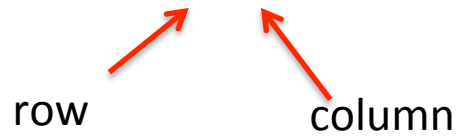
W4D2: Introduction to Numpy

- Why Numpy?
  - (numerical) data organized in rows and columns, or even more dimensions
    - Think: spreadsheets
    - And in more than 2-D: multiple sheets
  - Matrix calculations (e.g. linear algebra)

- Alternative ('add-on') module: Pandas
  - Data frames

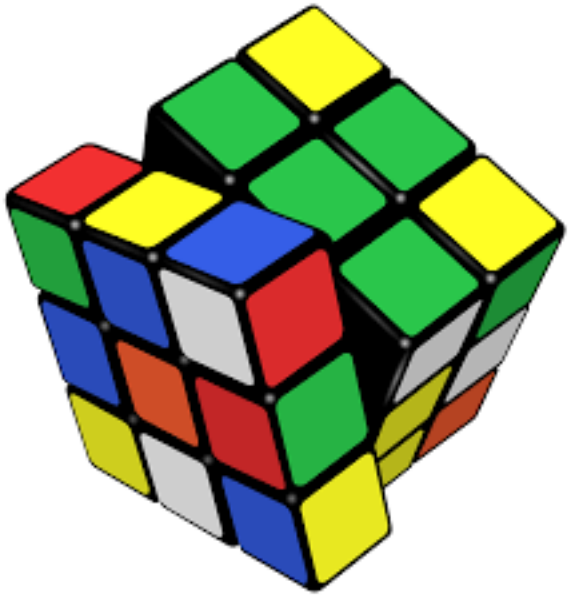
Matrix/Array/Vector

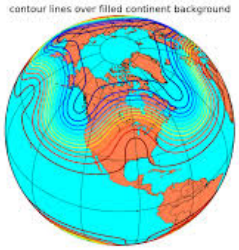
- A vector is a one-dim array/matrix
  - In numpy: np.array(list)
- A matrix has 2 or more dimensions
  - 2-D matrix: like a list-of-lists
  - Numpy makes it more easy to slice and index
    - `mylist = [[1,2],[3,4]]`
    - `mylist[1][1] # returns 4`
    - `myarray = np.array([[1,2],[3,4]]`
    - `myarray[1,1] # returns 4`



Arrays can have more than 2 dim

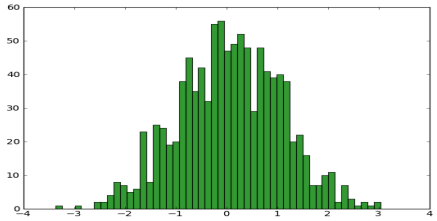
```
>>> mylist = [[[1,2],[3,4]],[[5,6],[7,8]]]

>>> mylist[0][1][1]

>>> myarray = np.array([[[1,2],[3,4]],[[5,6],[7,8]]])

array([[[1, 2],
        [3, 4]],

       [[5, 6],
        [7, 8]]])

>>> nparray[0,1,1]
>>> nparray[0,:,1]
```

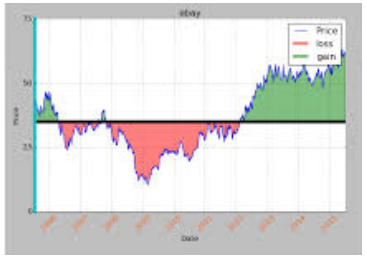


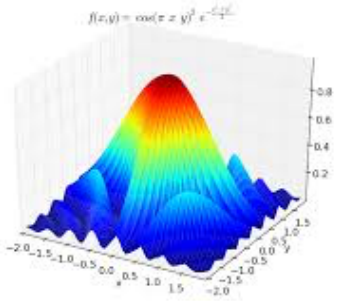


A few words on Matplotlib

- Python has a very powerful plotting library
  - Similar to Matlab
- Syntax is not straightforward
  - But to make nice plots, same for other languages.
- Beyond scope of this course, but:
  - Example of how you could use it (Iris data)
  - Few simple plots in next few days.

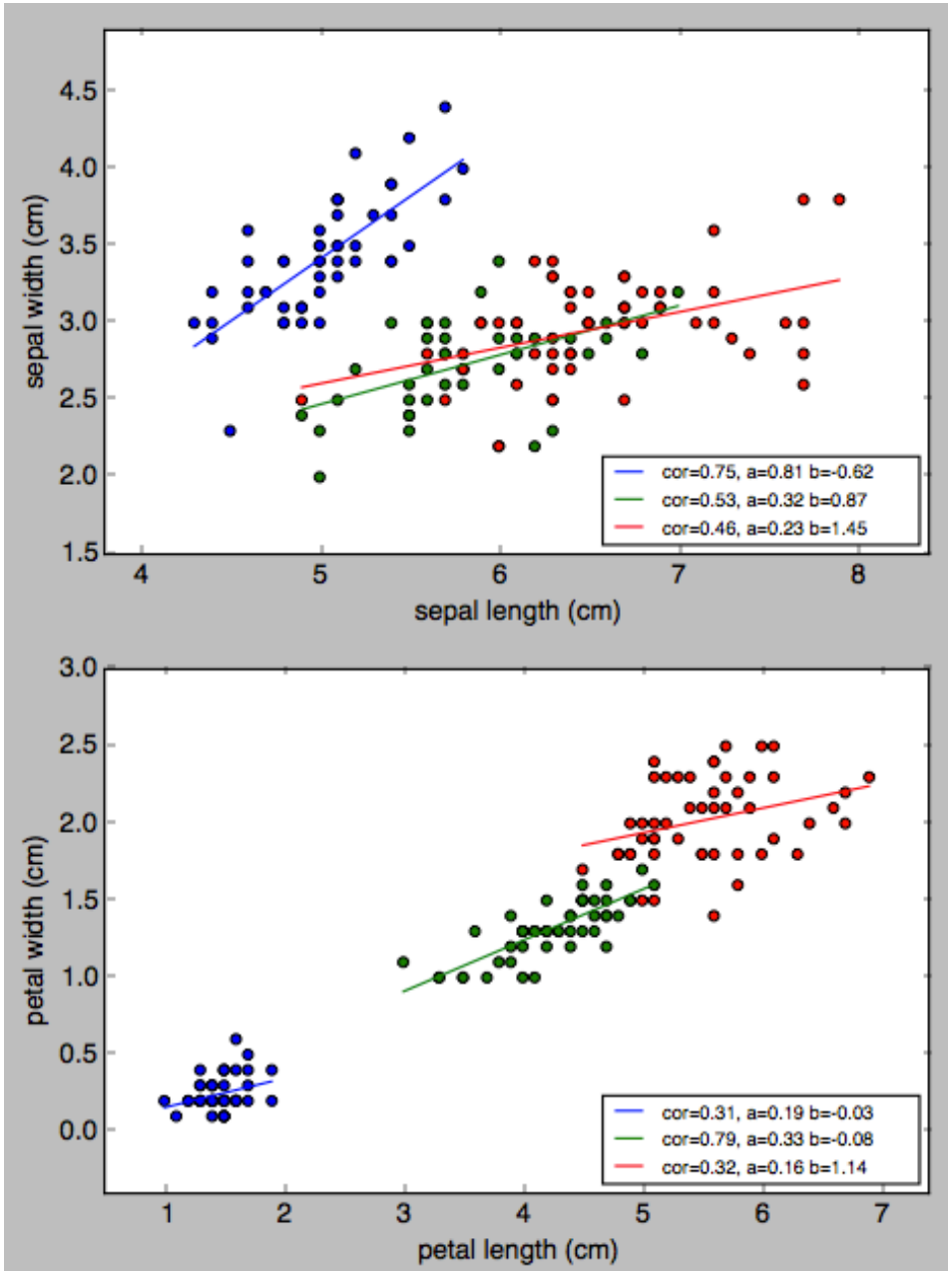




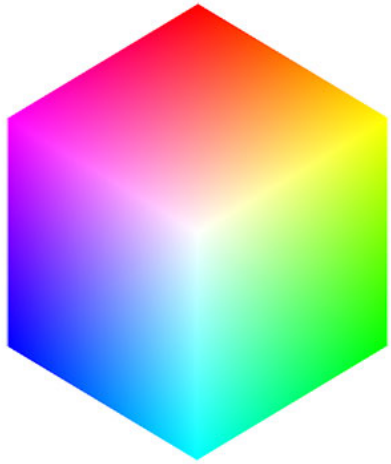


W4 Day 2 Basic Numpy

- Task 1: Basic Numpy
- Task 4: (optional) Plotting Iris data



Images - colors



- RGB – Red Green Blue
  - Represented as 3-D matrix
  - Rows and columns are 2D image, 3rd dimension holds values for R-G-B from 0-255
  - [0,0,0] is black, [255,0,0] is red, [255,255,0] is yellow, and [255,255,255] is white
- Gray: 2D array, values from 0 (black) to 255 (white).

W4 Day 3 - Flowers

- http://www.robots.ox.ac.uk/~vgg/data/flowers/17/

Task 2

- Understanding images and simple image manipulation

Task 3

- Color composition: histograms and differences between images