SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19EC351 – IMAGE PROCESSING AMD COMPUTER VISION

UNIT -2

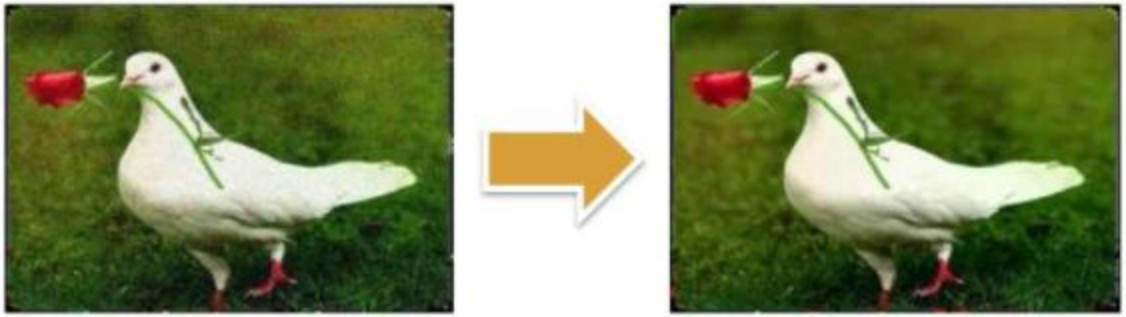
Image Enhancement

Introduction

What is Image Restoration?

Image restoration attempts to restore images that have been degraded

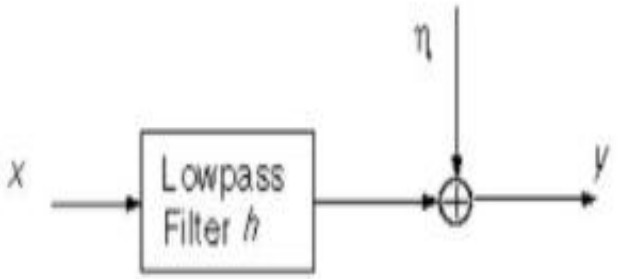
- Identify the degradation process and attempt to reverse it.
- Almost Similar to image enhancement, but more objective.



Degradation Model

Degradation Model

Block diagram of general degradation model:



Where y is the corrupted image obtained by passing the original image x through a low pass filter (blurring faction) h and adding noise to it.

Noise and Images

The sources of noise in digital images arise during image acquisition (digitization) and transmission

- Imaging sensors can be affected by ambient conditions
- Interference can be added to an image during transmission

Noise Model

We can consider a noisy image to be modelled as follows:

$$g(x, y) = f(x, y) + n(x, y)$$

where $f(x, y)$ is the original image pixel, $\eta(x, y)$ is the noise term and $g(x, y)$ is the resulting noisy pixel If we can estimate the model of the noise in an image, this will help us to figure out how to restore the image.

Filters

We can use spatial filters of different kinds to remove different kinds of noise

The *arithmetic mean* filter is a very simple one and is calculated as follows:

$$\hat{f}(x,y) = \frac{1}{mn} \sum_{(s,t)\in S_{xy}} g(s,t)$$

This is implemented as the simple smoothing filter Blurs the image to remove noise

Noise Models

There are many different models for the image noise term $\eta(x, y)$:

- Salt and pepper noise
- Gaussian noise
- Speckle noise
- Exponential
- Uniform

Salt & Pepper Noise

- It known as shot noise or impulse noise
- Its appearance is randomly scattered white or black or both pixel over the image .
- there are only two possible values exists that is a and b and the probability of each is less than 0.2 .

Salt and pepper noise

Original Image

Image with Salt and Pepper

Filtering techniques :

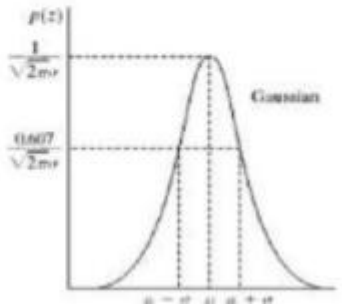
- mean filtering .
- Median filtering
- Gaussian filtering

Gaussian Noise

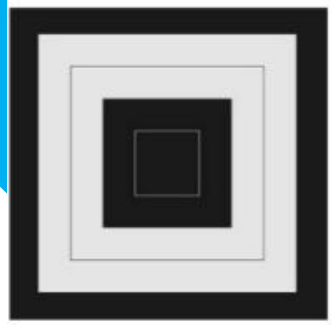
Gaussian noise is caused by random fluctuations in the signal , its modeled by random values add to an image

Gaussian noise:

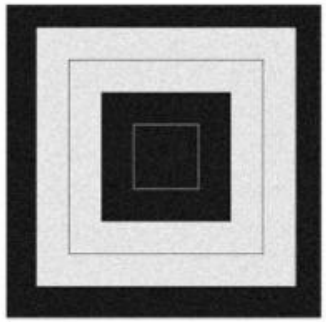
$$p(z) = \frac{1}{\sqrt{2\pi}\sigma} e^{-(z-\mu)^2/2\sigma^2}$$



Gaussian Noise



Without Noise



With Gaussian Noise

filtering techniques :

- mean (convolution) filtering
- Median filtering
- Gaussian filtering

Uniform Noise

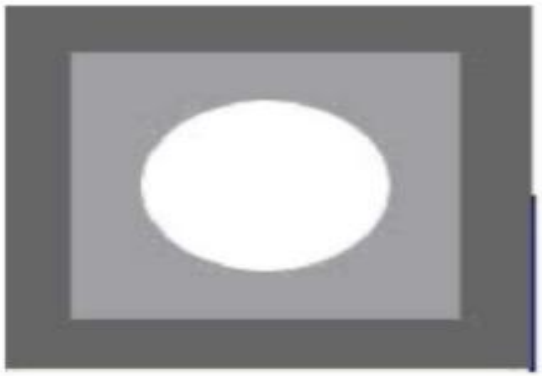
The **uniform noise** cause by **quantizing the pixels** of image to a number of distinct levels is known as **quantization noise.**

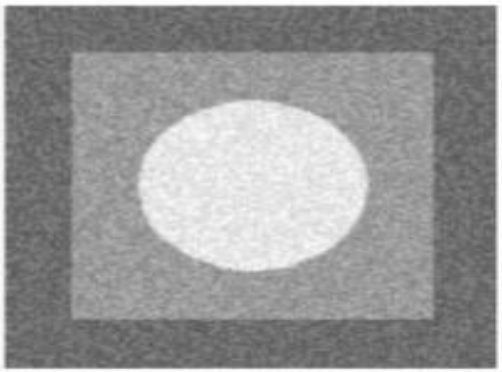
Uniform noise can be analytically described by :

Uniform noise:

$$p(z) = \begin{cases} \frac{1}{(b-a)} & \text{if } a \le z \le b \\ 0 & \text{otherwise} \end{cases}$$

Uniform Noise





THANK YOU