2022-1 Data Structure

HW1: C++ File I/O

◎ Due date

3/23 23:59

◎ Submit

LearnUs

◎ Caution

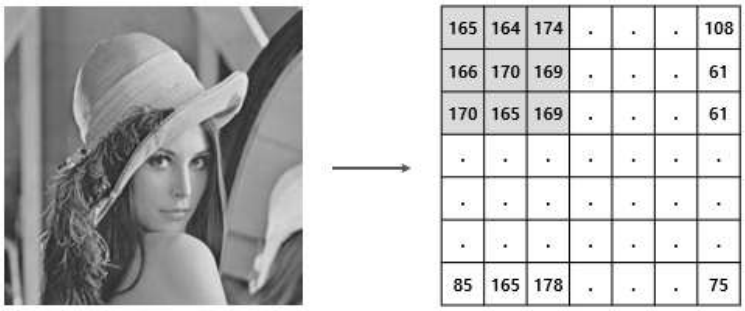
- Please upload your codes(*.cpp) and report(*.pdf) with a file name of **HW1_NAME_ID.zip** at LearnUs.
- You do not need to submit a hard copy.
- Reports can be written in Korean, and there is no fixed format.
- Explain your implementation and discuss your results

[Problem1]

File stream is used in C++ to perform functions similar to fopen and fclose used in C language.

*** ifstream, ofstream : It is a class that helps to get the contents written in a file and input/output to the program. (input/output file stream)**

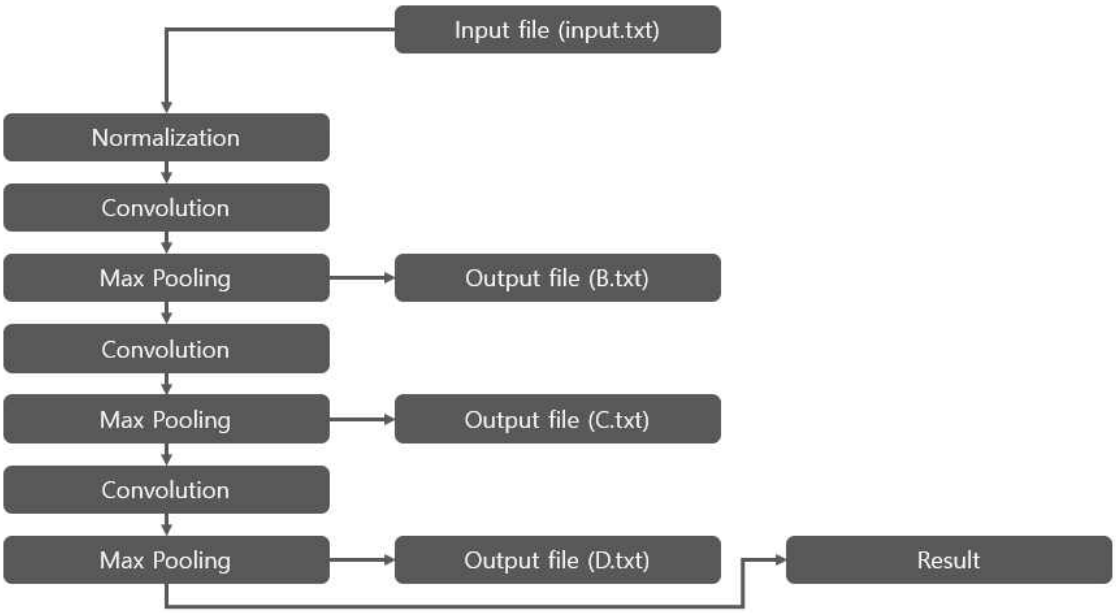
In order to implement a simple image processing technique, describe the results obtained through the process below on a 28X28 array with image pixel values between 0 and 255.



165	164	174	.	.	.	108
166	170	169	.	.	.	61
170	165	169	.	.	.	61
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
85	165	178	.	.	.	75

1. **Read this file** 'input.txt', a 28X28 array with values between 0 and 255, and assign it to a new 28X28 array
2. Normalizing the data from 0~255 to 0~1
3. Convolution operation using 3X3 filter (padding X),
   - Filter : [0, 1, 0; 1, 2, 1; 0, 1, 0]
   - Stride = 1
4. After max pooling, the result is **saved as a new txt file**
   - Stride = 2
5. Step 4,5 are performed three times
6. Print the final result

* Array size changes when convolution and pooling



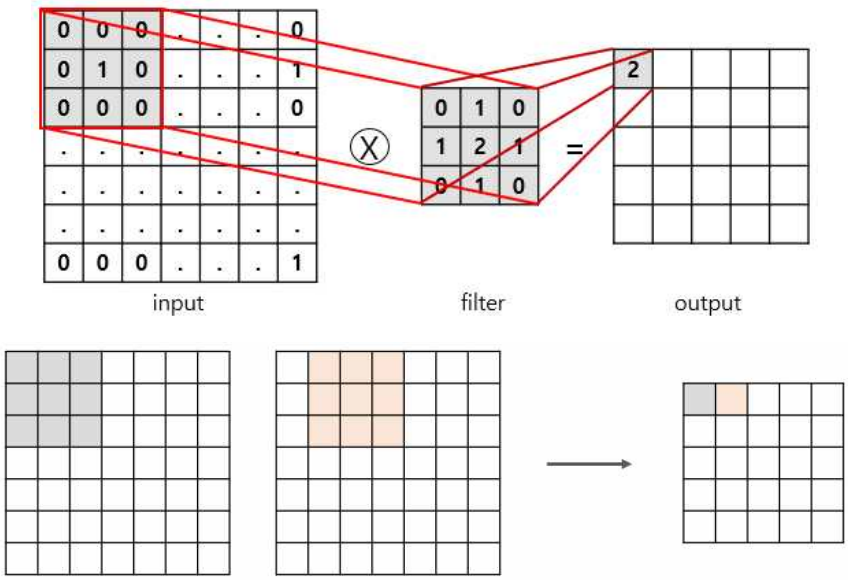
Normalization

Normalizing the input data from 0~255 to 0~1

$$input\_norm[x][y] = \frac{input[x][y]}{255}, \quad (input[x][y] = 0\sim255, input\_norm[x][y] = 0\sim1)$$

Convolution

3X3 filter performs a convolution operation and moves the input data at a specified interval. In this HW, it is implemented to move one pixel at a time using a filter with a value in the figure.



Padding

Before the convolution operation, you can resize the output data by padding a specific value around the input data.

Stride

Stride is the interval at which the filter is applied. The larger the stride value, the smaller the size of the output data.

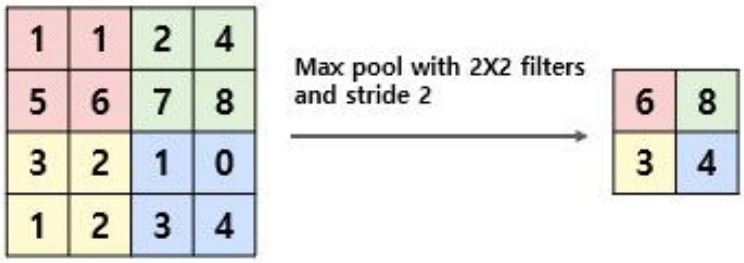
Input size = (H, W)
Filter size = (FH, FW)
Output size = (OH, OW)
Padding = P
Stride = S

$$OH = \frac{H + 2P - FH}{S} + 1$$

$$OW = \frac{W + 2P - FW}{S} + 1$$

Max Pooling

Pick the maximum value out of 4 spaces. In this task, if the number of layer pixels is odd, the last line is omitted.



[Results]