Middle East Technical University Department of Computer Engineering

CENG 466

Fundamentals of Image Processing

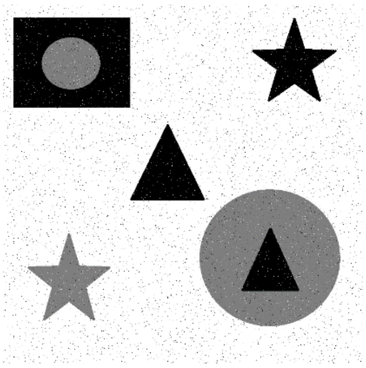
Spring 2017-2018

Assignment 1

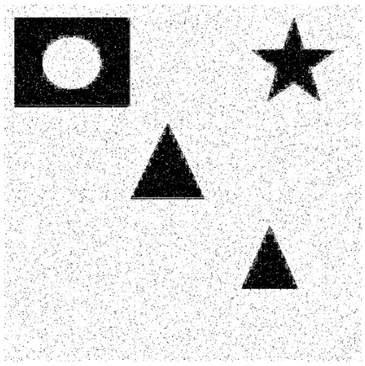
Due date: April 2 2018, Monday, 23:55

Part I - Adding Noise

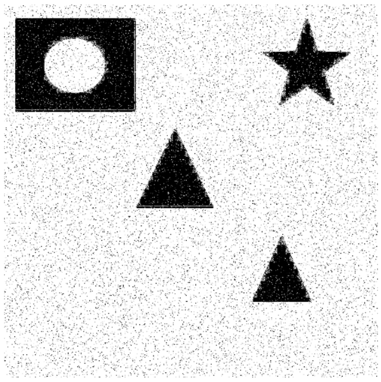
Salt & Pepper Noise



One salt & pepper noisy image



Average of 4 Noisy Images



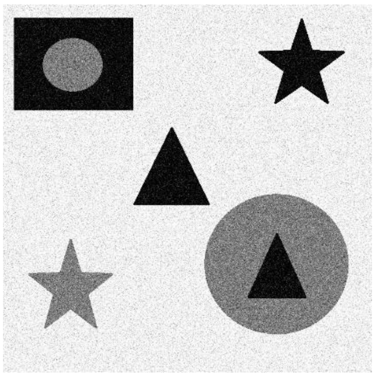
Average of 16 Noisy Images

When we add a salt & pepper noise on an image, original image pixels will be randomly black or white. This means that, for an 8-bit image, typical values are “0” for pepper, salt can be taken as 255.This noise is sharply despersed in the image. The salt & pepper noise is caused by typically the camera in the work of pixels elements in defects, defective memory locations from timing errors in the digitization process.

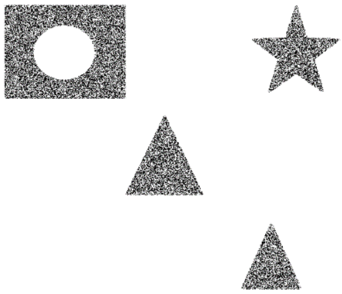
When we take average of 4 random salt & pepper noisy images, we get a more distant image than one salt & pepper noisy image from original image.

When we take average of 16 random salt & pepper noisy images, we get also distant image from original image.If we have to compare average of “4 Noisy Images” and “average of 16 Noisy Images “, though there will not be much difference, when the average of images (N) increases, there is a slight improvement in the image.

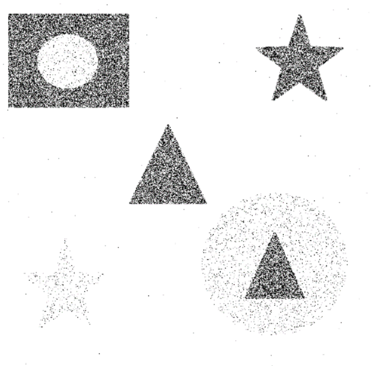
Gaussian Noise



One gaussian noisy image



Average of 4 Noisy Images



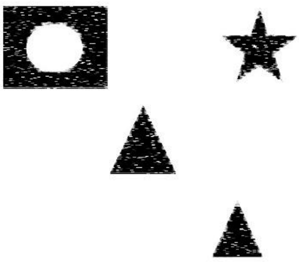
Average of 16 Noisy Images

When add gaussian noise on an image, random fluctuations are emerging on the new image. Unlike salt & pepper noise we add noise with two variables here.These variables “m” and “v” are median and variance.

When we take average of 4 random gaussian noisy images, the gray colors disappears in the average of 4 noisy images and becomes a brighter image than is one gaussian image.
Unlike “salt & pepper noise”, in this noise type, when we increase the number of images that we average for example when we get the average of 16 images instead of 4, we get closer to the orijinal image.

Part II – Averaging

Averaging

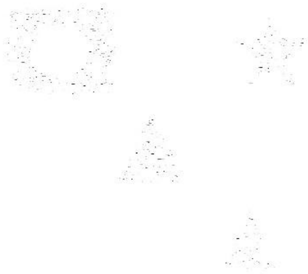


Averaging for Salt & Pepper

The output of a smoothing, linear spatial filter is simply the average of the pixels contained in the neighborhood of the filter mask. These filters sometimes are called averaging filters. For reasons explained in they also are referred to a low pass filters. The idea behind smoothing filters is straightforward. By replacing the value of every pixel in an image by the average of the gray levels in the neighborhood defined by the filter mask, this process results in an image with reduced “sharp” transitions in gray levels. Because random noise typically consists of sharp transitions in gray levels, the most obvious application of smoothing is noise reduction.

$$\frac{1}{9} \times \begin{array}{|c|c|c|} \hline 1 & 1 & 1 \\ \hline 1 & 1 & 1 \\ \hline 1 & 1 & 1 \\ \hline \end{array}$$

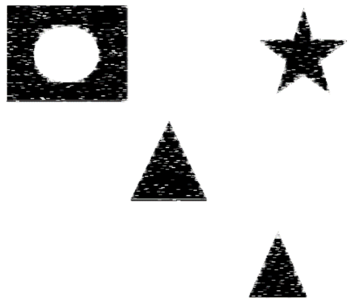
The averaging method of this type of noise is quite successful and produces a picture close to the original picture.



Averaging for Gaussian

This averaging method, unlike the salt and pepper method, did not work very well in the gaussian noisier and brought a white picture to an excessive amount.

Weighted Averaging



Weighted Average for Salt & Pepper

Weighted Average for Gaussian

This type is a little more interesting. This mask yields a so-called weighted average, terminology used to indicate that pixels are multiplied by different coefficients, thus giving more importance (weight) to some pixels at the expense of others. In the mask the pixel at the center of the mask is multiplied by a higher value than any other, thus giving this pixel more importance in the calculation of the average.

$$\frac{1}{16} \times \begin{array}{|c|c|c|} \hline 1 & 2 & 1 \\ \hline 2 & 4 & 2 \\ \hline 1 & 2 & 1 \\ \hline \end{array}$$

Parameters	Average Filter	Weighted Filter
Noise Reduction	Reduces Noise but it introduces blurring effect at edges.	Blurring effect is less as compared with Average filter
Percentage of noise Reduction	100% noise Not Reduced	100% noise Not Reduced
Size of Filter	As we increase the size of the filter mask, Noise reduces but blurring effect increases.	As we increase the size of the filter mask, Noise reduces but blurring effect increases.
Mask	1/9x[1,1,1;1,1,1;1,1,1]	1/16x[1,2,1;2,4,4;1,2,1]
MATLAB Function	filter2(mask,Noisy_img)	filter2(mask,Noisy_img)

Part III

In the first part, we got 16 different noisy picture averages in two noise types and we showed a picture. In the second part we applied two different types of noise reduction for a picture, averaging and weighted averaging. A noisy average in the second part gave better results than the average in the first part. However, averaging and weighted averaging did not give the best results. I suggest the median averaging method.