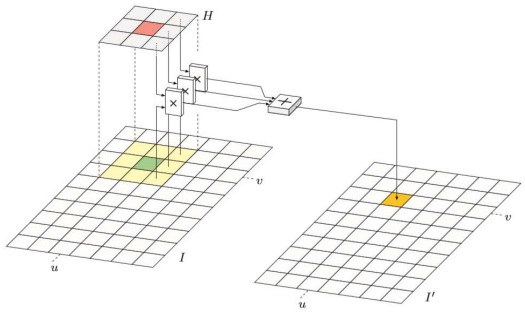
FILTER

MODIFICATION OF THE PIXEL VALUE
USE MORE THAN 1 PIXEL TO COMPUTE NEW PIXEL VALUE

LINEAR FILTER

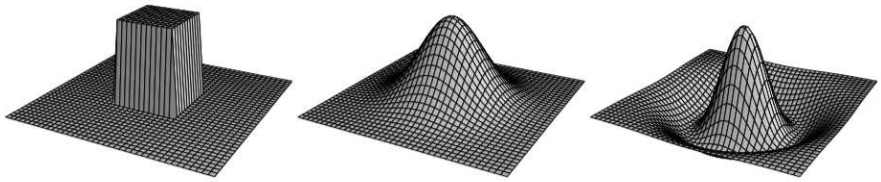
It combine the pixel values in the support region in a linear fashion; i.e., as a weighted summation.

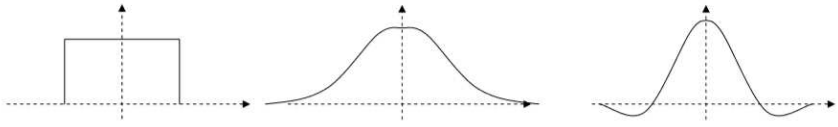


This is the method to apply the filter to the image by multiply the pixel value around interesting area by the filter at the same position and then sum and average all of them.

$$I'(u,v) = \sum_{i=-1}^{i=1} \sum_{j=-1}^{j=1} I(u+i, v+j) \cdot H(i,j)$$

Here are examples of linear filter





0	0	0	0	0
0	1	1	1	0
0	1	1	1	0
0	1	1	1	0
0	0	0	0	0

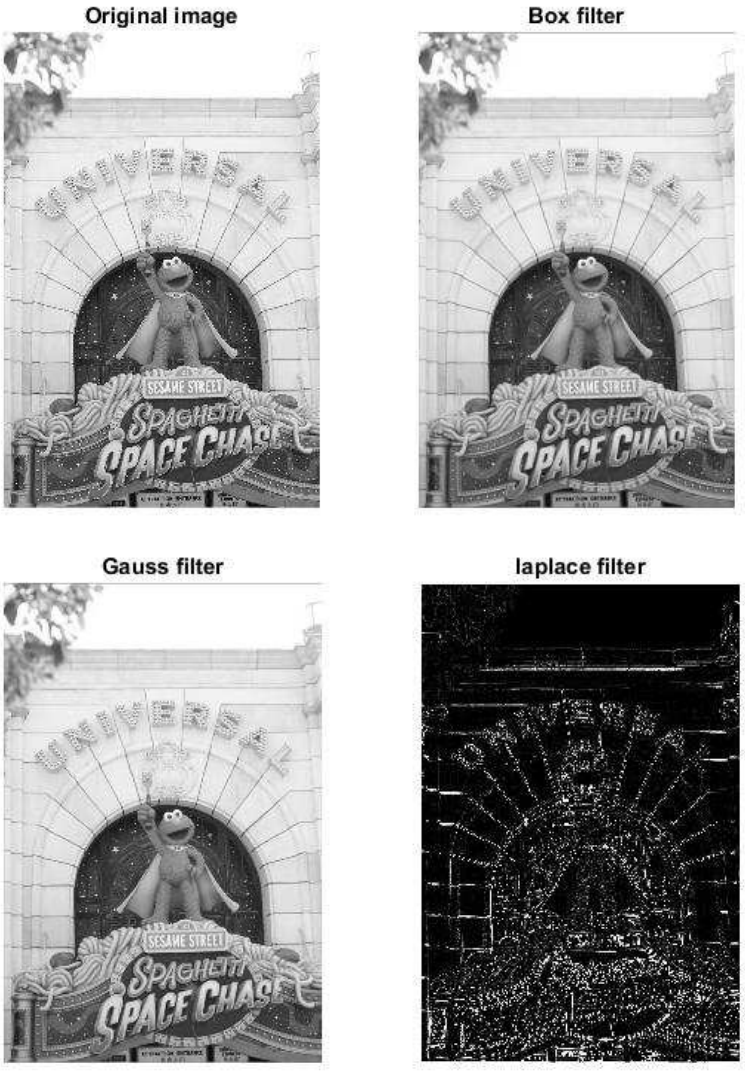
Box filter

0	1	2	1	0
1	3	5	3	1
2	5	9	5	2
1	3	5	3	1
0	1	2	1	0

Gauss filter

0	0	-1	0	0
0	-1	-2	-1	0
-1	-2	16	-2	-1
0	-1	-2	-1	0
0	0	-1	0	0

Laplace or
Mexican hat filter



Box and Gauss filter are smoothing filter but Laplace filter is difference filter as you can see in the picture above.

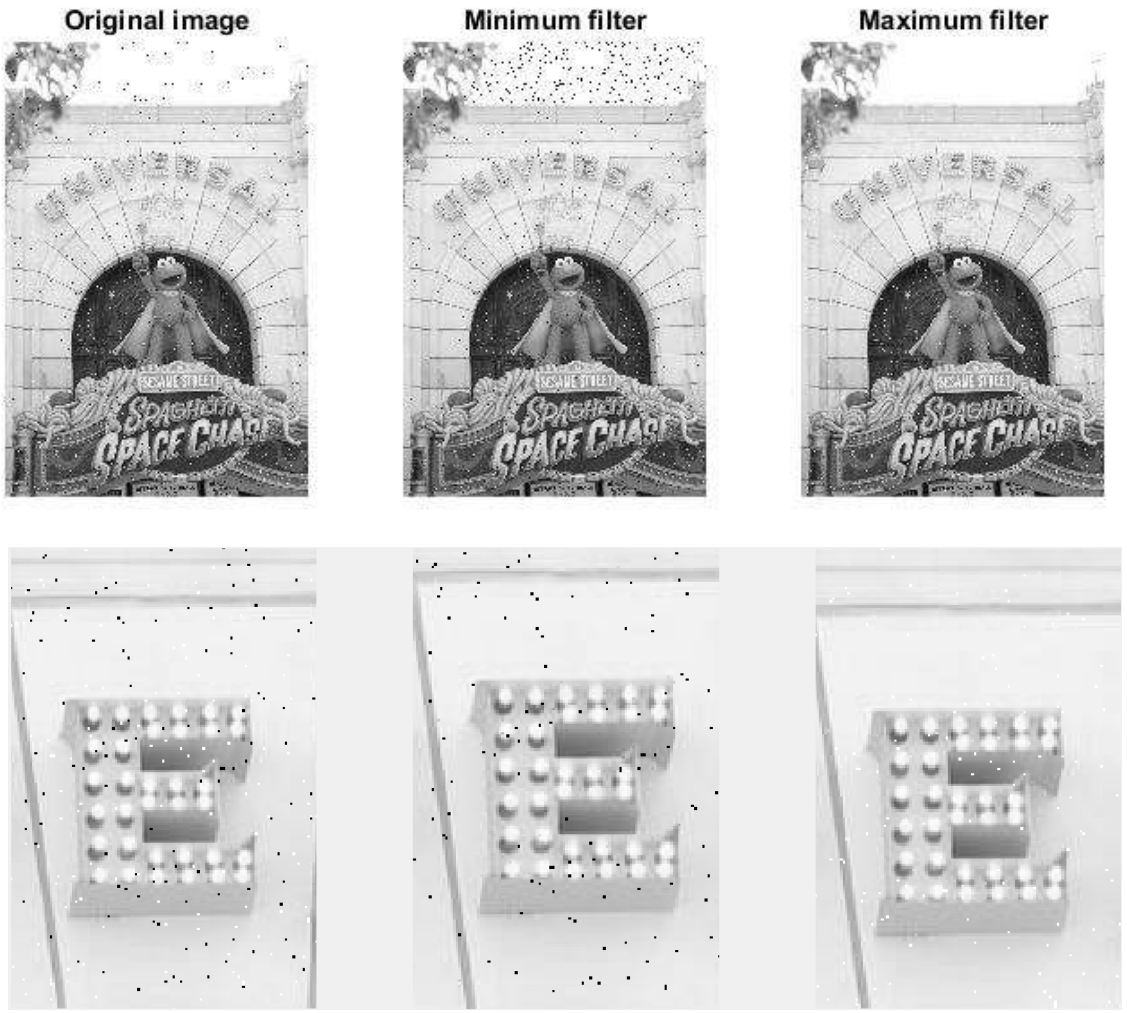
NONLINEAR FILTER

- MINIMUM FILTER

Replace white dot by smallest pixel value in the region. This filter will delete white dot and expand black dot.

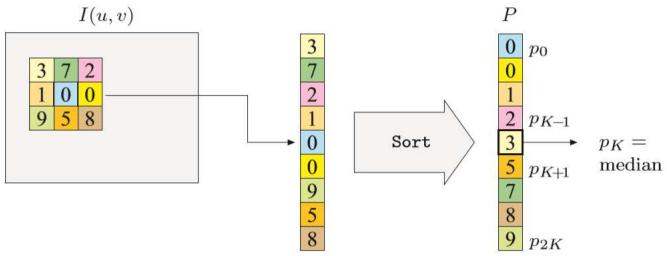
- MAXIMUM FILTER

Replace black dot by bigest pixel value in the region. This filter will delete black dot and expand white dot.



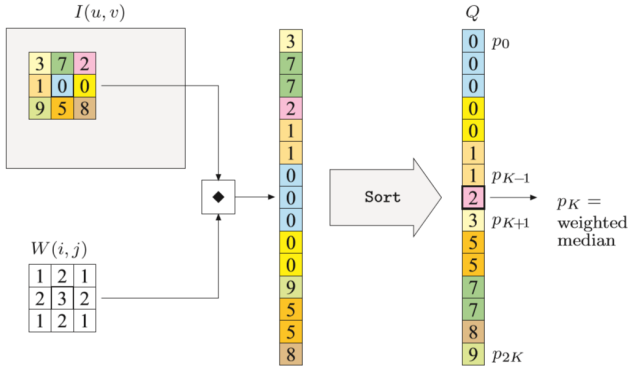
- MEDIAN FILTER

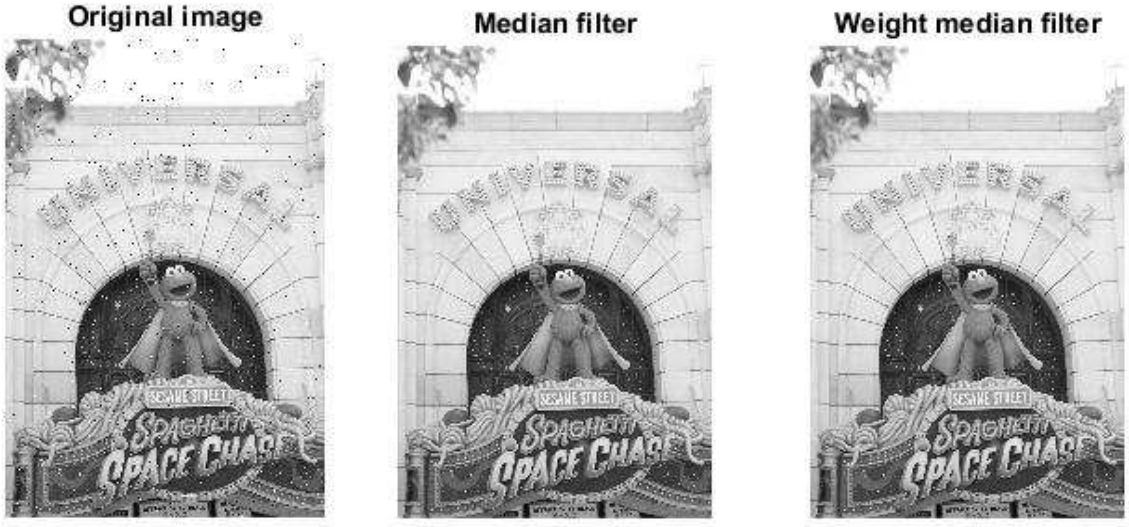
Rank the pixel value in the region and find the middle value.



- WEIGHT MEDIAN FILTER

Do like median filter but adding weight matrix before.





You can see that Median filter and Weight median filter are better than Minimum and Maximum filter.