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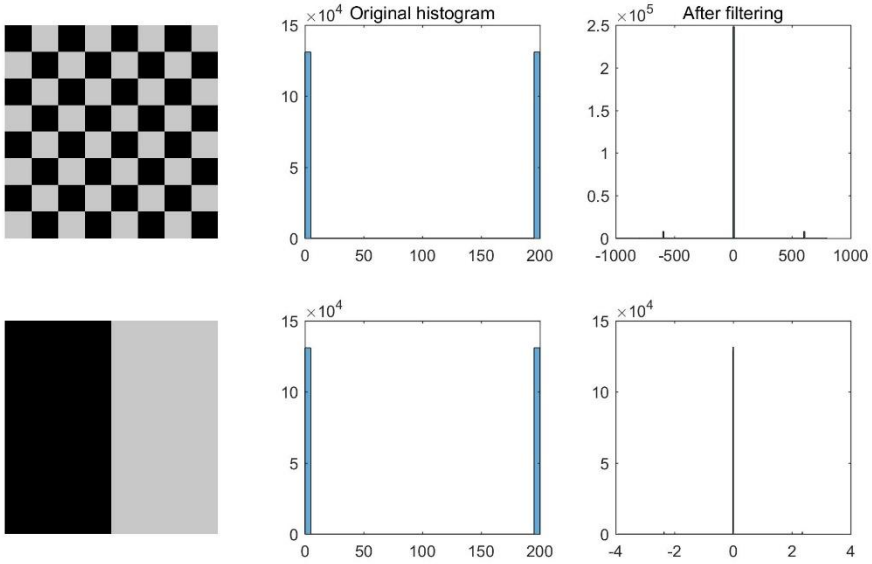
1.(b) Different as we can see from the following graph.



1. a) No, the edges are much more in the chess board image than that with edge only vertically between 0 and 255. So when the image is enhanced by a Laplacian filter, the histogram will be different.

2. (a) Yes, because a convolution of image is linear, same is with the case of a convolution of a convolution.

(b) $\frac{1}{9}\begin{bmatrix}1&1&1\\1&1&1\\1&1&1\end{bmatrix}$ and $\frac{1}{9}\begin{bmatrix}1&1&1\\1&1&1\\1&1&1\end{bmatrix} \Rightarrow \frac{1}{81}\begin{bmatrix}1&2&3&2&1\\2&4&6&4&2\\3&6&9&6&3\\2&4&6&4&2\\1&2&3&2&1\end{bmatrix}$

~~(c) No. Since Both filters are Linear operations~~

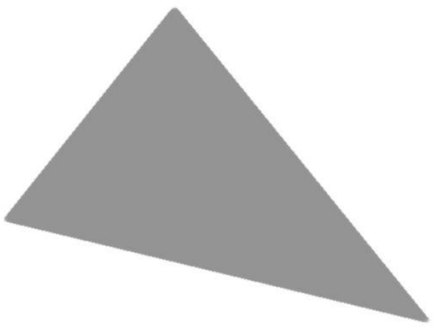
(c) The double filtering will result in a blurrier output image since it has a larger size kernel.

3. (a) Yes, the convolution of a convolution is a linear operation of an linear operation.

(b) $\begin{bmatrix}1&1&1\\1&-8&1\\1&1&1\end{bmatrix}$ and $\frac{1}{9}\begin{bmatrix}1&1&1\\1&1&1\\1&1&1\end{bmatrix} \Rightarrow \frac{1}{9}\begin{bmatrix}1&2&3&2&1\\2&-5&-3&-5&2\\3&-3&0&-3&3\\2&-5&-3&-5&2\\1&2&3&2&1\end{bmatrix}$

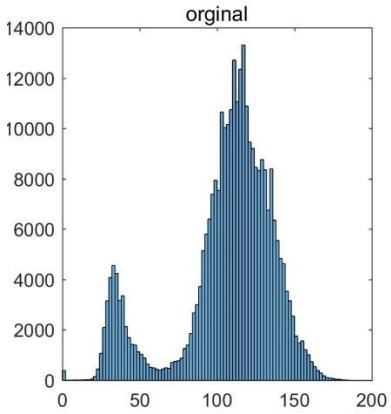
(c) No. since they are both linear operators, order does not matter.

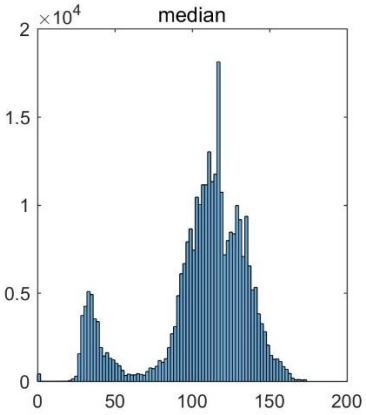
Computer problem:

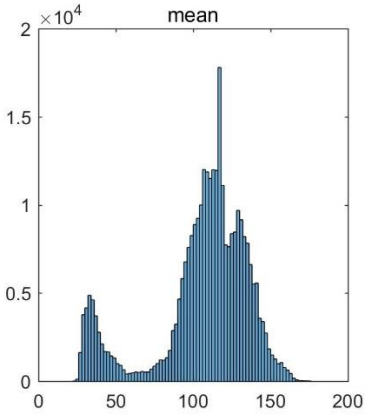


9x9 Averaging filter

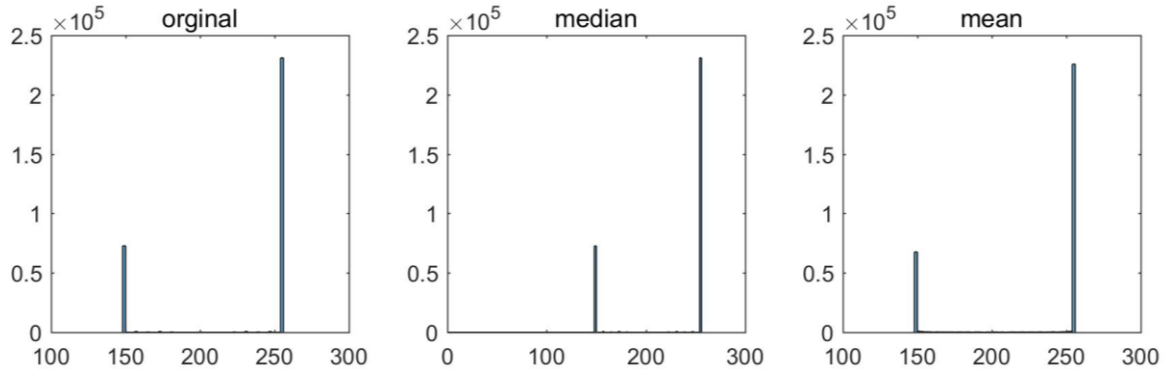
9x9 Median filter







Histogram of cat



Histogram of triangle