DEPARTMENT OF
ELECTRONICS AND COMMUNICATION ENGINEERING
Faculty of Engineering and Technology
SRM Institute of Science and Technology

MINI PROJECT REPORT
ODD SEMESTER, 2020-2021

Lab Code & Sub Name : 18ECC204J, Digital Signal Processing

Year & Semester : 3RD Year, 5th Semester

Project Title : **IMAGE DENOISING USING MATLAB**

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IMAGE DENOISING USING MATLAB

KEYWORDS: MATLAB, Image Processing, Noise, Gaussian, LPF, HPF, Filtering

AIM: The main objective of this project is to add various types of noise like Gaussian, Salt & Pepper, Poisson, and Speckle or rather interference to an image followed by its removal in order to compare the before and after images.

INTRODUCTION: MATLAB is a high-level language and interactive environment for computer computation, visualization, and programming. Image Processing Toolbox is an application available for use in MATLAB, which provides a comprehensive set of reference-standard algorithms, functions, and apps for image processing, analysis, visualization, and algorithm development.
Using these tools provides a fast and convenient way to process and analyze images without the need for advanced knowledge of a complex coding language.

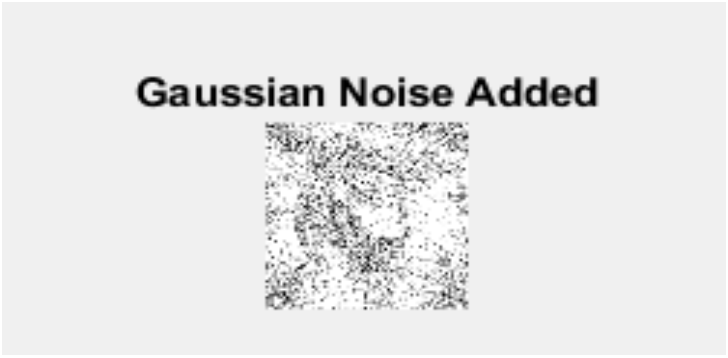
SOFTWARE USED:
MATLAB 2020
Image Processing Toolbox

HARDWARE REQUIREMENT:
Operating System: windows XP or better, Mac OS X Lion or better
Processors: Intel or AMD x86 processor
Disk Space: 4 GB or better
RAM: 2048 MB at least recommended
Graphics Card: Hardware accelerated graphics card supporting OpenGL 3.3 with 1 GB GPU memory recommended.

NOISE AND ITS TYPES:

Noise is random variation of brightness or colour information in images, and is usually an aspect of electronic noise. It can be produced by the image sensor and circuitry of a scanner or digital camera. Image noise can also originate in film grain and in the unavoidable shot noise of an ideal photon detector. Image noise is an undesirable by-product of image capture that obscures the desired information.
The main types of noises are Gaussian, Poisson, Speckle, and Salt & Pepper.

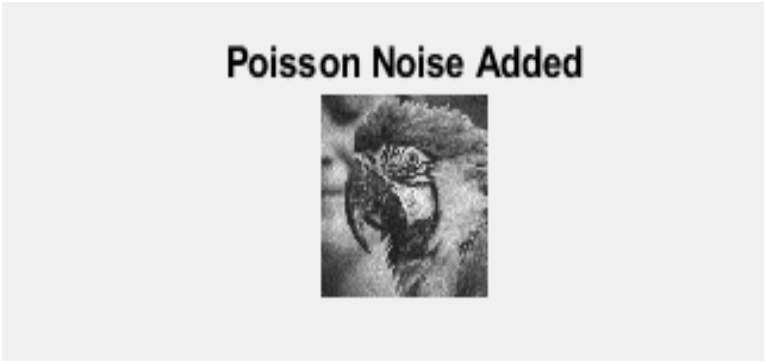
GAUSSIAN NOISE:
A form of image noise that adds small positive and negative deviations to the pixels in an image, often caused by the random variations between the elements of a CCD sensor. Plotting the number of occurrences of each deviation on a histogram produces the bell-shaped curve of the normal distribution, which is also called the Gaussian distribution.



POISSON NOISE:

The appearance of this noise is seen due to the statistical nature of electromagnetic waves such as x-rays, visible lights and gamma rays. The x-ray and gamma ray sources emit a number of photons per unit time.

These rays are injected in patient's body from its source, in medical x rays and gamma rays imaging systems. These sources are having random fluctuation of photons. Resulting image has spatial and temporal randomness. This noise is also called as quantum (photon) noise or shot noise.



SPECKLE NOISE:

A fundamental problem in optical and digital holography is the presence of speckle noise in the image reconstruction process. Speckle is a granular noise that inherently exists in an image and degrades its quality. Speckle noise can be generated by multiplying random pixel values with different pixels of an image.

SALT & PEPPER NOISES:

Salt and Pepper noise is added to an image by addition of both random bright (with 255 pixel value) and random dark (with 0 pixel value) all over the image. This is also known as data drop noise because statistically it drop the original data values.

PROCESS:

#1 IMPORTING AND CONVERTING THE IMAGE:

In the application section of the MATLAB software, Image Processing Tool Box is to be downloaded. Now a new MATLAB script file is created wherein the code is typed.

The first few lines clear the workspace to remove any previous variables and clear the command window.

It is important to note that the Current Folder that is being worked out of be the folder that contains both the script file and image.

The command '*imread*' reads an image and converts it into a grayscale image. The image used in this tutorial is bird.*jpg,* which is an 800 by 800 pixel image.

The image is converted to grayscale so that less information needs to be provided to each pixel.

After this process the image is then converted into a binary image wherein 1 is assigned for white pixels and 0 for black pixels followed by resizing of the image.

DSP_mini_PROJECT.m

```
% DSP MINI PROJECT
% TITLE: IMAGE DENOISING USING MATLAB
% MEMBERS: PRATEEKSHA.G(RA1811004010319), YAJNISH.M(RA1811004010291),
% PRADIKSHA.M(RA1811004010280)
clear all;
close all;
clc;            %%%~~ NOISE ~~%%%

var=imread('bird.jpg');             %read the img
subplot(6,2,1)
imshow(var)                         %display the image
title('Image')

gray=rgb2gray(var);                 %gray scale conversion
subplot(6,2,2)
imshow(gray)
title('Grayscale Image')

bw=im2bw(var);
subplot(6,2,3)
imshow(bw)
title('Binary Image')

re=imresize(gray,[256 256]);        %resize of img 1
subplot(6,2,4)
imshow(re)
title('Resize Image')

```

#2 ADDING VARIOUS TYPES OF NOISES

This is the process wherein various types of noises like Gaussian, Poisson, Speckle and Salt & Pepper is added to the image.
The function ‘Imshow’ is used to add the noises and view them in a separate window.
In this step no filters are used so that the output image will be present with noises or rather interference as intended.
Subplot function is used here in order to show multiple images in a single window without overlapping.

PL SCROLL DOWN

DSP_mini_PROJECT.m

```
29
30
31
32 -    gnoi= imnoise(re,'gaussian',0.5,0.1);     %Gaussian Noise
33 -    subplot(6,2,5)
34 -    imshow(gnoi)
35 -    title('Gaussian Noise Added')
36
37 -    h=ones(256);                          %Local Varible Noise
38 -    lvnoi= imnoise(re,'localvar',h);
39 -    subplot(6,2,6)
40 -    imshow(lvnoi)
41 -    title('Local Variable Noise Added')
42
43 -    poinoi= imnoise(re,'poisson');      %poisson Noise
44 -    subplot(6,2,7)
45 -    imshow(poinoi)
46 -    title('Poisson Noise Added')
47
48 -    spnoi= imnoise(re,'salt & pepper',0.5);     %salt & pepper noise
49 -    subplot(6,2,8)
50 -    imshow(spnoi)
51 -    title('Salt&Pepper Noise Added')
52
53 -    specnoi= imnoise(re,'speckle',0.4);         %speckle noise
54 -    subplot(6,2,9)
55 -    imshow(specnoi)
56 -    title('Speckle Noise Added')
57
```

#3 REMOVAL OF THE NOISE

This process mainly involves the reconstruction of the image from the noisy form.

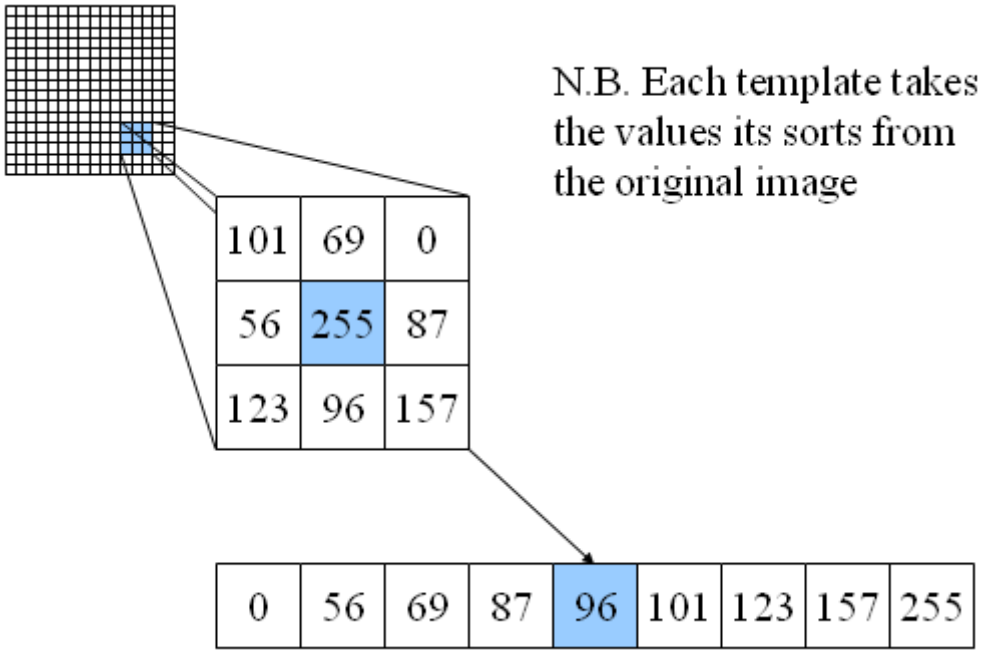
The key filter used here in the median filter denoted by the function ‘medfilt2’. It is one of the important filters to remove random valued impulse noises.

In this filter the value of corrupted pixel in noisy image is replaced by median value of corresponding window.

The median is calculated by first sorting all the the pixel values in ascending order and then replacing the pixel being calculated with the middle pixel value.

This process is repeated again until all the pixels are replaced.

Other types of filters include LPF, HPF, and Mean filter. LPF filter discards or attenuates the high frequency information in an image and preserves the low frequency information. Removing the high frequency information from an image removes the detail and blurs the image.

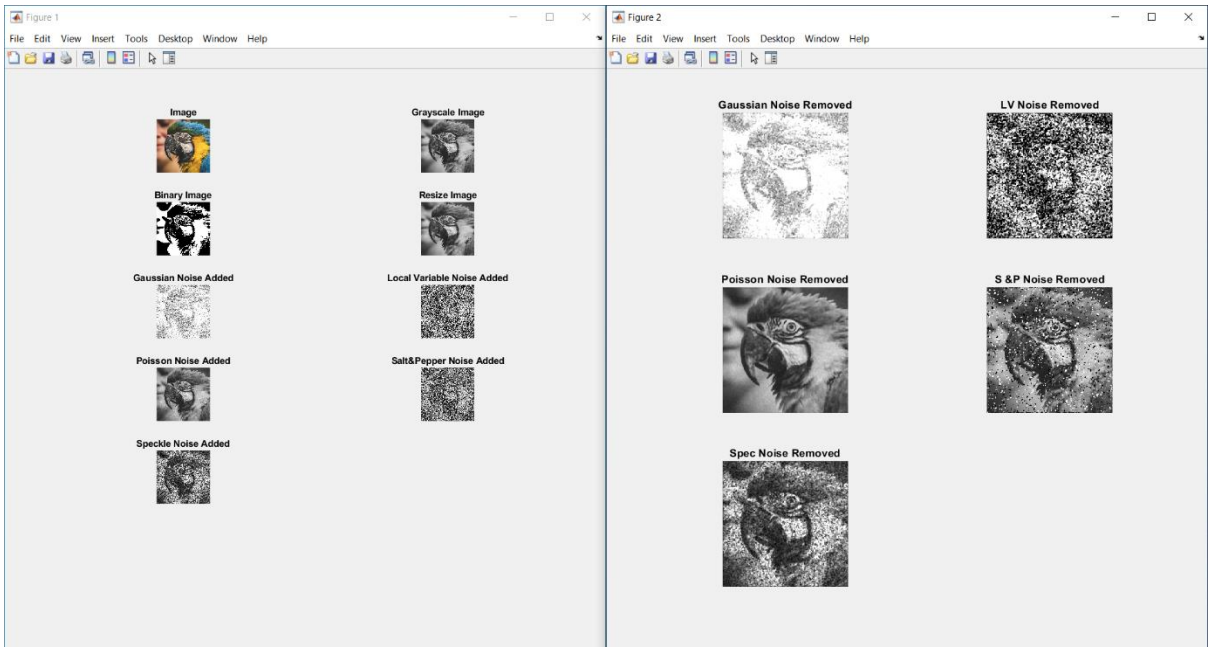


HPF is a type of filter that preserves or amplifies the high frequency information in an image. Sharpening is implemented by a high pass filter.

DSP_mini_PROJECT.m

```
60
61 -    gfil= medfilt2(gnoi, [3,3]);            %Gaussian Noise Removed
62 -    figure
63 -    subplot(3,2,1)
64 -    imshow(gfil)
65 -    title('Gaussian Noise Removed')
66
67 -    lvfil= medfilt2(lvnoi, [3,3]);          %LV Noise Removed
68 -    subplot(3,2,2)
69 -    imshow(lvfil)
70 -    title('LV Noise Removed')
71
72 -    poifil= medfilt2(poinoi, [3,3]);        %Poisson Noise Removed
73 -    subplot(3,2,3)
74 -    imshow(poifil)
75 -    title('Poisson Noise Removed')
76
77 -    spfil= medfilt2(spnoi, [3,3]);          %S &P Noise Removed
78 -    subplot(3,2,4)
79 -    imshow(spfil)
80 -    title('S &P Noise Removed')
81
82 -    specfil= medfilt2(specnoi, [3,3]);      %Spec Noise Removed
83 -    subplot(3,2,5)
84 -    imshow(specfil)
85 -    title('Spec Noise Removed')
86
```

AN OVERVIEW OF THE FINAL OUTPUTS:



CONCLUSION:

One of the fundamental challenges in the field of image processing and computer vision is image denoising, where the underlying goal is to estimate the original image by suppressing noise from a noise-contaminated version of the image. Image noise may be caused by different intrinsic (i.e., sensor) and extrinsic (i.e., environment) conditions which are often not possible to avoid in practical situations. Therefore, Image denoising plays an important role in a wide range of applications such as image restoration, visual tracking, image registration, image segmentation, and image classification, where obtaining the original image content is crucial for strong performance.

RESULT: Thus we have successfully denoised the given image using the image processing toolbox in MATLAB and have analysed it in detail by comparing it to the original noisy form.