Study on Image De-noising Methods and their Performance Comparison

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Abstract

In real time image acquisition, the image sensor may be exposed to various noise resources. It needs to be restored before further processing. So image restoration is a vital step in image processing. In this paper, a study on different image restoration filters and their performances comparison through image quality matrices has been done. The study has been undergone through software simulated using MATLAB platform. The process involves the execution of image de-noising methods on a noisy image followed by the measurement for image quality matrices after getting the recovered image. The matrices like Peak Signal to Noise Ration (PSNR) is a key factor to determine which de-noising filter performance better than others and finally a comparison has been shown through a graph.

Keyword: *Image Restoration, Image Quality Metric, Peak Signal to Noise Ratio, Minimum Mean square error.*

Introduction

Digital image are represented as a two dimensional function f(x, y), and the processing of the digital image are done with the help of digital computer. Digital image processing has many application in the filed of medical science, remote sensing, pattern recognition, security, video processing etc [1]. The processing of raw image is necessary for any application, but the image acquisition is the first stage of image processing. The main challenge in image acquisition is the affect of noise during acquisition which is a vital thing and this is due to the image sensor. So the image restoration is a main part in the steps of image processing. The image is get affected by noise and the noise is random signal which is described by random variable and its probability distribution [2]. Many noises like Gaussian noise, impulse noise are affecting the quality of the image. But during the restoration, different de-nosing methods like, mean filter median filter etc are available to recover the original image from the noisy image [3]. After recovery of the image the quality can be measure by different image quality matrices like mean square error and peak signal to noise ratio [4]. In the paper the section II has focused on different noise distribution, de-noised method and different image quality matrices. Section III describes the process to perform the de-noising process and comparison of different methods and their performance. The section IV the results have been shown and discussion about the result and finally in section V the conclusion has been mentioned.

Noise Distribution and Filtering Method

Digital images get affected by noise during the image acquisition, and that should be filtered to get back the original image using image reconstruction. As the noise is a random signal, so it can be analyze through probability density function [5]. There some common probality density function which are mostly used in image processing. Some of the listed noise distributions are Gaussian noise, Rayleigh noise, Gamma noise, Exponential noise, uniform noise, Impulse or Salt & pepper noise [6].

Gaussian Noise: Gaussian Noise is a statistical noise having a probability density function equal to normal distribution, also known as Gaussian distribution [7]. The probality density function of Gaussian random variable z , is given as

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

where z represent gray level, μ is mean of average value of z and σ is standard deviation

Impulse Noise: Generally impulse function exists at 0 with unit area under the curve. Likewise the impulse noise is called as Salt and pepper noise. This noise affects the image by adding random bright and random dark point inside the image. Where salt noise means random addition of white and pepper noise