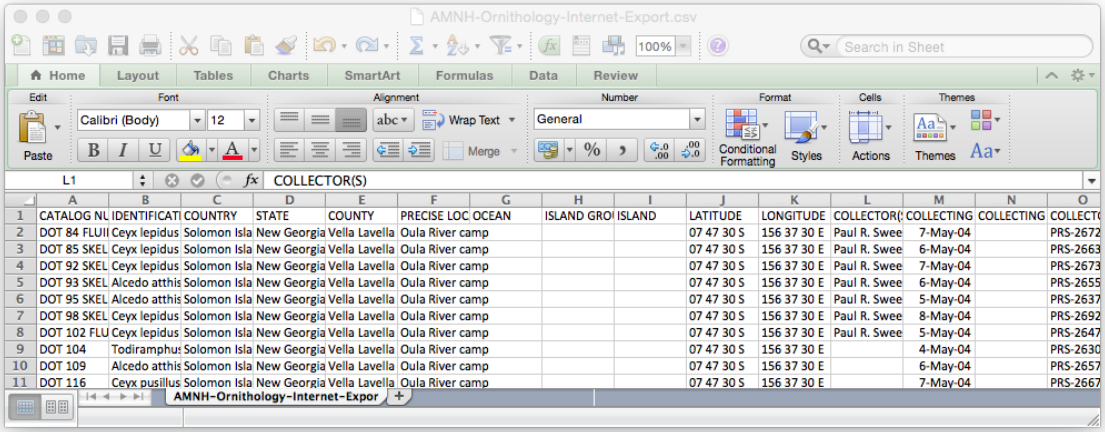

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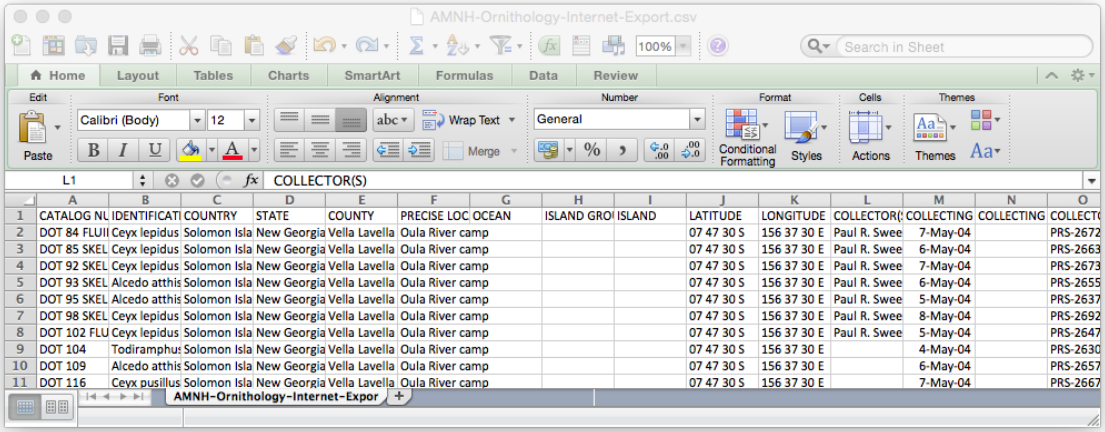

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- Rows look like:

```
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Island,Oula River camp,,,,07 47 30 S,156 37 30 E,Paul R. Sweet,7-May-04,,PRS-2672,,,"Tissue Fluid "
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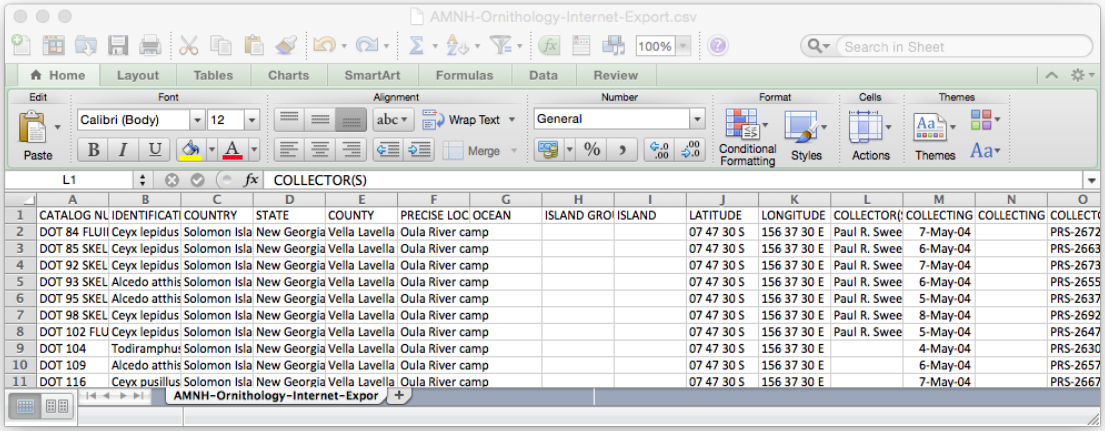

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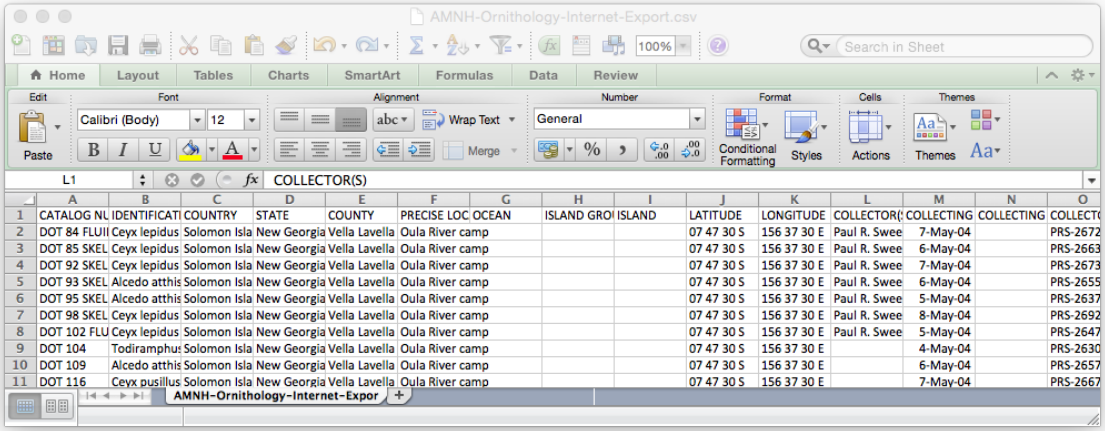

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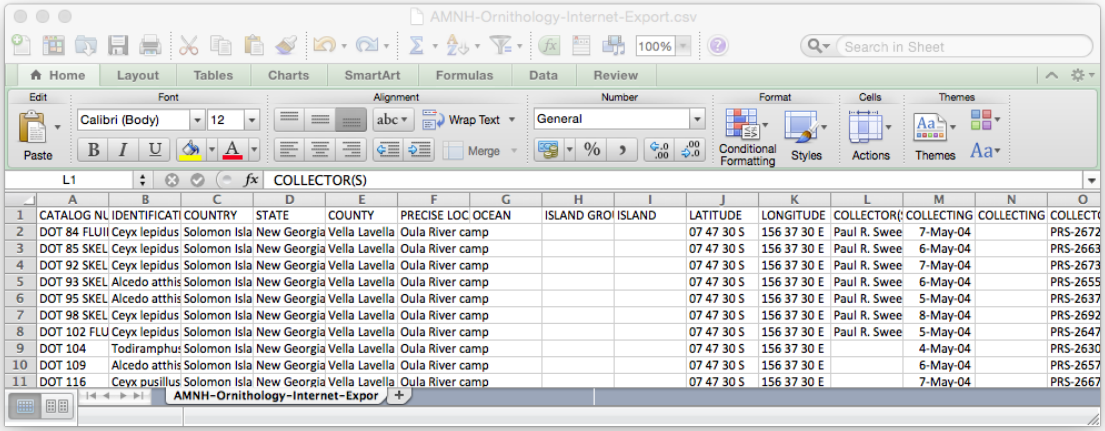

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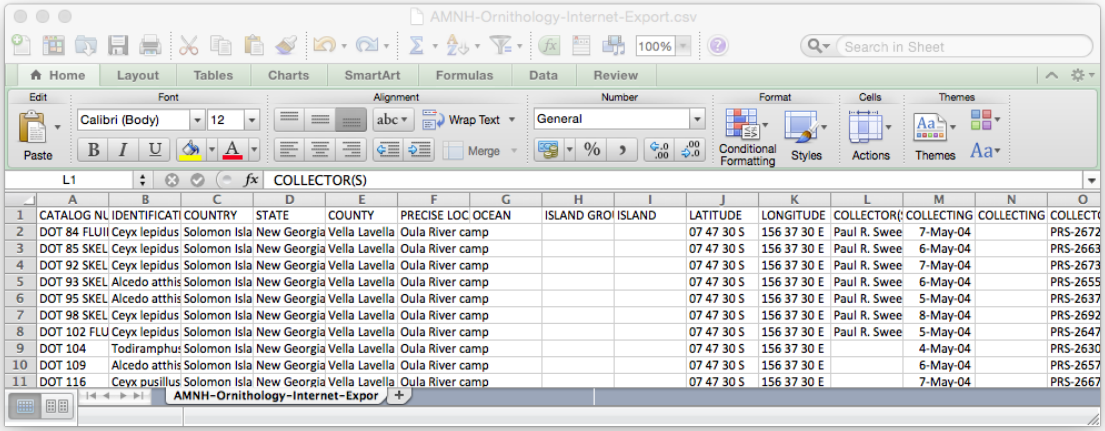

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10	DOT 109	Alcedo atthis	Solomon Isla	New Georgia	Vella Lavella	Oula River camp				07 47 30 S	156 37 30 E		6-May-04		PRS-2657
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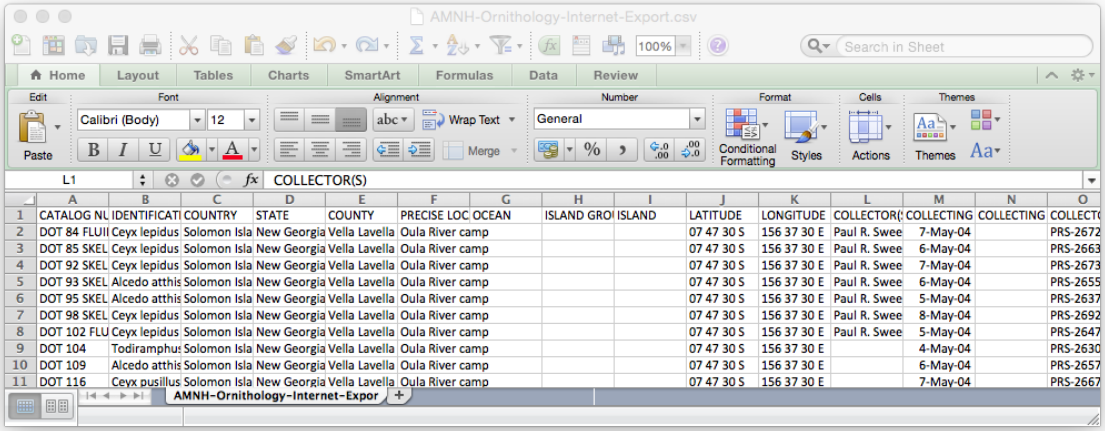

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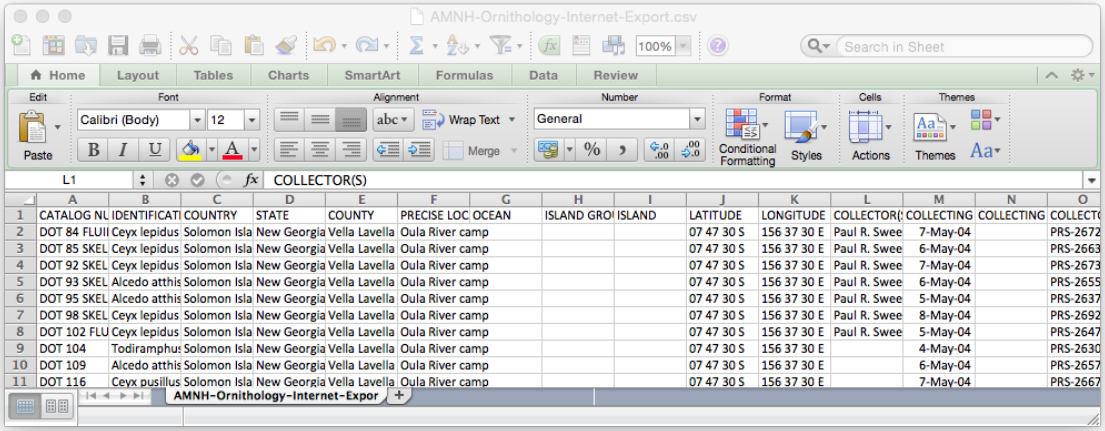

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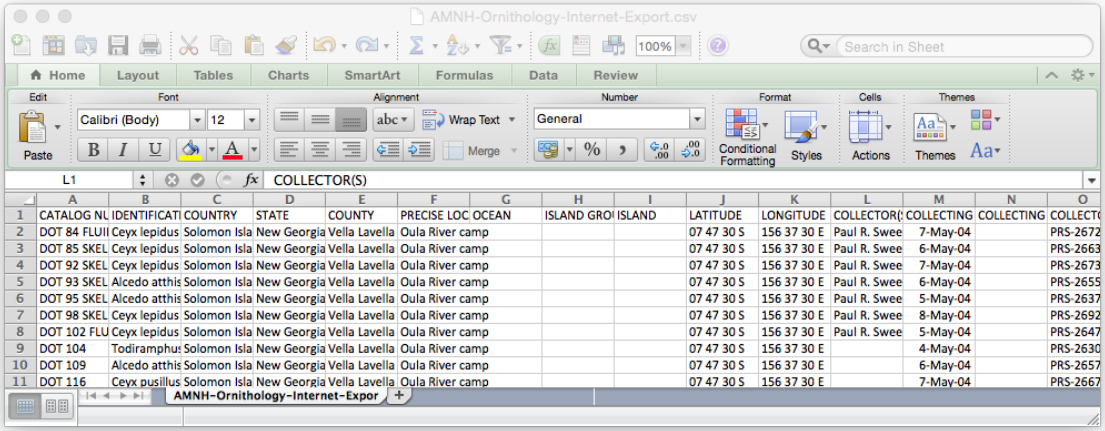

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1	CATALOG NU	IDENTIFICATI	COUNTRY	STATE	COUNTY	PRECISE LOC	OCEAN	ISLAND GRO	ISLAND	LATITUDE	LONGITUDE	COLLECTOR(	COLLECTING	COLLECTING	COLLECT
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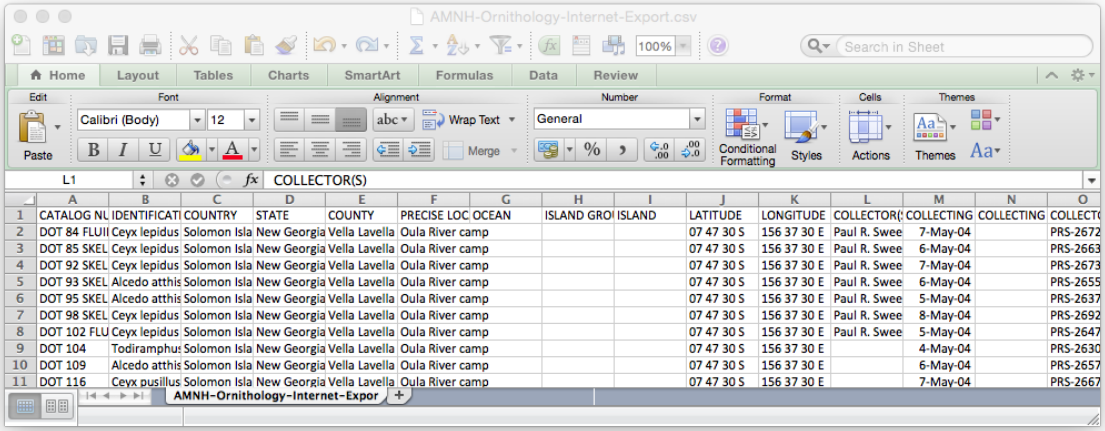

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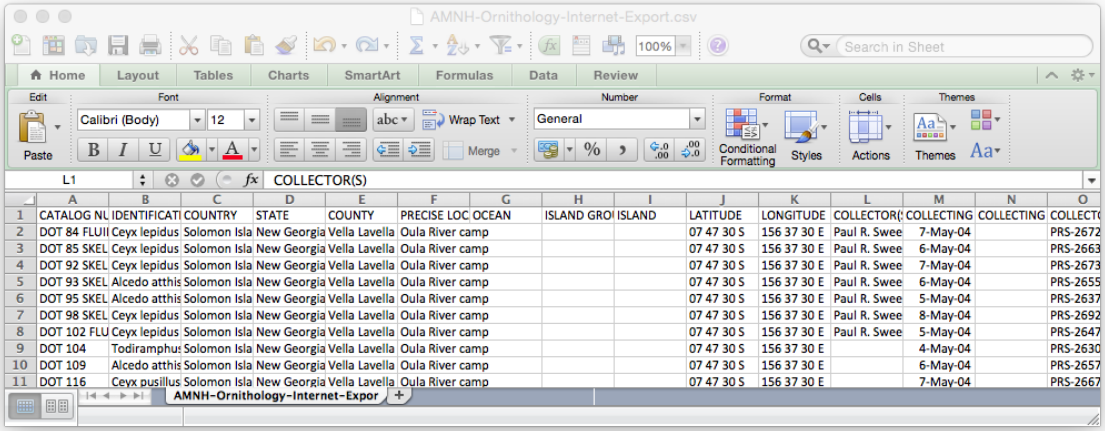

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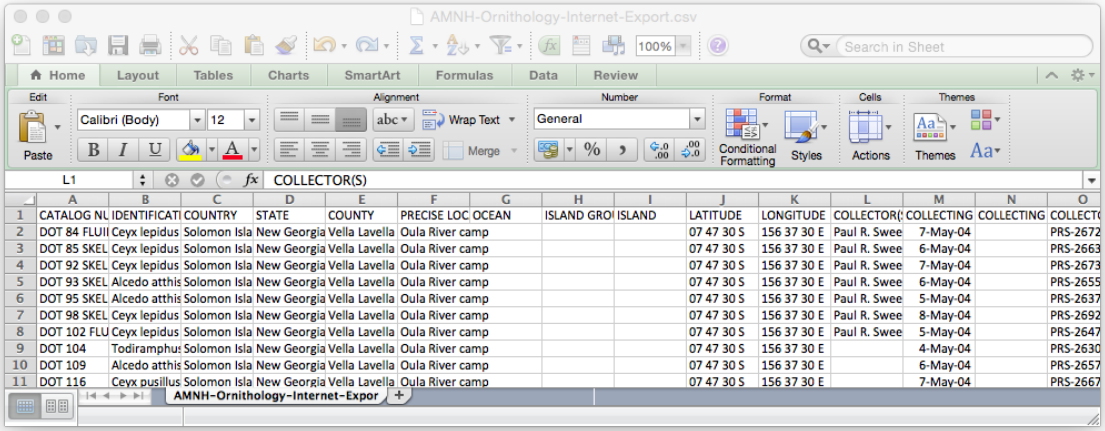

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    `if "Malaysia" in row['COUNTRY']: ...`

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ACGTTTAATTATATATAAAA
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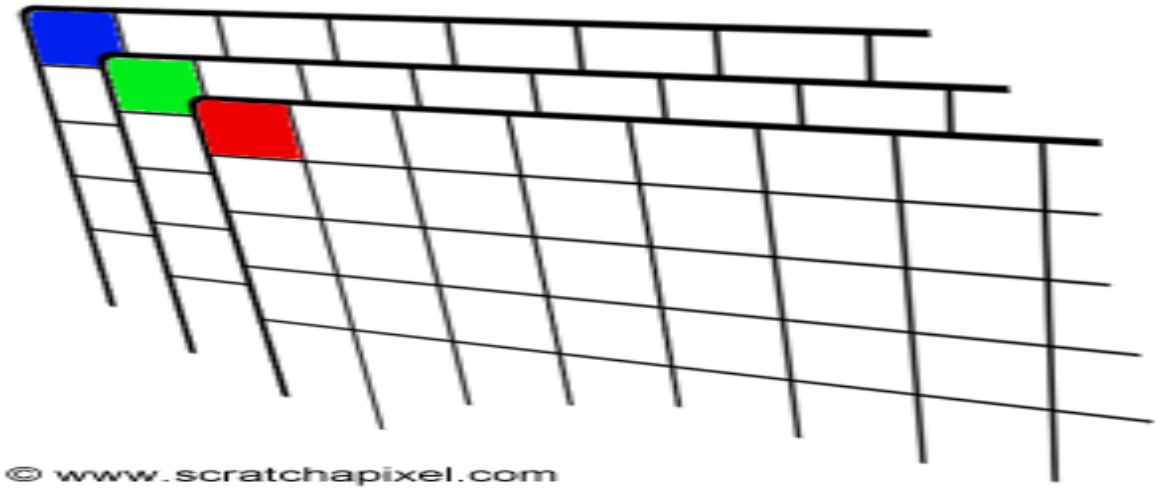
- Portable Network Graphics (PNG): stores images pixel by pixel.
- Structured Query Language (SQL): used to access/modify relational databases.

Color By Numbers...



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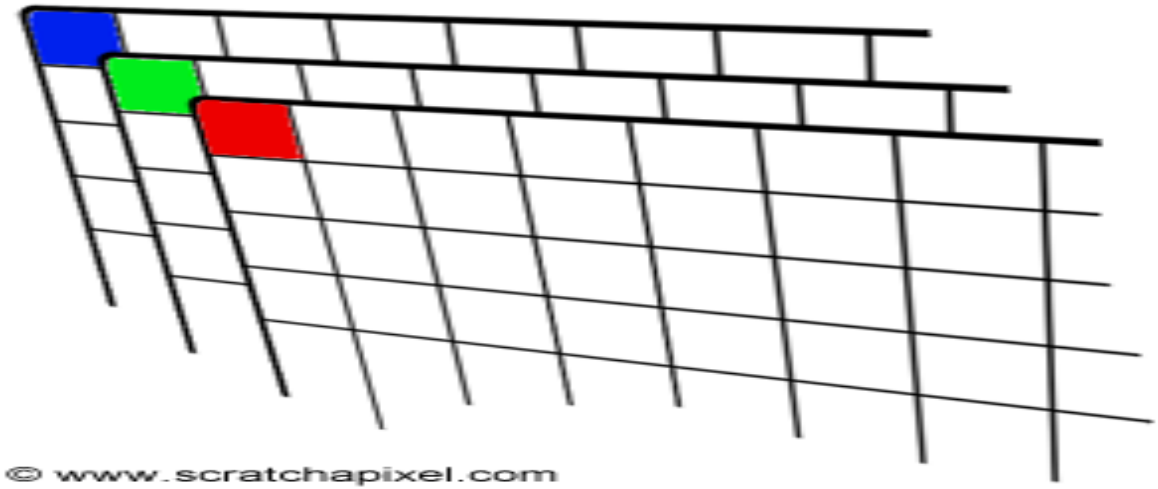

- Images are a grid of pixels.
- Can access color value for pixel (row, col):

```
print "Red:   ", img[row,col,0]
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```

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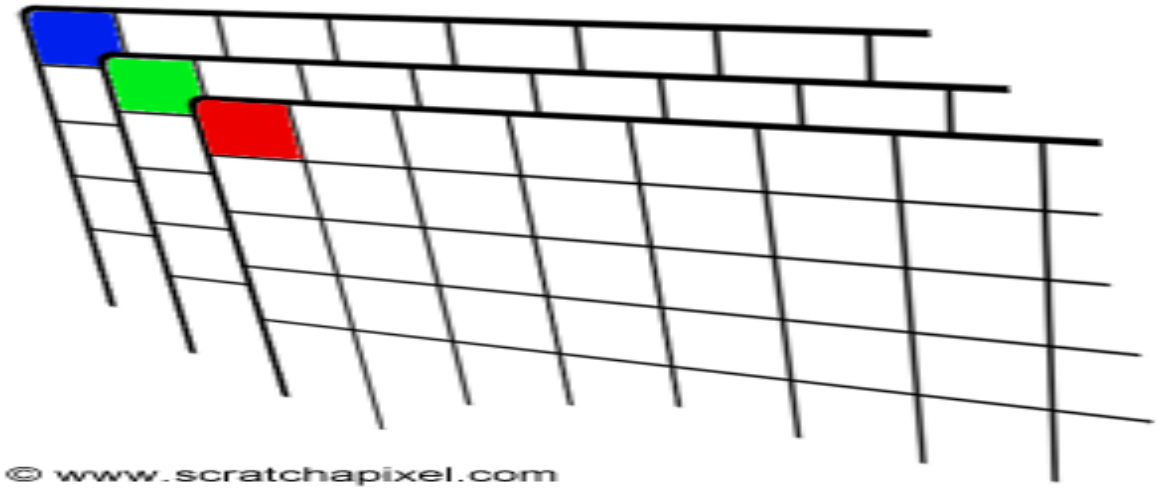

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- Challenges: manipulate images, pixel by pixel.

Code Review

filterImage.py - /Users/stjohn/gitHub/bridgeUp-STEM-Miscellanea/imageProcessing/filterImage.py (2.7.9)

```
#Sample image processing file for BridgeUp: STEM
#Assumes a input file called:  bf1.png is in the same directory

import matplotlib.pyplot as plt    #Import plotting and numbers libraries
import numpy as np

img = plt.imread('bf1.png')    #Read in first butterfly image
plt.imshow(img)                #Load image into matplotlib
plt.show()                     #Open window to show image (close to continue

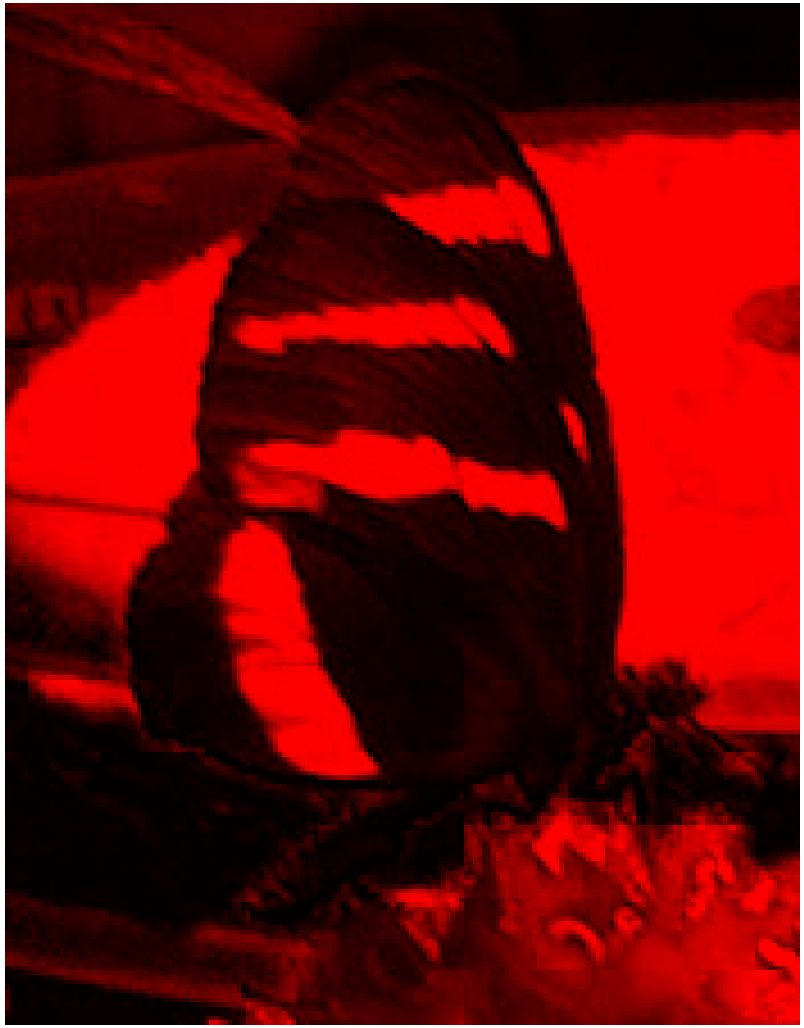
height = img.shape[0]
width = img.shape[1]
newImg = np.zeros((height,width,3))

for i in range(height):
     for j in range(width):
          newImg[i,j,0] = img[i,j,0]    #Line to change!
          newImg[i,j,1] = 0
          newImg[i,j,2] = 0

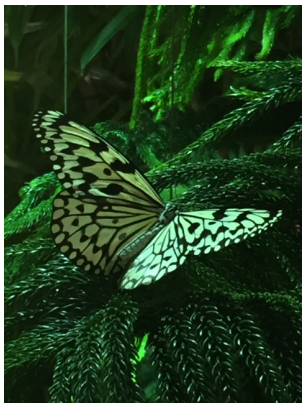
plt.imshow(newImg)
plt.show()
plt.imsave('rogue.png',newImg)
```

Ln: 24 Col: 0

Code Review

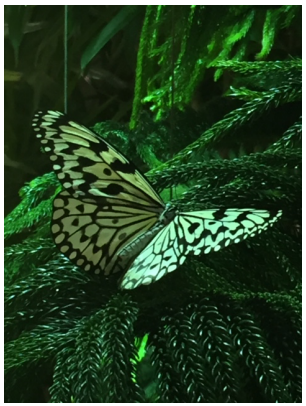


Challenges



- Display the green channel, the blue channel, and in black and white.

Challenges



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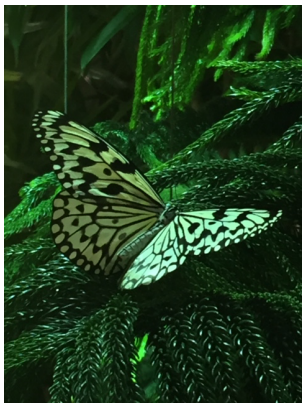

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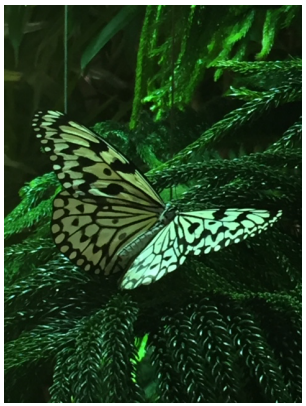

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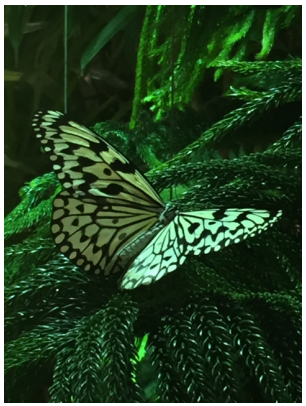

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- Starting with a monochromatic butterfly (e.g. `bflyBlue.png`), display only the butterfly.
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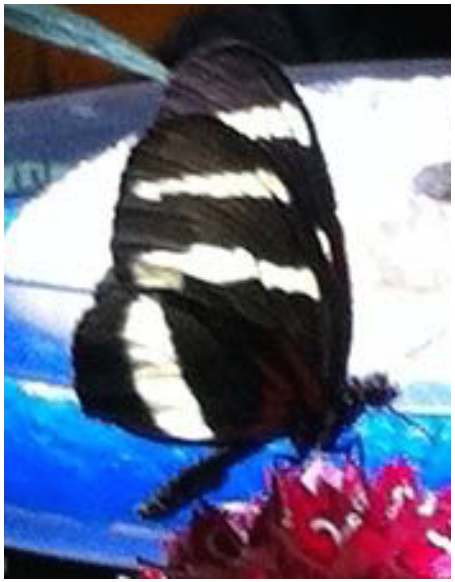
- Display the image upside down.
- Subtract two similar images and display pixels that differ by more than 30%.

Recap



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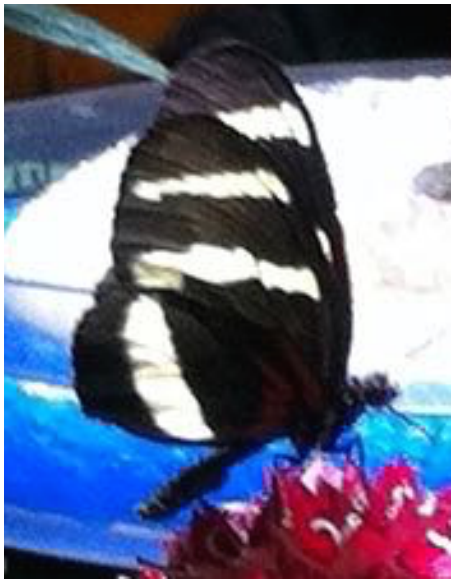

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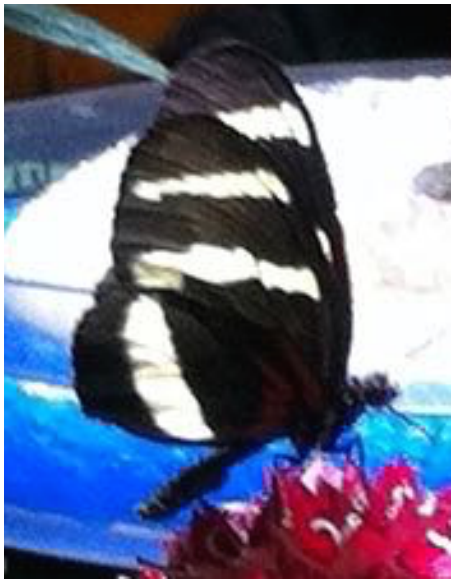

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