CSE473/573 SUMMER 2018

PROGRAMMING ASSIGNMENT #1

Submitted by

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PROBLEM (1) (1D and 2D Convolution on Images)

(a) The result obtained after performing 2D convolution with the specified filters are:
Time taken for 2D convolution: 3.718974642628021 seconds


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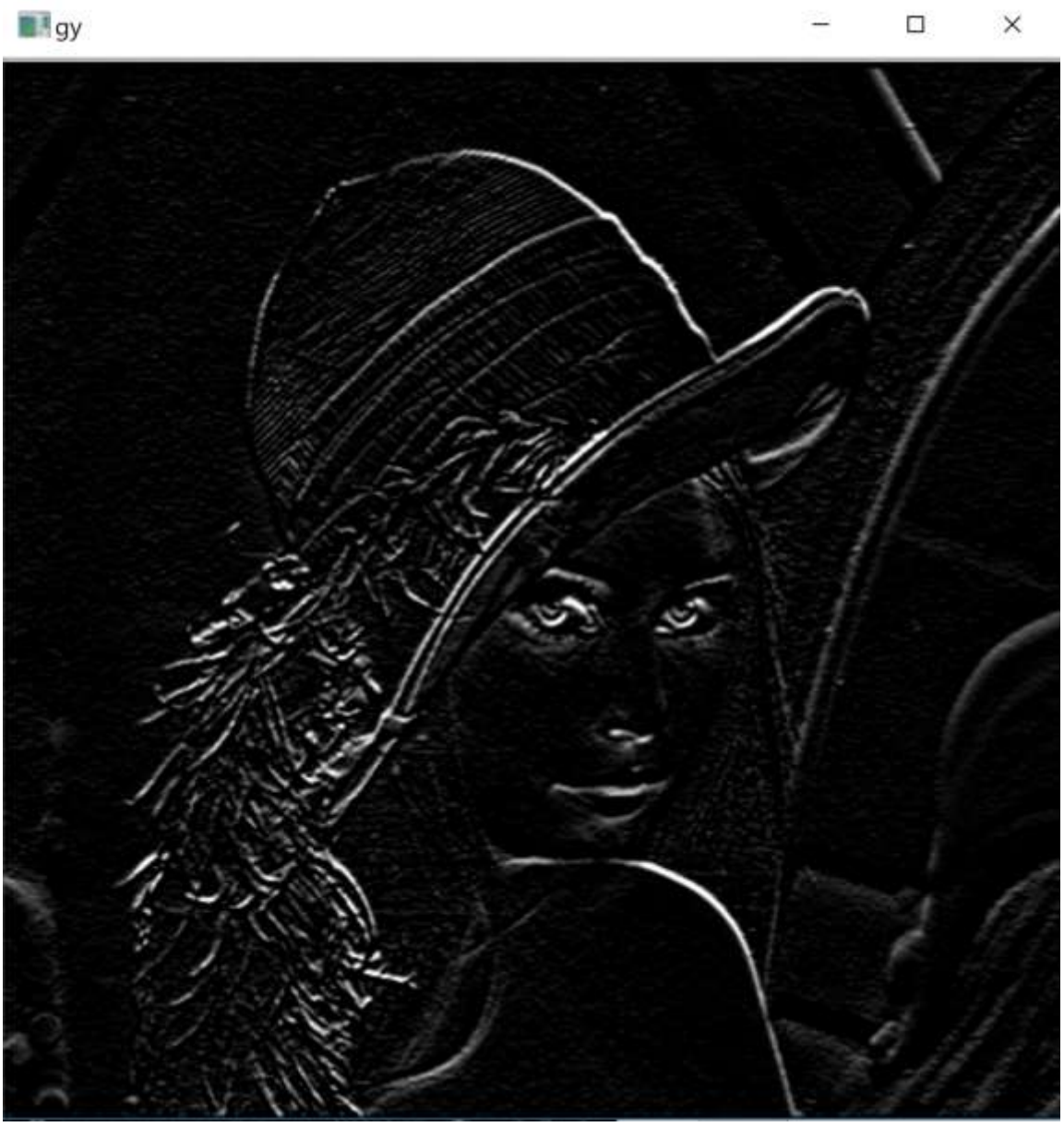
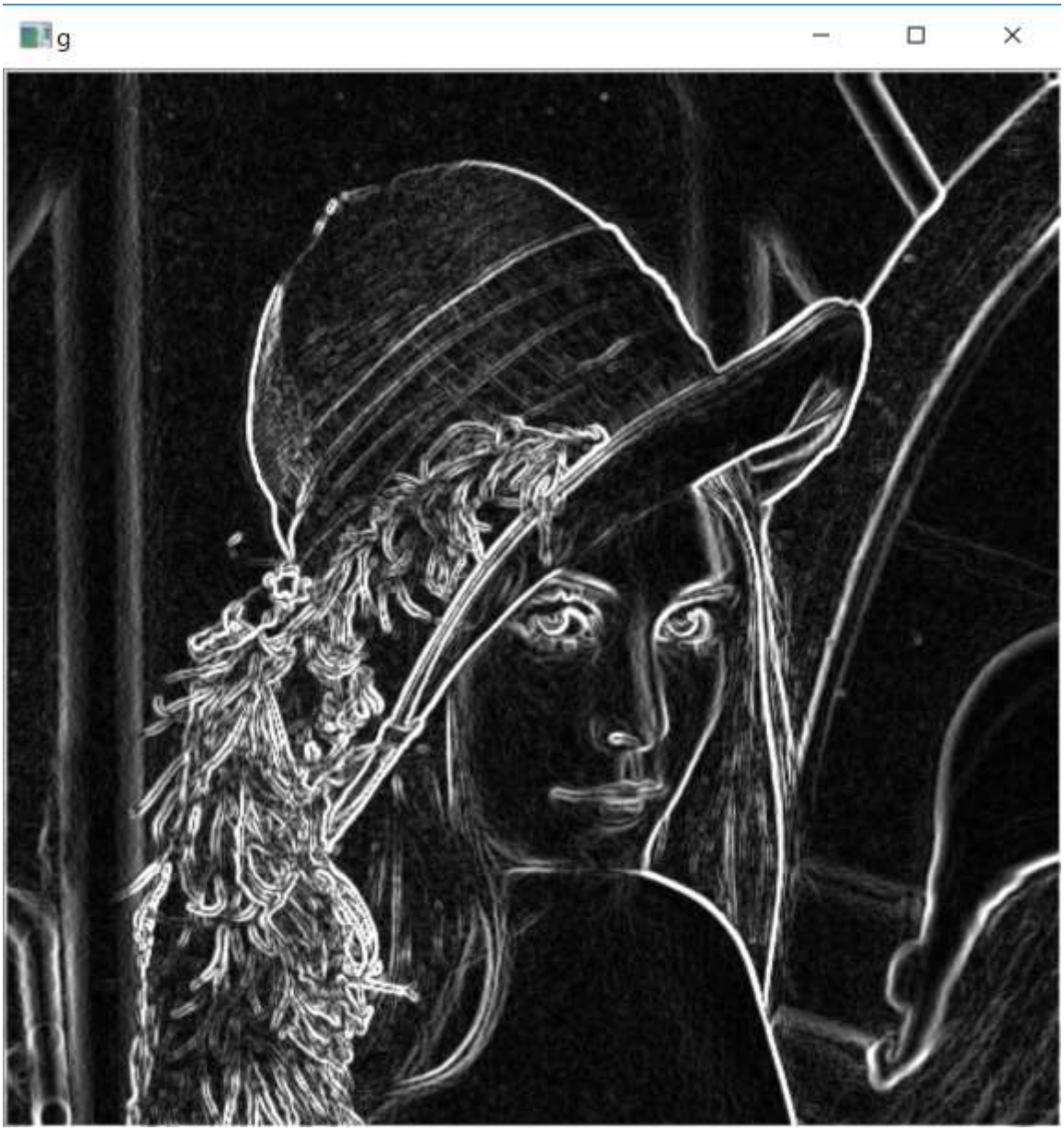
(b) The result obtained after performing 1D convolution with the specified filters are shown below. It can be seen that the result after 1D convolution is same as the one obtained from 2D convolution from (a).
Time taken for 1D convolution: 4.234997265220159 seconds


gx


gy



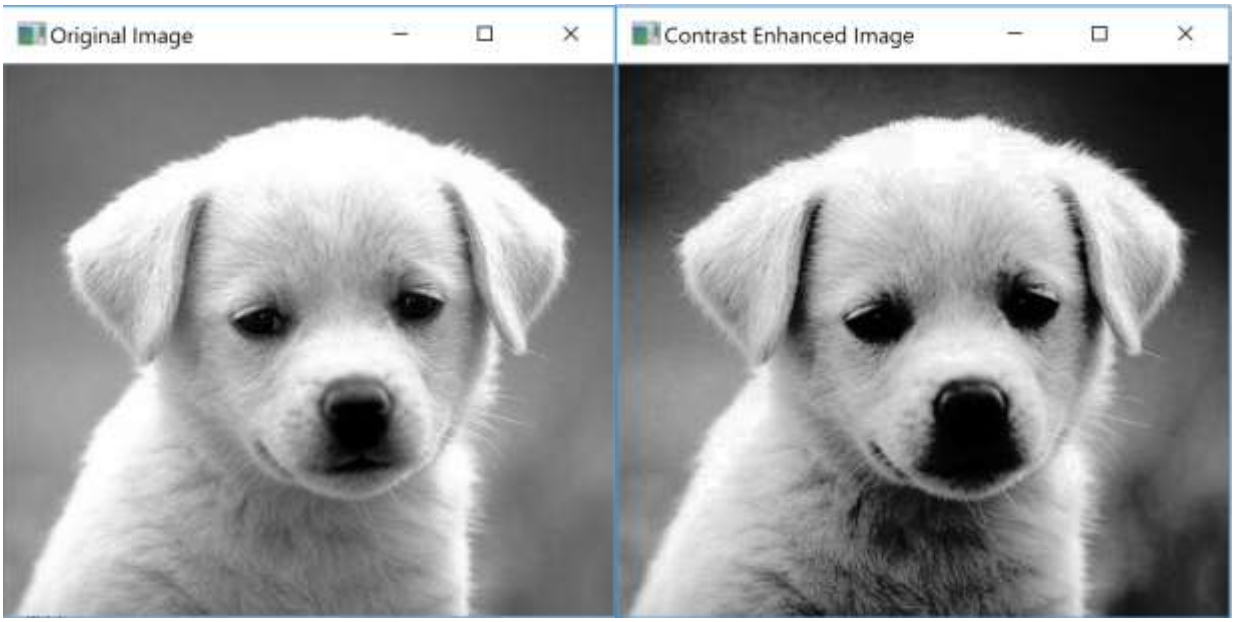
(c) It is given that the image is MxN and the filter is PxQ, so the computational complexity of performing **2D** convolution is **O(MNPQ)** as the complexity for computing the 2D convolution for a single pixel is O(PQ).
The computational complexity of performing **1D** convolution is **O(MN(P+Q))** as the complexity for computing the 1D convolution for a single pixel is O(P+Q).

(d) After creating a seperable filter of 100x100 dimension, it was applied to the given image using both 2D convolution and 1D convolution and the execution time was obtained as follows:

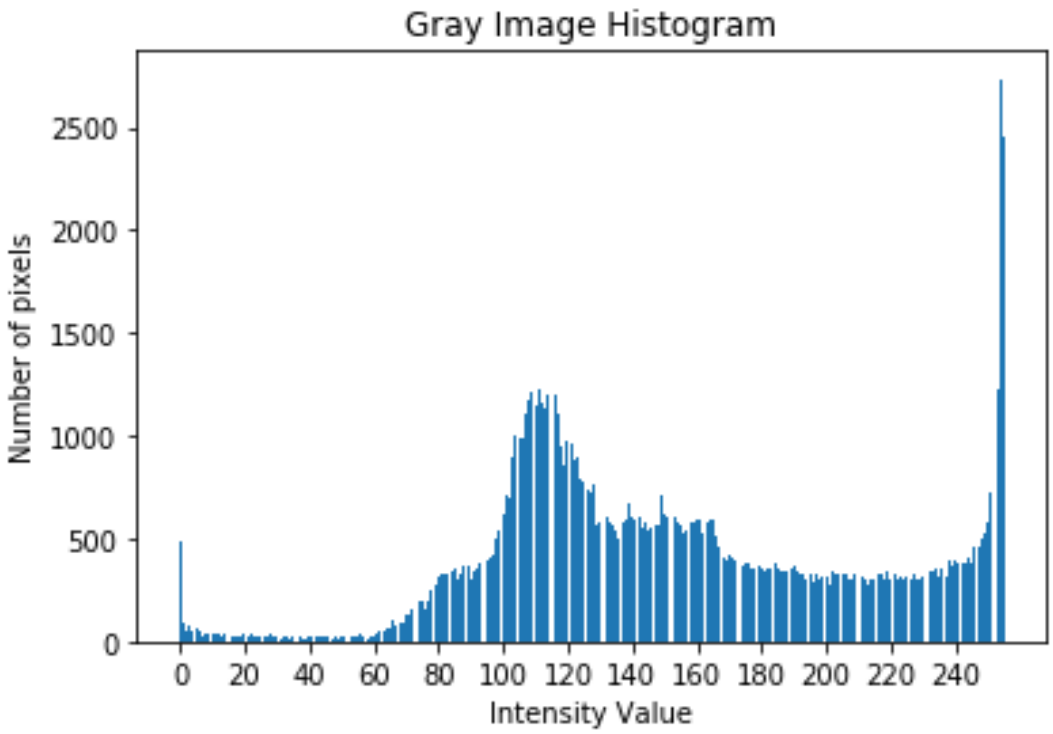
Time taken for 2D convolution: 5.235561185043934 seconds
Time taken for 1D convolution: 2.017782751558798 seconds
It is observed that the time taken for 1D convolution is much lesser than 2D. Theoretically, 1D convolution has a speed up of PQ/(P+Q) over 2D convolution.

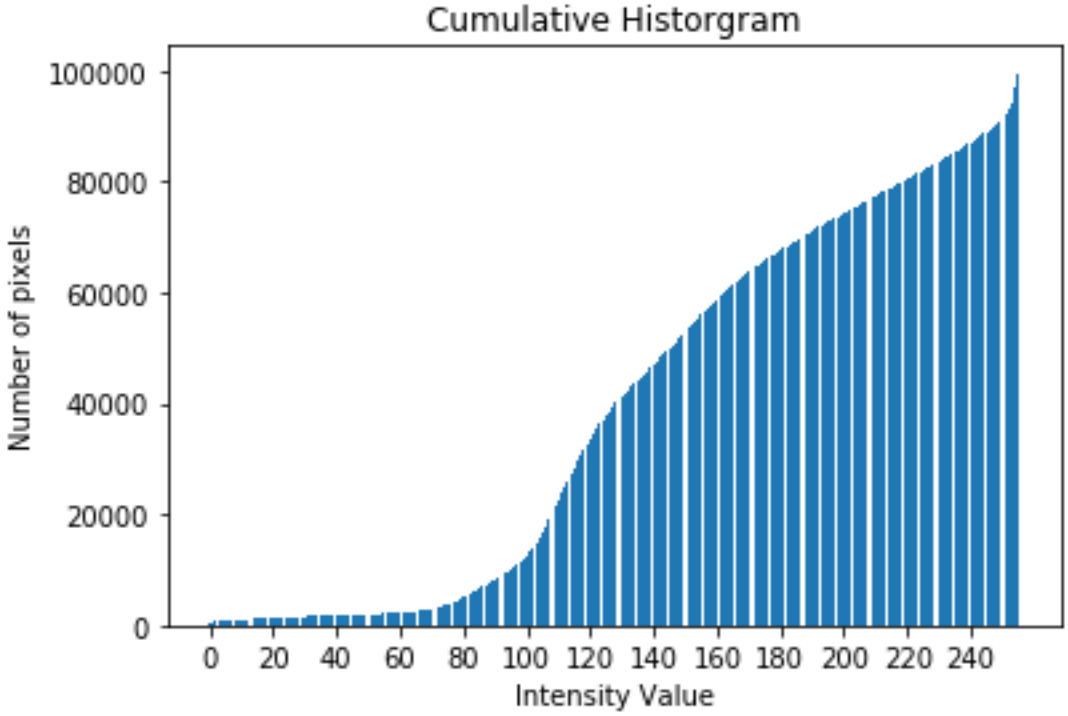
PROBLEM (2) (Histogram Equalization)

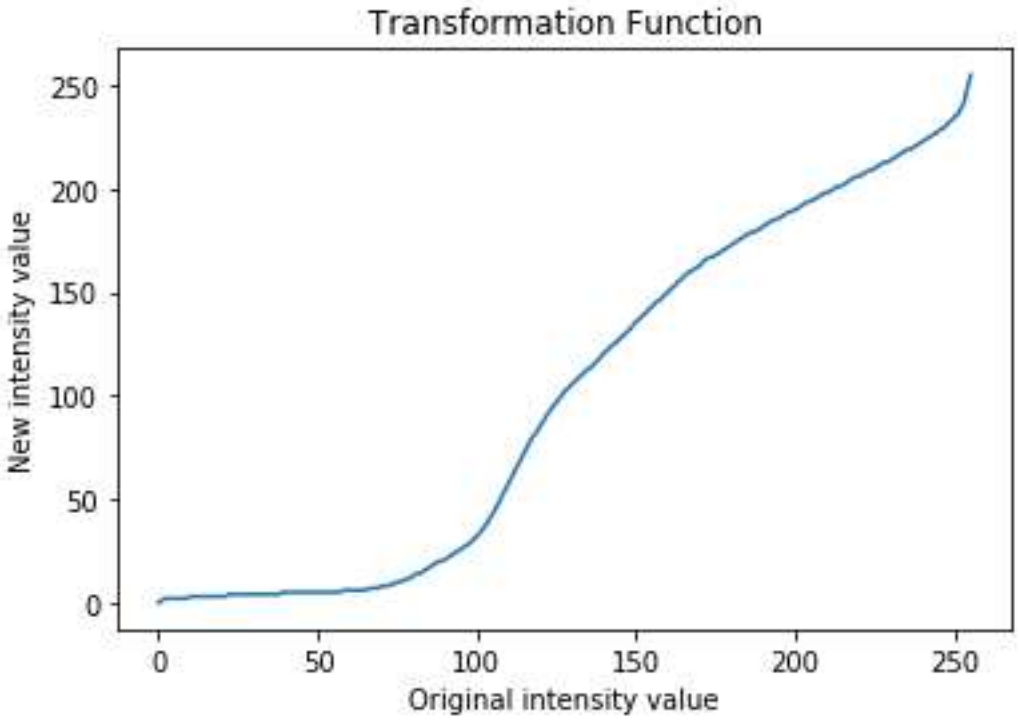
After performing histogram equalization on the chosen image the following results were obtained.

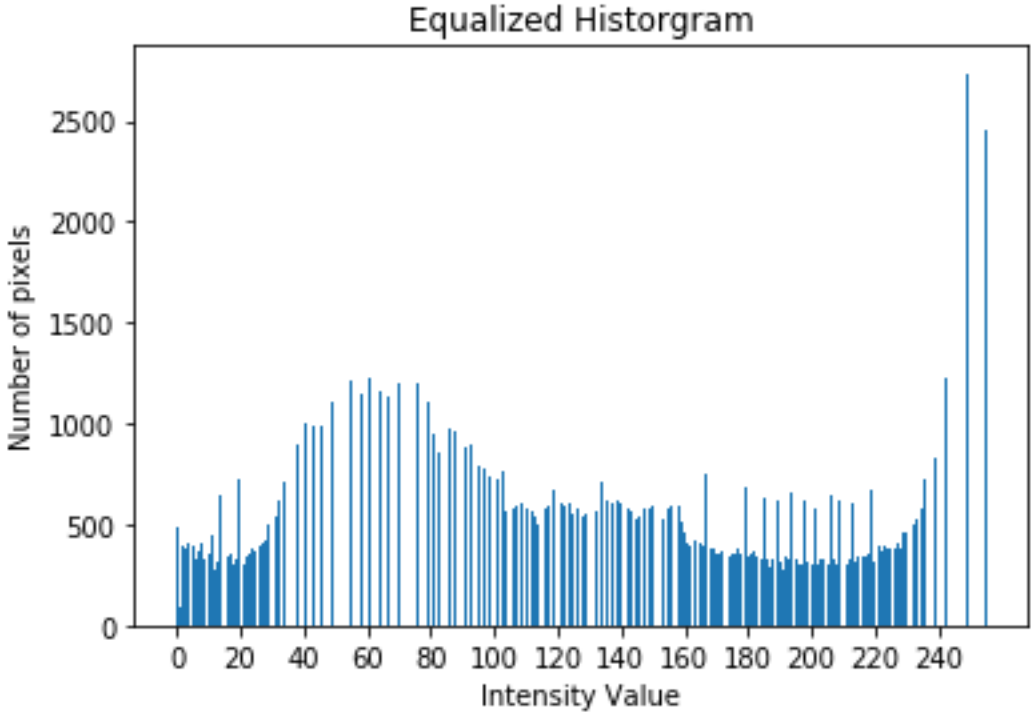


The 4 required histogram plots of the chosen image are:


Gray Image Histogram
Number of pixels
2500
2000
1500
1000
500
0
0 20 40 60 80 100 120 140 160 180 200 220 240
Intensity Value


Cumulative Historgram
Number of pixels
100000
80000
60000
40000
20000
0
0 20 40 60 80 100 120 140 160 180 200 220 240
Intensity Value


Transformation Function
New intensity value
Original intensity value
0
50
100
150
200
250


Equalized Historgram
Number of pixels
Intensity Value
0
500
1000
1500
2000
2500
0 20 40 60 80 100 120 140 160 180 200 220 240