

# Brief Review of Image Restoration Algorithms

Sunita Ahirwar, Prof. Anuj Bhargav

Departments of Electronics, SRCEM, Morena, RGPV, University, Bhopal, Madhya Pradesh, India

**Abstract**—Restoration is the technique which removes the noise from the existing image and transforming the same into a better quality image. The aging process distorts the quality of the same various algorithms are popular in the field. We have reviewed various algorithms popular in the field of image restoration .

**Keywords**— Restoration, Transformation, aging .

## I. INTRODUCTION

Image-is an important item of communication. In the modern era it has become important to archieve the age old images in better form. The main causes of the distortion in the image quality are like blur, noise and camera misfocus. The atmospheric effects and mishandling are main causes of the distoration of the old images over the period. The areas of application are scientific exploration, forensic investigations, flim industry and archivals.

## II. IMAGE RESTORATION

Image restoration aims at removal of noise from the image and extraction of the original image,  $y \in R^m$

$$Y = Bu + n \tag{1}$$

Where B is a linear operator called a convolution operator. The image restoration process can be modelled as,

$$Y(i,j) = H[f(i,j)+n(i,j)] \tag{2}$$

Where  $y(i,j)$  is a degraded image,  $f(i,j)$  is the original image, H an operator that represents the degradation.  $n(i,j)$  the external noise which is assumed to be image independent

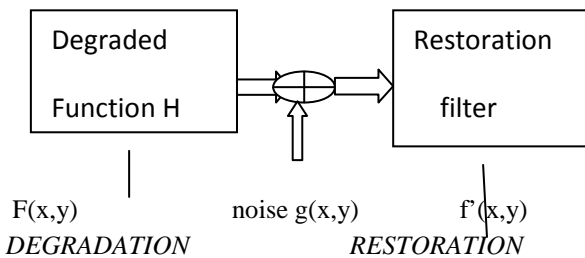


Fig1: Image degradation and restoration techniques

## III. SUMMARY OF THE NOISE MODELS

Gaussian noise, The different blurs are:

- Blur model: The motion blur occurs when there is a relative motion the object and camera.

Atmospheric distoration occurs in the astronomical objects.

**3.1 Performance Indices:** Blurred Signal to noise ratio(BSNR) is a the measure which describes the degradation model.

**3.2 Median filter:** To restore an image from linear degradation the filter used are (i) pseudo inverse filter (2i), Weiner filter and blind deconvolution filter.

Inverse filter is

$$H(u,v) = \frac{1}{H(u,v)} \text{ and } F(u,v) = G(u,v)H(u,v)$$

The recovered image is



Degraded image

Restored image

Fig.2 : Image degradation and restoration using inverse filter.

**3.3 Pseudo Inverse Filter:**

$$H(u,v) = \begin{cases} \frac{1}{H(u,v)} & |H(u,v)| \geq t \\ 0 & |H(u,v)| < t \end{cases}$$



Degraded image

restored image

Fig 3: Image degradation and restoration using pseudo inverse filter.

**3.4 Weiner Filter:** Weiner filter is not good at noise filtering mean square error filtering is used which incorporates both the degradation function statistical characteristic of noise into image restoration process the drawback of this type of filter is that the power spectra of under graded and power spectra of noise must be clear.

#### IV. BLIND DECONVOLUTION ALGORITHMS

It can be used when no information about the distortion is known.[4] The algorithm restores the image and point spread function (PSF) concomitantly. The accelerated damped Richardson- Lucy algorithm is used in each cycle

$$Y = k \otimes x \quad (3)$$

Where  $x$ , is a visually sharp image and  $k$  is a non negative blur kernel.

#### V. RICHARDSON LUCY DECONVOLUTION ALGORITHM

The Richardson – Lucy deconvolution algorithm has become popular in medical and astronomy.

#### VI. HISTOGRAM EQUALIZATION

The image is restored using this technique. During histogram equalization the intensity is distributed effectively[2]. Histogram Equalization uses probability. The pixel values of the image are listed and with their respective occurrence values. The probability of a pixel in the output image is calculated by applying probability distribution method.

##### 6.1 Contrast Limited Adaptive Histogram Equalization (CLAHE)

This technique works on small regions in the image that are called Tiles. Each tile's contrast is enhanced, so that the histogram specified by the distribution parameter.

#### VII. CONCLUSION

In our review paper the image restoration techniques have been applied using Histogram equalization MSE, PSNR, average difference normalized absolute error. Salt –n-pepper noise can be qualitatively removed by median filter. The results reveal that median, adaptive filters are better as compared with CLAHE and Histogram Equalization techniques.

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