CSE 473/573 Summer 2018 Programming Assignment 1

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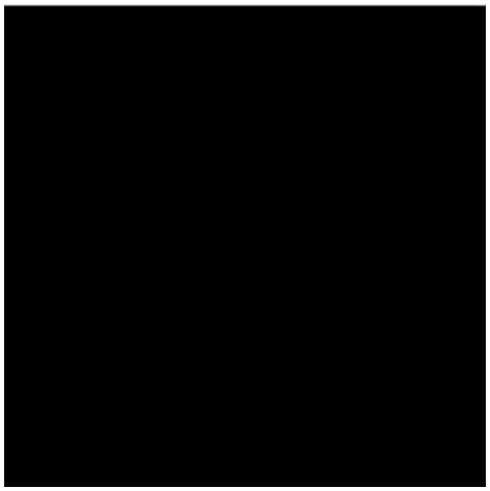
2D convolution

Gx Gy G

1D convolution

Gx Gy G

Verification G (2D Convolution)-G (1D Convolution) gives an image with 0 intensity value at all pixels



Computational Complexity

Filtering an M-by-N image with a P-by-Q filter kernel requires roughly *MNPQ* multiplies and adds (assuming we aren't using an implementation based on the FFT).

If the kernel is separable, you can filter in two steps. The first step requires about *MNP* multiplies and adds. The second requires about *MNQ* multiplies and adds, for a total of *MN(P + Q)*.

The computational advantage of separable convolution versus nonseparable convolution is therefore:

$$PQ/(P+Q)$$

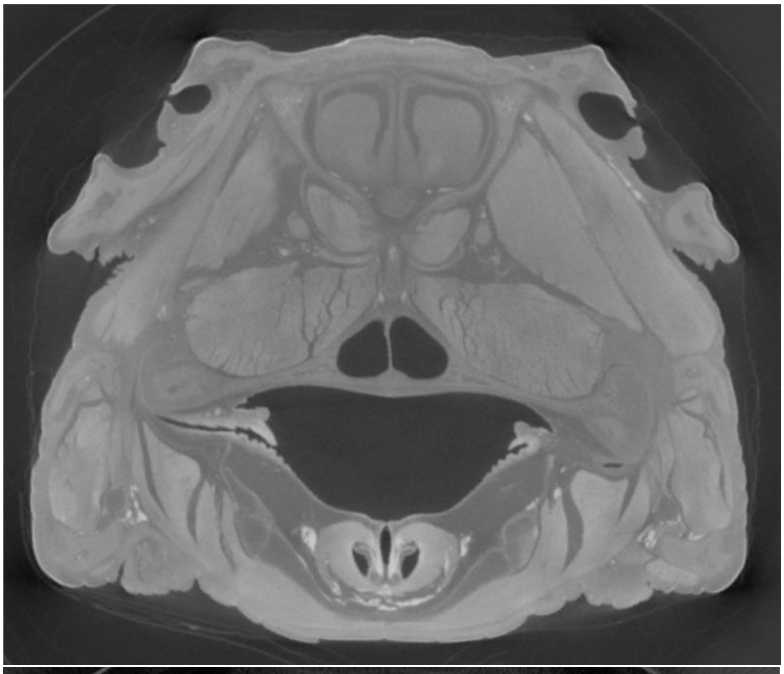
Run Time Measurements

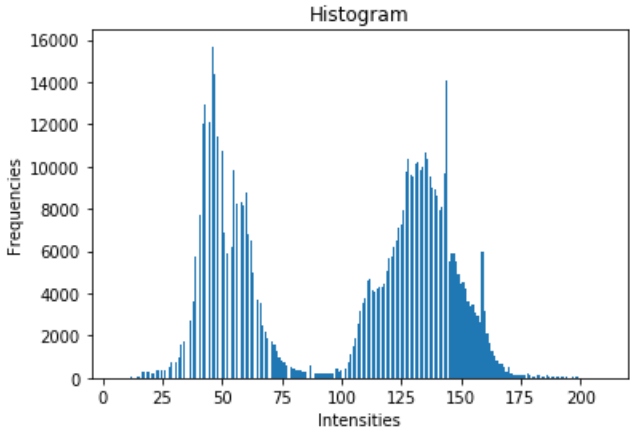
2D Convolution: 5.09 sec

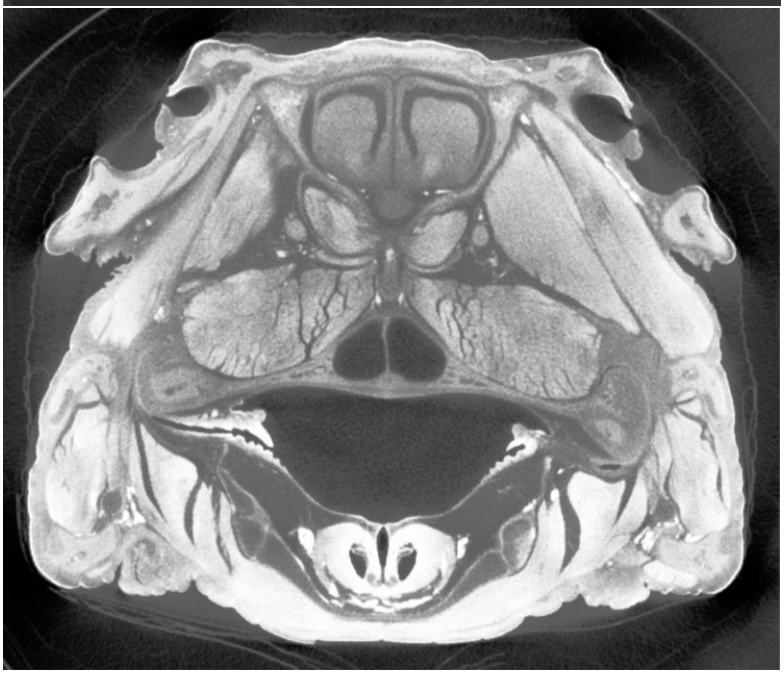
1D Convolution: 2.44 sec

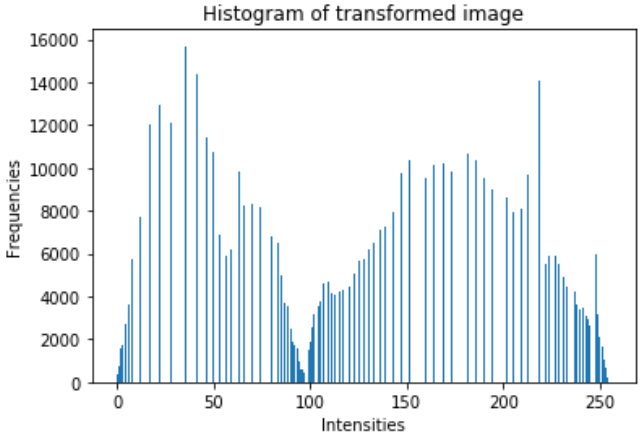
1D Convolution is 2.08 times faster than 2D Convolution for a kernel of 100x100 ones.

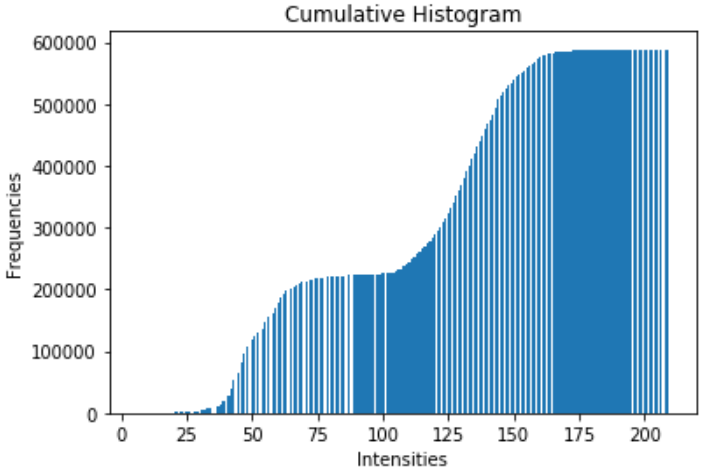
Histogram Equalization

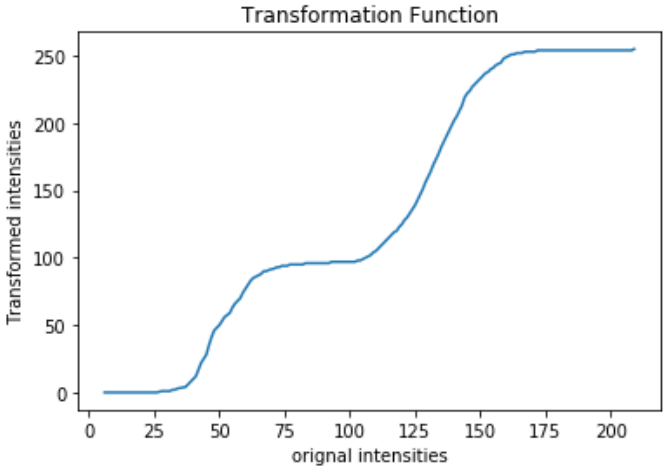


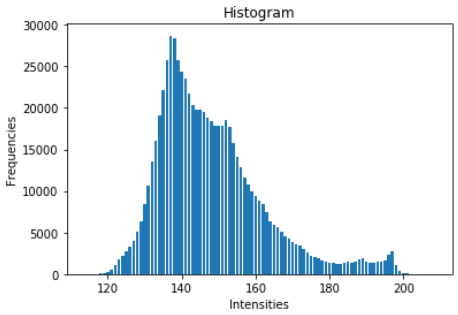


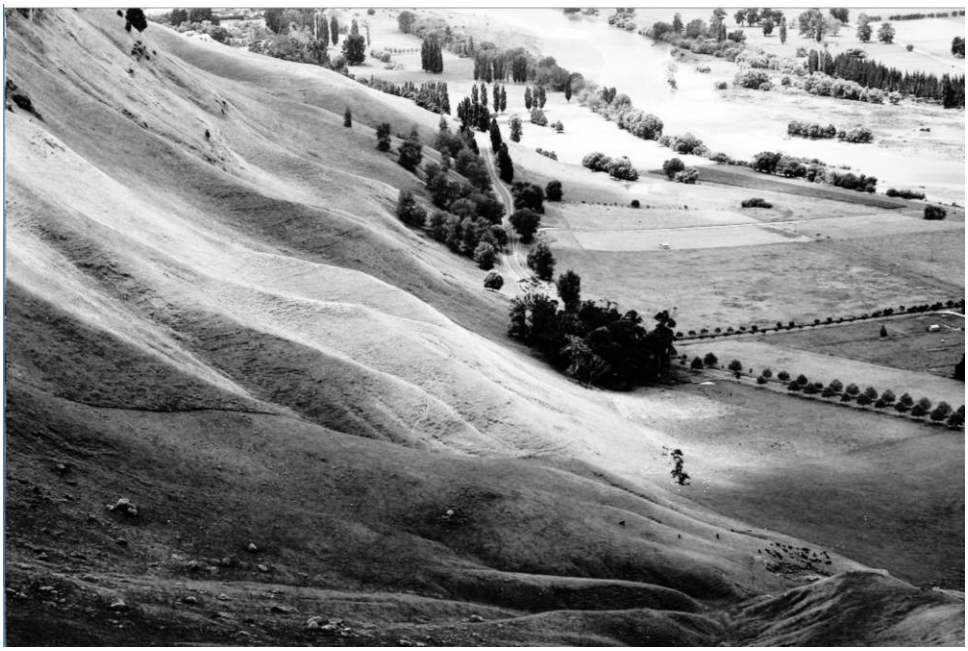


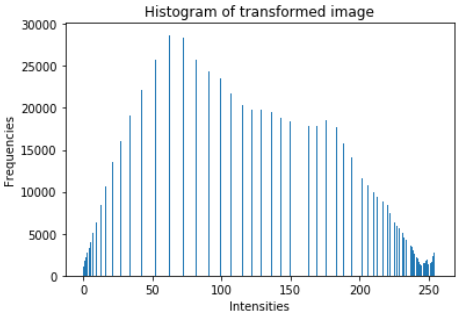


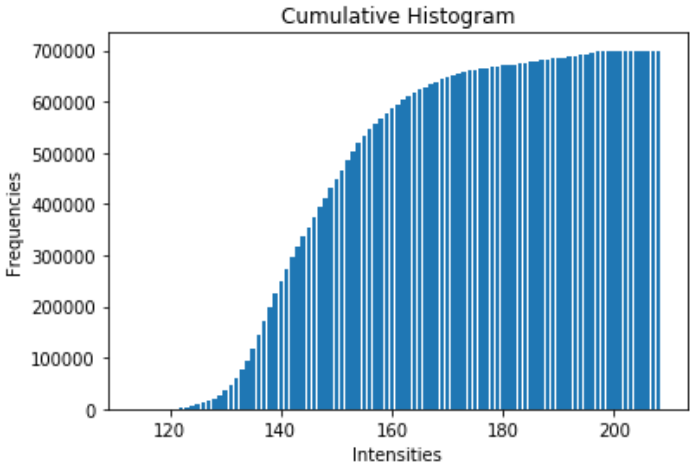


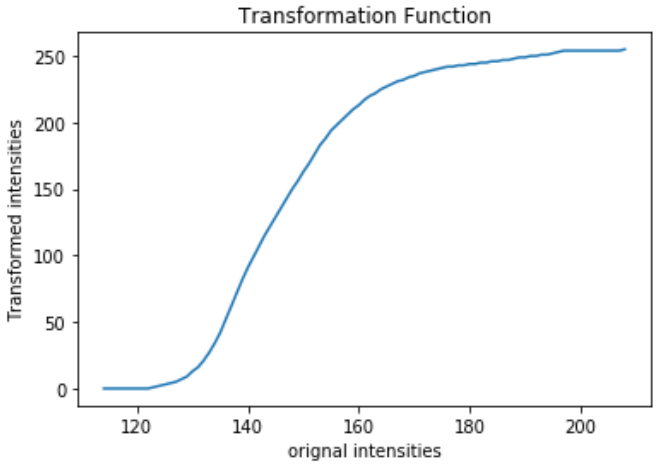



Histogram
Frequencies
Intensities
0
5000
10000
15000
20000
25000
30000
120
140
160
180
200




Histogram of transformed image
Frequencies
Intensities
0
5000
10000
15000
20000
25000
30000
0
50
100
150
200
250


Cumulative Histogram
Frequencies
Intensities
0
100000
200000
300000
400000
500000
600000
700000
120
140
160
180
200


Transformation Function
Transformed intensities
orignal intensities
0
50
100
150
200
250
120
140
160
180
200