Week 7

Slides & Exercises

Installation required

install these modules (using easy_install, pip or anything you want)

in order:

numpy

scipy

pil

ndimage

and also these extra ones (unrelated to the above):

json

argparse

Last week’s exercise review

- Homework 6-1 (console demo only)
- exercise 6-1 to 6-4 (solution provided)

Homework 7-1:
Have more soup please!

http://www.jma.go.jp/en/yoho/320.html

Write a script that prints/output tomorrow’s weather forecast (“CLOUDY”,”RAIN”, etc)!

(look at the findall pattern in <ex56.py>, some “extra” may be required to extract the info. This extra could either be beautiful soup or regexp(grab upper case?) Hints: a certain type of HTML tag that has a certain class. You will get a list, narrow down the result by getting a certain member of the list, then grab upper case

Installing NumPy & SciPy

http://docs.scipy.org/doc/numpy-1.10.1/user/install.html

```
>>pip install numpy
```

JSON format, json modules

- Download input data file examples: <*example-input-format-json.zip*> from SFS (example JSON files): <ex-input-format1.json>, etc
- Also Download <`week7-examples.zip`> from SFS, open <`jsonrw.py`> and review it.
- **By using this approach you can treat those data structures in the familiar way (list, dictionaries)! as if you define them in the program**

Exercise 7-1(submit last today!)

Modify <*jsonrw.py*> to

- Read all (5)   input data files example
- Combine example 4 and 5 and save it as <combined45.json> (Hints: “+” operator)
- Print/output “Cute Captain Tottoro” using values extracted from some of the files.” Cute” from example 2, “Captain” from example 3, “Tottoro” from example 1

format used on the next topic

[[12,3,40],[8,0,100],[99,10,25]]

this “list” format(example 4&5 above) is the one we’ll use for our “data crunching” using NumPy in the next part of this class

This typically represent **matrix**

It will need be converted into “NumPy array” format first (will be shown on the next slide)

Introducing NumPy

- A powerful modules for data crunching
- run <*numpy_demo.py*> and observe
- It has so many features, we'll be focusing on Numpy Array and matrix(dot) multiplication (powerful for many data processing)

Introducing NumPy(cont)

- There is also “matrix” format, but Numpy Array is commonly used to represent matrix, used by other modules(SciPy, etc)
- http://wiki.scipy.org/Tentative_NumPy_Tutorial

Numpy Array

- Defining a Numpy Array:

```
a = array([[1.0, 2.0], [3.0, 4.0]])
```

- a “list” read from json examples above (3 &4) need to be converted into Numpy Array first to be conveniently processed:

`D=array(dread),` where “dread” is data read from json file example 3 or 4 on exercise 7-1 above

some array operations

Open and review <*`array-op.py`*> (read comments)

- transpose
- slice,indexing,array looping
- addition
- (scalar) multiplication

some array operations(cont)

- multiplication (matrix, “dot” operator)
- generating array: eye, one, linspace,
- yes you can use the familiar way:range
- a.shape, a.dtype, a.ndim methods

Exercise 7-2

- read example 4 & 5 file from exercise 7-1
- convert the contents into NumPy Array
- perform matrix (dot) multiplication
- save the output to a file <matrixmult.json>

hints:

you will have to convert multiplication result (NumPy Array format) into list format before saving into output file using. convert it using tolist(), for example:

```
np.array([[1,2,3],[4,5,6]]).tolist()
```

Image processing example

open <`lena.py`> and review it (read comments)

(lena photo is a classic image processing photo sample)

ref:

http://scipy-lectures.github.io/advanced/image_processing/

Additional library required for image processing

https://pypi.python.org/pypi/Pillow/2.2.1

Install the library(read URL above). If you get an error make sure you have gcc installed (make sure Xcode is installed with command line options- gcc is required)

Exercise 7-3

- Numpy’s method eyes(x) will generate an “identity matrix” with the size of (x,x)
- find out the size of lena.png using .shape method and generate identity matrix of the same size.
- perform dot(multiply operation), save the output to “leni.png” observe the output

Exercise 7-4

- use numpy method of “flipud” and “rotate” to manipulate lena.png
- use this equation to crop lena:

```
crop_lena = lena[lx / 4: - lx / 4, ly / 4: - ly / 4]
```

hints: pay attention to comments in lena.py

Exercise 7-4(cont)

- save the outputs to <lena_flip.png>, <lena_rotate.png>, <lena_crop.png>
- observe the output

Discover it your self(interesting package for image)

Examples: openCV (computer vision)

https://opencv-python-tutroals.readthedocs.io/en/latest/

Car Licence Plate recognition:

https://github.com/openalpr/openalpr

Much more!(do your own research)

SciPy

- is built on NumPy.
- Two of these are used to build “octave” (**free**/open source software with Matlab-like features)
- (many advanced mathematical e.g solving differential equation, /using numerical method etc)

SciPy (cont)

- many machine learning/”Artificial Intelligence” modules on python use this module
- please explore!
- matplotlib is also useful (for plotting graphics)

(WAS NOT COVERED IN CLASS) Code Convention

https://www.python.org/dev/peps/pep-0008/

Self reading then revise your codes!

*.py (homework?)

(WAS NOT COVERED IN CLASS) IDLE

https://www.python.org/download/mac/tcltk/

Graphic Libary (may be covered later on this semester)