EEE 391

Matlab Assignment 1

İlke Doğan 21702215

Section 1

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Introduction

The assignment covers a specific signal named image signal. The colourful images such as RGB and Grayscale images, the size of the image, rotated version of images, images with convolution and edge detection and sharpening filter, and lastly, noise images are included.

Part 1

In part 1, based on the image shown in Figure 1, several tasks are realized. Pixels of color images with a 3D matrix have three channels corresponding to red, green and blue (RGB) colors. First, by assigning the matrices of the individual color pairs to 0, only red, blue, and green are obtained, as seen in Figure 2, Figure 3, and Figure 4. After that, for the second task, I converted the image into grayscale with given formula $Gray = (0.299 \times R + 0.587 \times G + 0.114 \times B) \div 512$ shared in Figure 5. Thirdly, I firstly make the image upside down and rotate it 90 degrees given in Figure 6. Fourtly, I cropped the image based on the given pixel interval (25:775,50:750) shown in Figure 7. Lastly, new pixels in grayscale images for being lower than 0.2 to 0 pixel values are realized in Figure 8, however, it can be seen in this figure the color is really close to black because it is getting closer to 0.

Figure 1- Given Dog Image

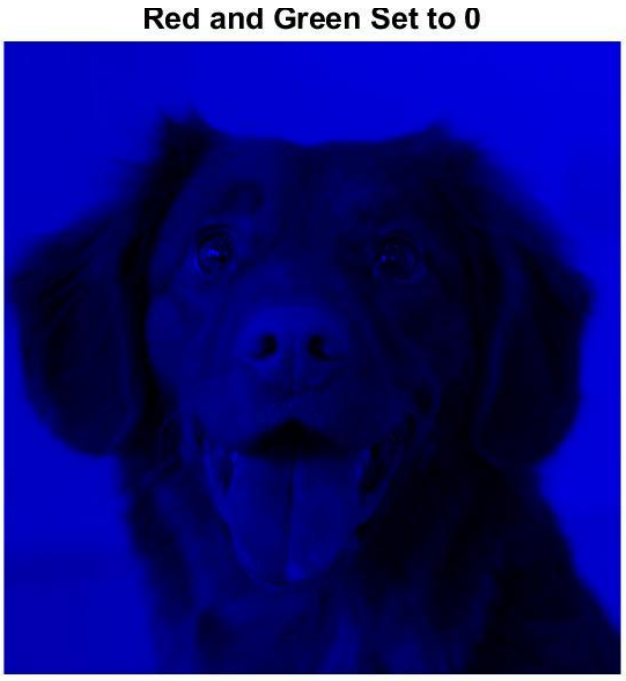

Figure 2- Blue Dog Image

Figure 3- Green Dog Image

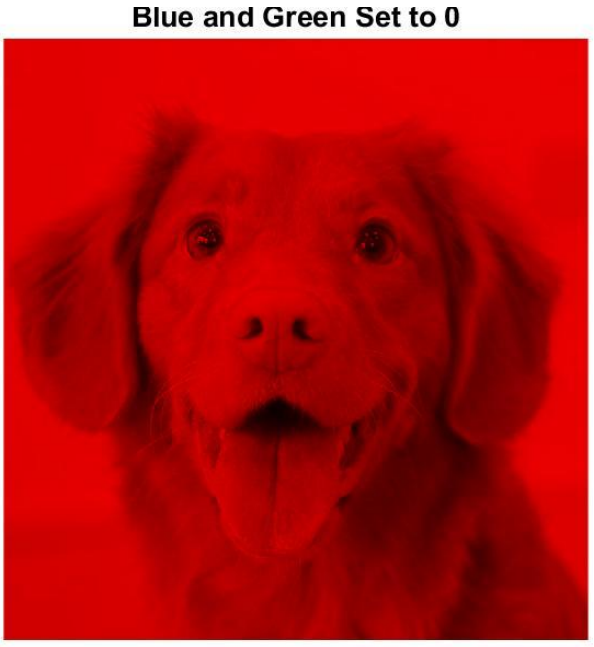

Figure 4- Red Dog Image

Figure 5- Grayscale Dog Image

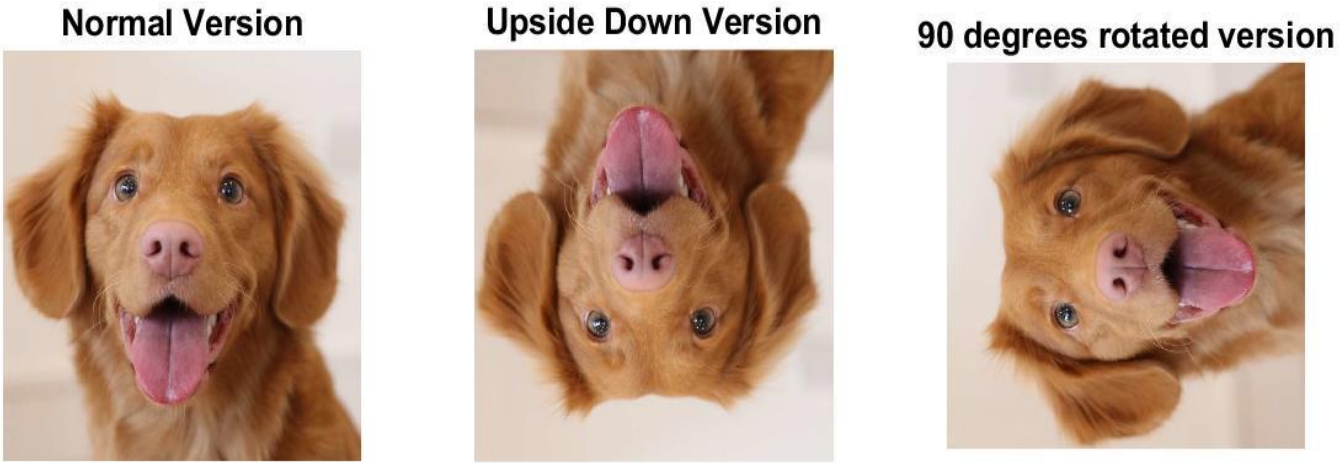

Figure 6- Upside Down & 90 Degrees rotated Image

Figure 7- Cropped Dog Image

Figure 8- New Pixelled Dog Image

Part 2

By using convolution, the images are tried to be tested in terms of vertical, horizontal and merge sides.

i) Vertical Edge Detection Filter is used for turning an image into vertical mode. There is no specific difference between Vertical Edge Detection Filter and Vertical Edge Detection Filter with Conv2 function which is given below in Figure 9 and Figure 10.

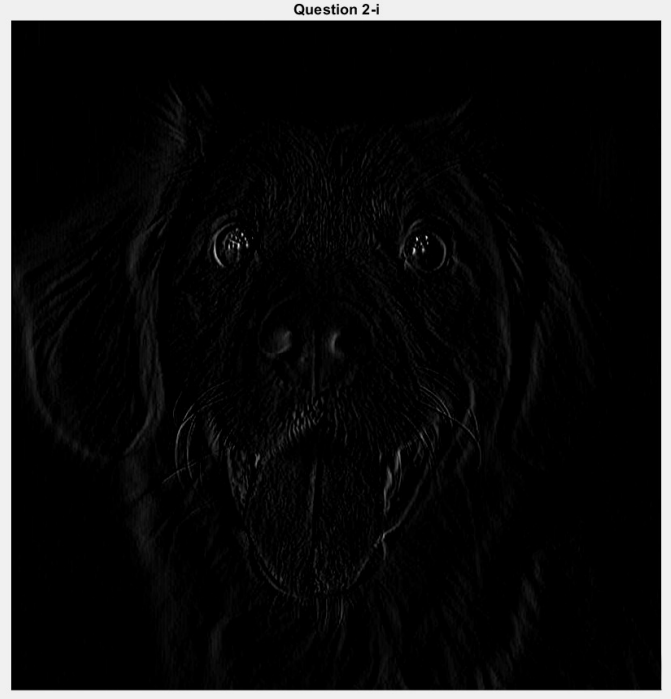

Figure 9- Vertical Edge Detection Filter Image

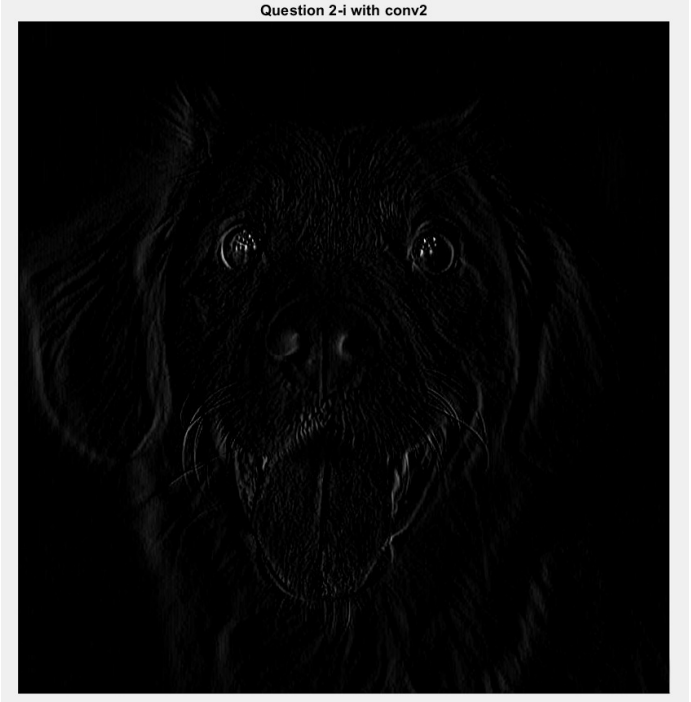

Figure 10- Vertical Edge Detection Filter with Conv2 Image

ii) Horizontal Edge Detection Filter is used for turning an image into horizontal mode and the result is nearly the same given below in Figure 11 and Figure 12.

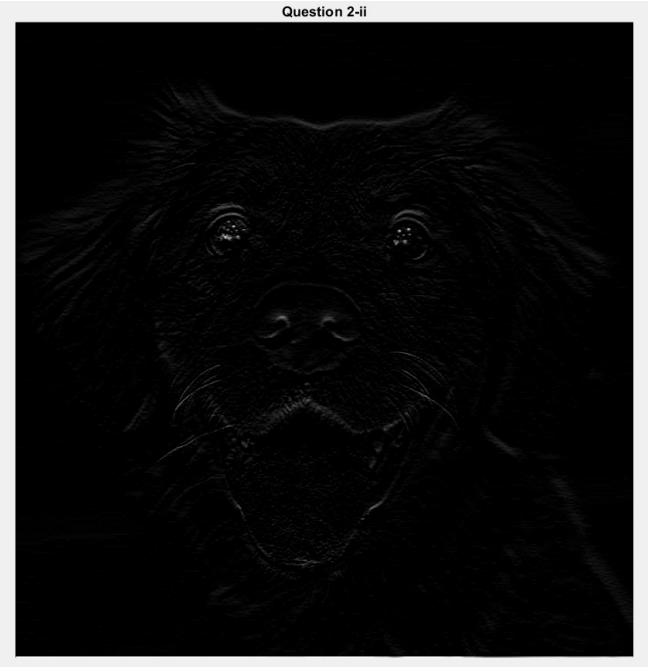

Figure 11- Horizontal Edge Detection Filter Image

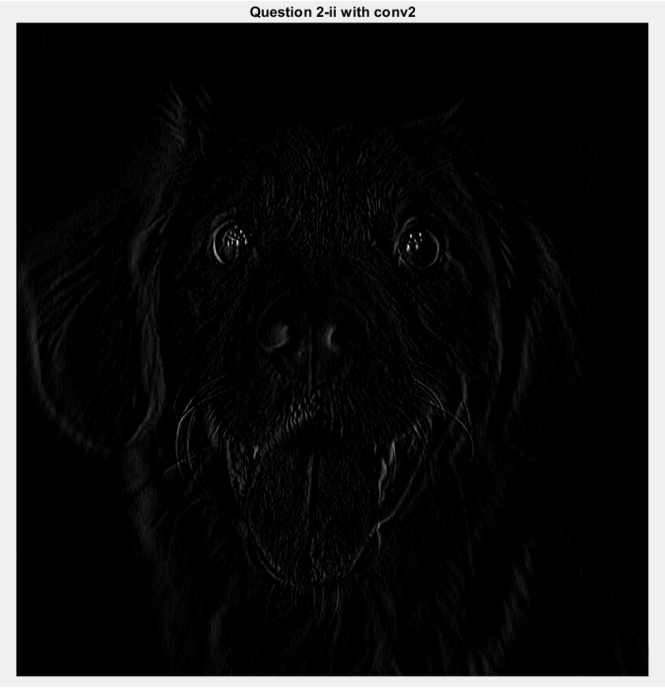

Figure 12- Horizontal Edge Detection Filter with Conv2 Image

iii) Merging vertical and horizontal edge detection filters is used for turning an image into a similar image that is uploaded. Vertical Edge Detection Filter and Horizontal Edge Detection Filter are merged given in Figure 13. It can be deduced that the image is different from vertical and horizontal filters as it has much more lines and looks clear.

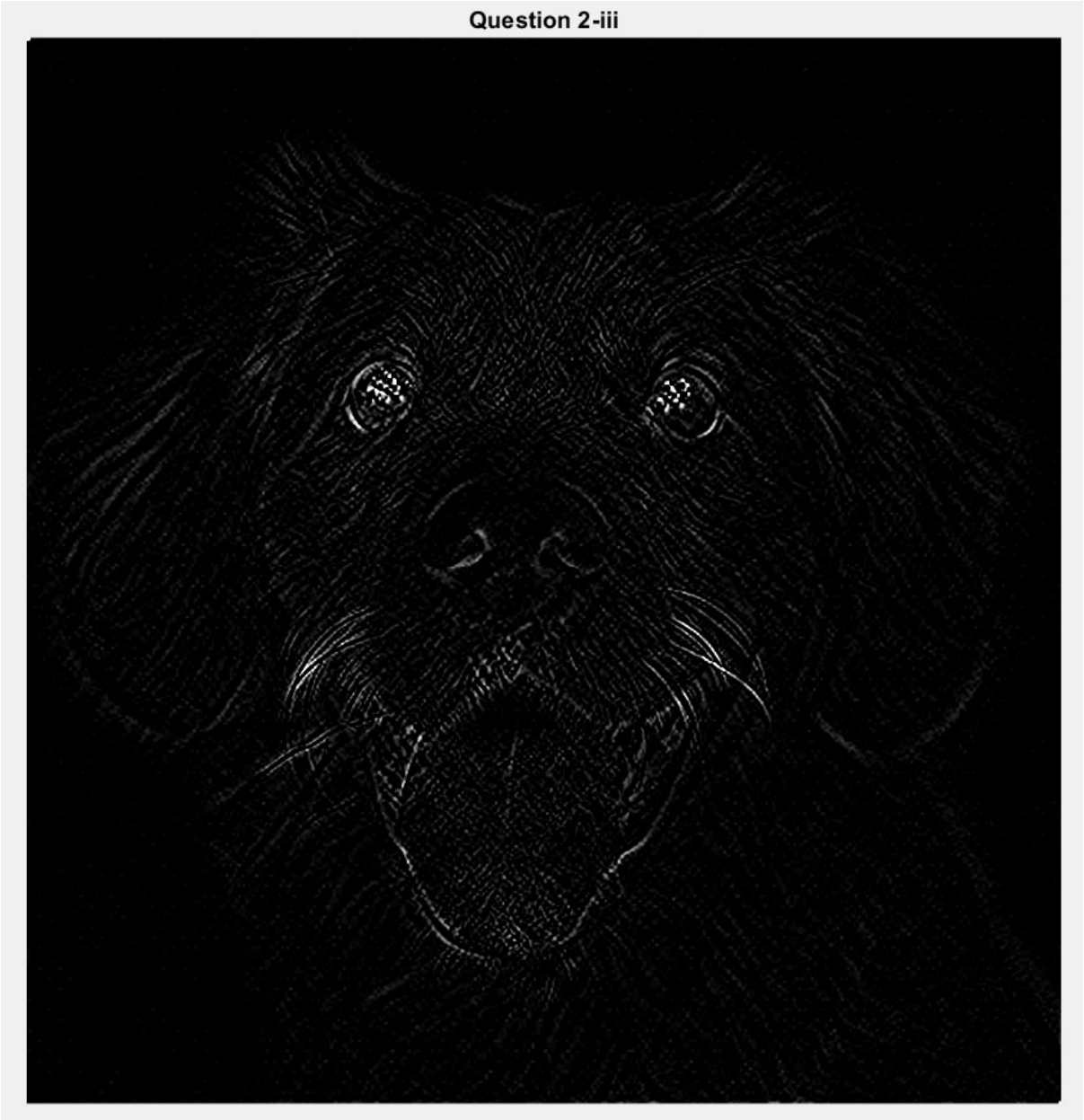

Figure 13- Horizontal & Vertical Edge Detection Filter Image

Part 3

i) By using convolution operation, sharpening vector is implemented for the given matrix $\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$ and the images look blurred given below in Figure 14. Compared to other images, it can be clearly seen that when the sharpening filter is used, the details in the picture are more emphasized and a more distinct image is obtained. For example, the amount of light in their eyes was different, with the hairs appearing more distinctly rather than compact, and appearing one by one.

Figure 14- Sharpening filter

ii) Instant changes in a signal correspond to high frequency components. Therefore, images having sharp transitions between neighbor pixel values carry high frequency components. Object edges are highlighted and details can be recognised more easily in such images. By considering that, what kind of filter is sharpening filter do you think (High pass, low pass, band pass)?

I think the high pass is a sharpening filter. For example, when considering a 3x3 matrix, the higher the difference between the contact numbers, the difference should be within a certain limit, the image can be clearer.

iii) freqz2 function is used with the value 2^10 = N. It can be deduced that the 4 sides with yellow color are closer to the number 1, and on the contrary, the middle region is closer to the number 0 because it is darker based on the given matrix.

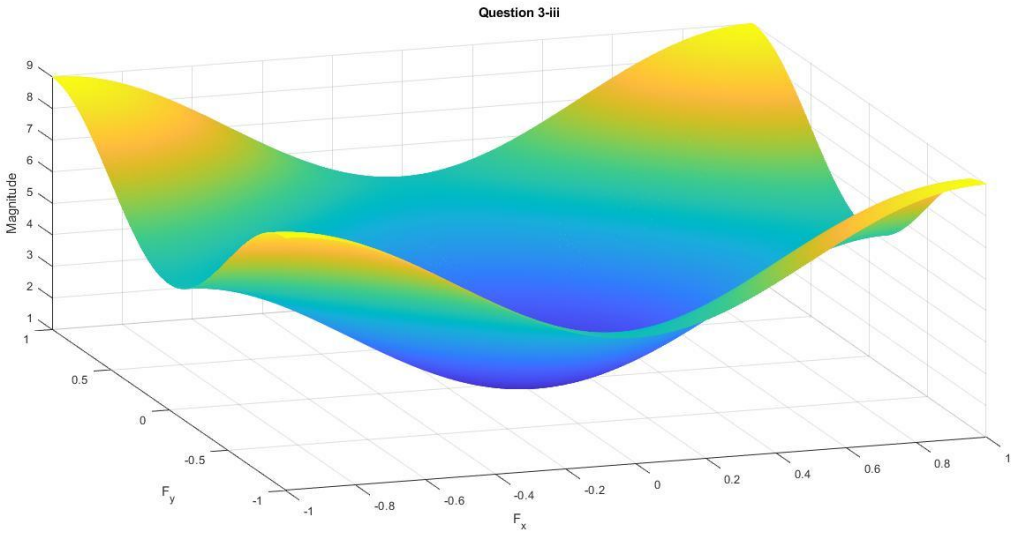

Figure 15- ‘freqz2’ Function Plot

Part 4

i) In this part, some noisy signal is added into the normal image. Mean value is 0 and standard deviation 0.5. Generated matrix is multiplied with 0.2 and the last version of the images given in Figure 16.

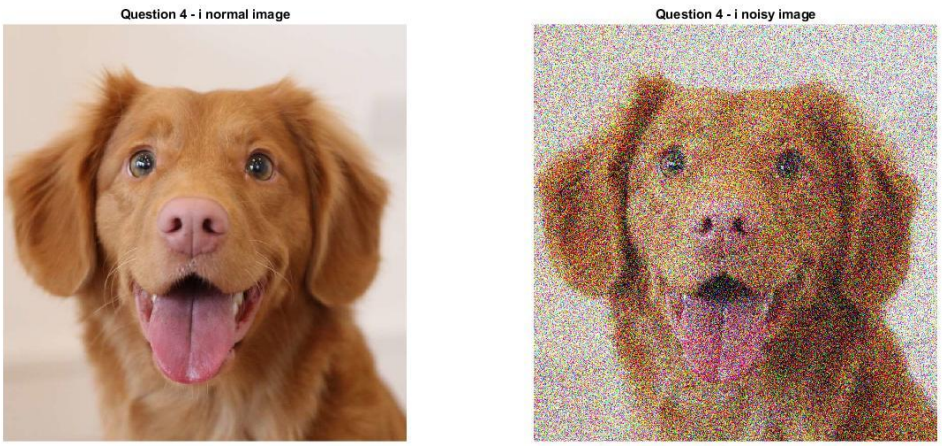

Figure 16- Creating Noise

ii)The noisy images are tried to be fixed by the formula. Then, based on the formula (M-1) / 2, neighbour pixels' average is gathered and the noise of the image is tried to be reduced. These M points are chosen as 3, 7, 21, 41. It can be seen in Figure 17, Figure 18, Figure 19, and Figure 20, by using a moving average filter, the noise can be declined. One of the most suitable filters for reducing noisy images is a 7-point average filter. However, there is one undesirable effect regarding the average filter is that while the M point number increases, the blur of the image rises.

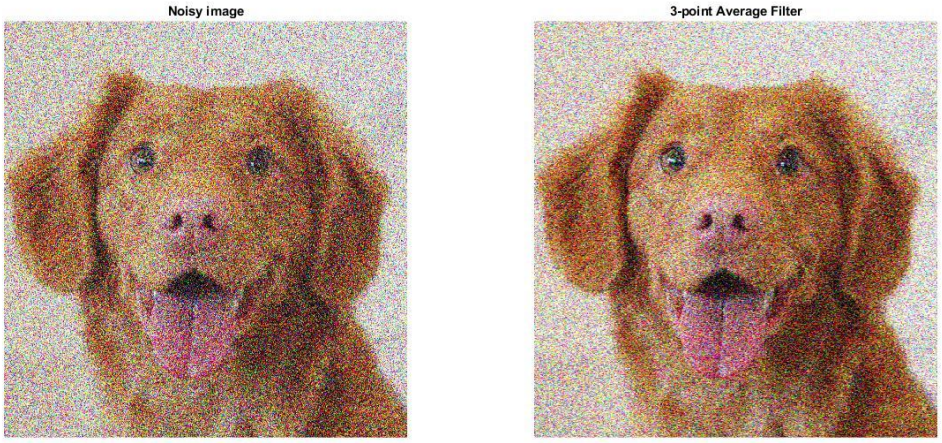

Figure 17- Comparison of Noisy image & 3-point Avarage Filter

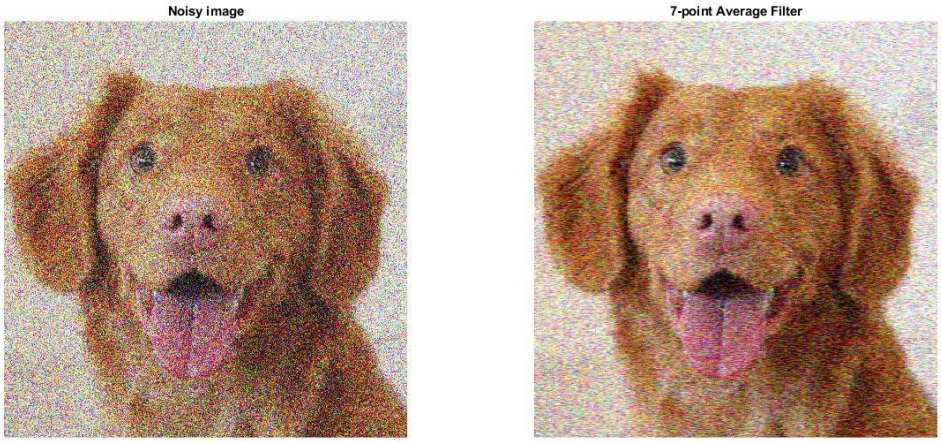

Figure 18- Comparison of Noisy image & 7-point Avarage Filter

Figure 19- Comparison of Noisy image & 21-point Avarage Filter

Figure 20- Comparison of Noisy image & 41-point Avarage Filter