計算機概論

Introduction to Computers

Homework 3

DICOM File Input/Output

Introduction to HW3

- Read and write text file
- Read, modify and write a DICOM file
- In this homework , you will learn
  - How to read/write regular text file
  - The format of DICOM
  - How to read and write a DICOM file
  - Basic image processing
  - Array manipulation

Input Files in a Dictionary

- There is a directory named “hw3_data”
- There are one txt file and eight DICOM files in it
- data_list.txt
  - The file names for 8 DICOM files
- 8 DICOM files for 000.dcm to 007.dcm

Get Information from Input Files

- (15%) Read “data_list.txt” in “hw3_data”, and print context in the file
- (10%) Use the file names you get from txt file. Read all files named “#”(file names you get from txt file), and print the following information in order:
  - Patient’s name
  - Patient ID

Image Processing and Output Files

- (10%) Modify information to your own:
  - Patient's name → Your English name
  - Patient ID → Your student ID
- (40%) Threshold the pixel array of DICOM file
- (10%) Output the modified DICOM file named "#-YourStudentID.dcm" in the directory named "output"(#: No. # image)
- (15%) Output a txt file named "output_list.txt" contains the names of your output files

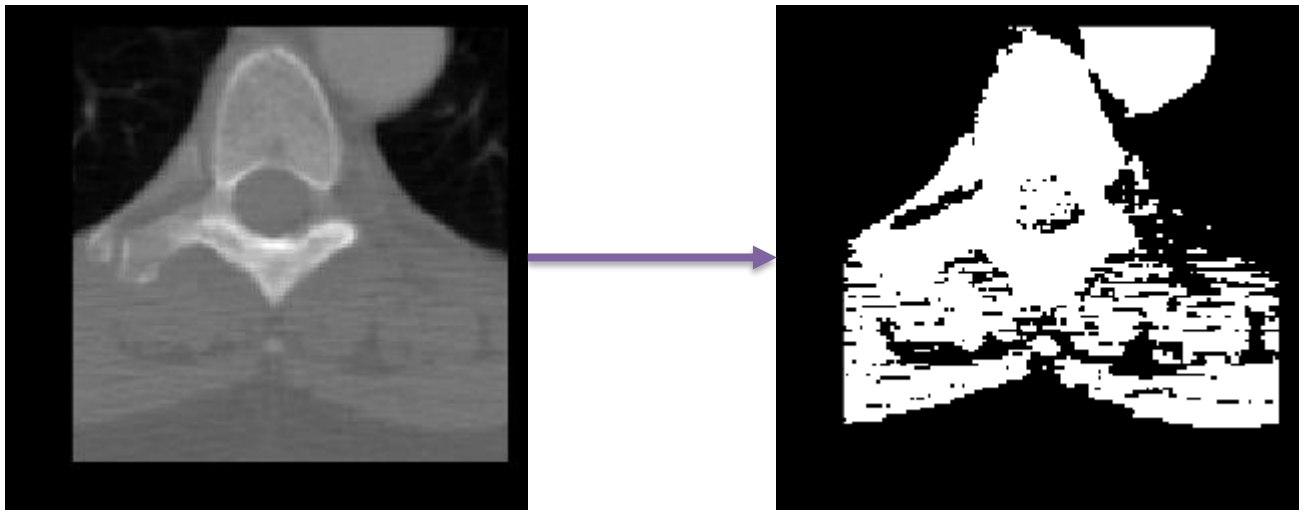
Threshold the Pixel Array

$$Max = maximum\ value\ in\ pixel\ array$$
$$Min = minimum\ value\ in\ pixel\ array$$
$$Threshold = \frac{Max + Min}{2}$$

Do the following transformation:

$$Pixel_{new} = \begin{cases} Max\ (if\ Pixel_{old} \geq Threshold) \\ Min\ (if\ Pixel_{old} < Threshold) \end{cases}$$

Example of Thresholding



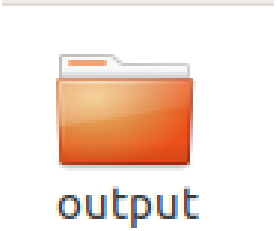
DEMO example

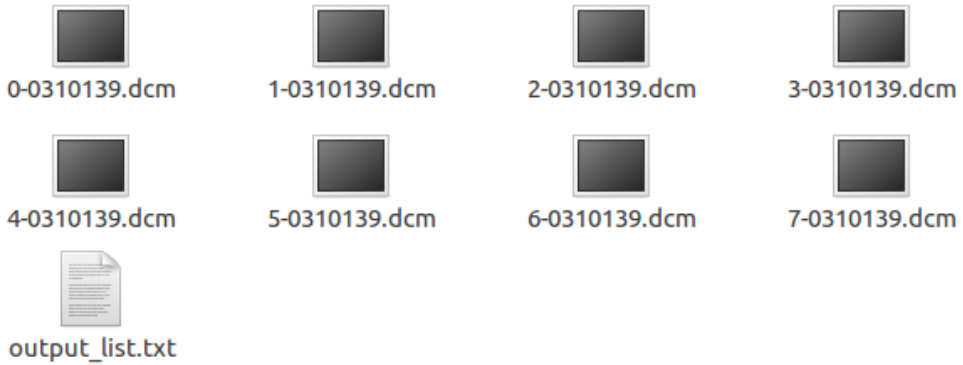
1. Print the context of “data_list.txt” in list form
2. Print the information in original input files

```
['001.dcm', '002.dcm', '003.dcm', '004.dcm', '005.dcm', '006.dcm', '007.dcm', '008.dcm']
Patient's Name: 3998S
Patient ID: 61948
Patient's Name: ROMD8
Patient ID: 29875
Patient's Name: GCRE0
Patient ID: 10758
Patient's Name: RCDGB
Patient ID: 37208
Patient's Name: V13KO
Patient ID: 11966
Patient's Name: 9JV88
Patient ID: 76590
Patient's Name: QW5T8
Patient ID: 79799
Patient's Name: AC5BV
Patient ID: 29901
```

DEMO example

2. Output all files named “#-xxxx.dcm”(#: number of image, xxxx: your student id) contain the modified context(your name, your student ID and pixel array after thresholding) to “output” directory:
3. Output “output_list.txt” into “output” directory





DEMO example

- “data_list.txt” contains all names of your output files:

Submission of HW3

- Upload your compressed file (compress the whole PyCharm) project to the link below:
  - https://www.dropbox.com/request/aF93AJkAWOgEoedhacSE
  - Deadline: 23:59 (2018/05/14)

Install pydicom & numpy

- You can use “pydicom” to help you read/write DICOM file
- You can install it by type the following command in command line:
  pip install -U pydicom
- Because pydicom may use “numpy”, you also need to install it:
  pip install –U numpy

Read DICOM File by pydicom

- Now, read/write DICOM file becomes easy, just try:
- **>> import pydicom**
- **>> dataset = pydicom.dcmread('XXXX.dcm')**
- **>> dataset.save_as('XXXX_1.dcm')**

- You can find more description in the documentation.
- Looking some examples in the documentation may be useful.

matplotlib

- You can use “matplotlib” to see what your image look like.
- Again, you can install matplotlib by typing this in command line:
  pip install -U matplotlib
- Now, if you read DICOM file properly before, you can show the image by:

```
>> import pydicom
>> import matplotlib.pyplt as plt
>> dataset = pydicom.dcmread('XXXX.dcm')
>> plt.imshow(dataset.pixel_array)
>> plt.show()
```

Reference

- pydicom Tutorial
  http://pydicom.github.io/pydicom/stable/index.html
- Matplotlib Documentation
  https://matplotlib.org/
- Threshold
  https://en.wikipedia.org/wiki/Thresholding_(image_processing)

If you have any questions, feel free to ask us on Piazza or search on Internet.