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PAGE No.
DATE / /

Experiment 7: Noise Models

Aim: To study various noise models like gaussian noise, salt and pepper noise and sinusoidal noise.

Apparatus: PC/Laptop, MATLAB Software and few Images.

Theory:

Noise is always present in digital images during image acquisition, coding, transmission, and processing steps. Noise is very difficult to remove from digital images without prior knowledge of noise model. This is why review of noise models are essential in the study of image denoising techniques. Noising in imaging systems is usually either additive or multiplicative.

Gaussian noise: It provides a good model of noise in many systems. Its probability density function (PDF) is:

$$p_n(n) = \frac{1}{\sqrt{\pi\sigma^2}} \cdot e^{-n^2/\sigma^2}$$

The gaussian distribution has an important property to estimate the mean of stationary gaussian random variable. one can't do any better than the linear average. This makes Gaussion noise, a worst-case scenario for non-linear image restoration filters

Salt and Pepper noise: It is a type of noise sometimes seen on images. It is also known as impulse image. The noise can be caused by sharp and sudden disturbances in the image signal. It presents itself as sparsely occuring white and black pixels.

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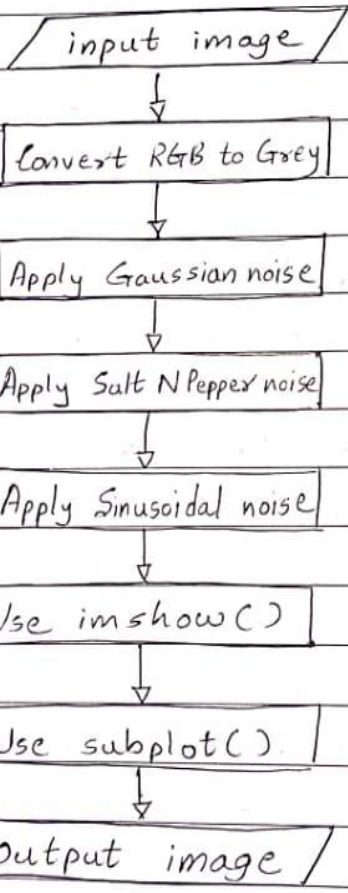
PAGE No.
DATE / /

Periodic / Sinusoidal noise: A common source of periodic noise in an image is from electrical or electromechanical interference during the image capturing process. An image affected by periodic noise will look like a repeating pattern has been added on top of the original image. In the frequency domain this type of noise can be seen as discrete spikes.

Flowchart & Algorithm:



Convert the input image from RGB to Grey. Define various noises mathematically and give the Grey input image as input and use imshow() and subplot() to display images in the same window.

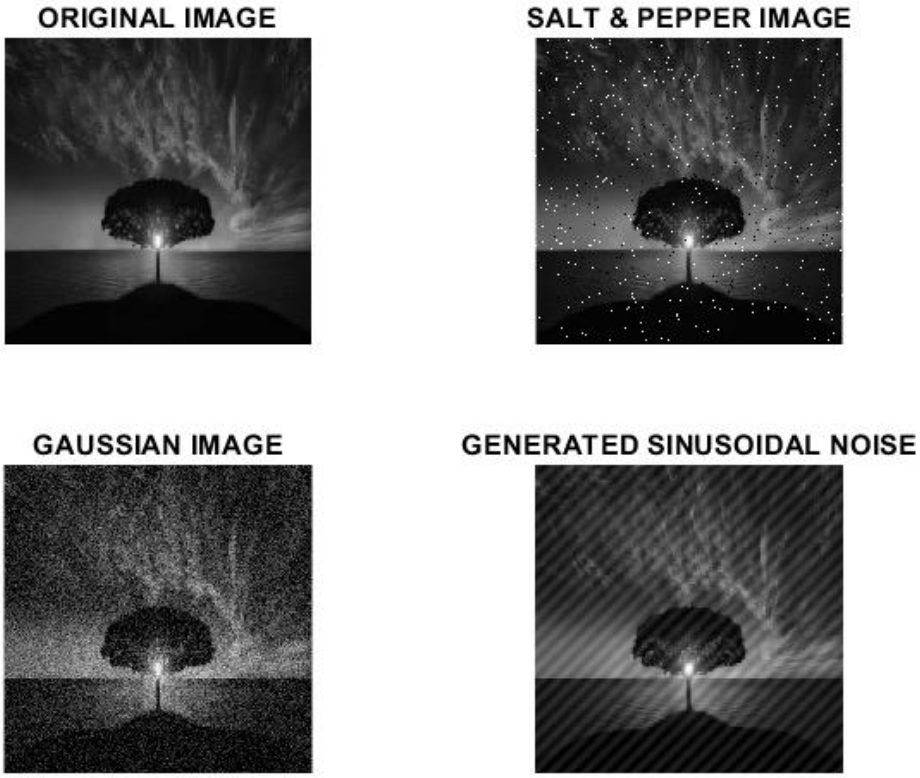
Coding and Output:

```
% Vighnesh Vikas Salgaonkar | B-21 | TY-EXTC
clc;
close all;
img2 = imread('IPMV1.jpg');
img3 = rgb2gray(img2);
img1 = imresize(img3, [256, 256], 'bilinear');
subplot(221);
imshow(img1);
title("ORIGINAL IMAGE");

SnP = imnoise(img1, 'salt & pepper', 0.02);
subplot(222);
imshow(SnP);
title("SALT & PEPPER IMAGE");

Gauss = imnoise(img1, 'gaussian', 0.02);
subplot(223);
imshow(Gauss);
title("GAUSSIAN IMAGE");

subplot(224);
[x, y] = meshgrid(1:256, 1:256);
SinNoise = 15*sin(2*pi/14*x+2*pi/14*y);
SinImg = double(img1) + SinNoise;
imshow(SinImg, []);
title("GENERATED SINUSOIDAL NOISE");
```



Conclusion: Thus, I conclude that, I have studied understood and performed the practical based on noise models successfully.