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Different Methods of Image Restoration

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Abstract: - Image restoration techniques are used to reduce the noise and improve the resolution of corrupted image. Based on the image restoration technique will be varied. This Paper summarizes the latest image restoration method for Millimeter wave (MMW) image, mammographic image, under water image, spectral computed tomography image, Bio medical image and MRI image. These latest proposed methods improves signal to nose ratio of the image and provides high resolution within less acquisition time.

Keywords: Biomedical image, Image restoration, Mammographic image, MMW image, MRI image, SCT image, under water image

I. INTRODUCTION

An image is a two dimensional function f(x,y). The amplitude of "f" at any coordinates represent the intensity of the image. There are various steps in image processing i.e; image acquisition, filtering restoration, water marking, segmentation, extraction etc. This paper discussed about image restoration.
Image restoration is a process of improving the appearance of image. Actually, these images are obtained from various sources such as photography, Astronomy, medical imaging, remote sensing and microscopy. In these images, there must be an underlying object, we wish to observe but that observed object may have noise, blur or any other degradations in the recorded image. Based on the type of application, images, the methods will vary. This paper described various restoration methods for different images.

II.METHODS

Based on the type of image, the corresponding image restoration methods are used. This paper addresses the latest image restoration used for Millimeter wave image, Mammographic Image, Under water image, Spectral Computed Tomography (SCT) image, Biomedical Image and MRI Images.

A.*Millimeter Wave (MMW) Images* –

The Millimeter Wave (MMW) imaging technique has been applied to various fields, such as dangerous substance inspection, human carry on safety inspection, aircraft landing guidance system, Plasma tests and so on. The limitation of MMW imaging is low resolution, very blur and theses images will have large noise. To improve resolution, super resolution restoration methods are developed, these are of two types. 1 linear and 2. Non –linear. Linear methods improve image quality but can't restore image i.e. outside of band pass imaging system. Currently, many nonlinear methods have been used widely in image processing. Previously, maximum a posteriori (MAP) method, regularization method, Lucy-Richardson (L-R) method, projection onto convex sets (POCS), Maximum entropy method and Gerchberg method .All these methods can't provide better resolution, when the given image has large noise. In these methods, L-R is the simple and easily implemented. At present in MMW image restoration methods, L-R method is considered. To this method, additional denoising technique is considered. Non-negative sparse coding shrinkage (NNSCS) is a denoising technique, this method reduces noise effectively without losing the characteristics of the image. So, for a given MMW image, first NNSC technique is applied, so it is free from noise,

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this low nosy image is given input to L-R method, it will restores the features of the image. This method is feasible and restores image with low resolution.

In millimeter wave images, Lucy-Richardson (L-R) is a nonlinear efficient method, this method can't provide better resolution, when the given image has large noise. So, at present Non-negative sparse coding shrinkage (NNSCS) technique is used, this method reduces noise effectively without losing the characteristics of the image. This NNSC is a denoised technique, for a given MMW image, first NNSC technique is applied, so it is free from noise, this low nosy image is given input to L-R method, it will restores the features of the image. This method is feasible and restores image with low resolution [1].

B.Mammographic Images–

Medical Images such as X-ray Images, Mammographic images and Ultrasound images are widely used to detect various images. But these images are too noisy and blurred. To remove Blur and noise, various restoration methods are needed. Depends on type of blur and noise and depends on image, corresponding technique can be used. Image restoration techniques are classified into two categories i.e. 1.Image Deconvolution and 2. Blind Image Deconvolution. In image deconvolution method, image is restored by applying the data related to recognized area of image and knowledge of blurring function. Where as in Blind Image Deconvolution, it uses entirely different approach without any knowledge of PSF, this method offers better quality and high image resolution. Where as in Blind Image Deconvolution, it uses entirely different approach without any knowledge of PSF, this method offers better quality and high image resolution. At present, to restore Mammographic image, Blind Deconvolution method with various filters are used [2].

C.Under water images –

Under water images are more prone to noise and blur effect. Generally, under water images are degraded due to range gated pulsed laser imaging system i.e. noise exists due to scattering and absorption of water particles, these images use laser as a light source. By using Blind Deconvolution method, this approach doesn't restore image to a best possible level of Point Spread Function (PSF). Wells' small angle approximation (SAA) theory is used to denoise the underwater image to a better level. At present Noise reduction is performed i.e. SAA method is performed first and then iterative blind deconvolution method is performed on denoised image in order to restore the original image. Blur metric method is used to determine the deconvolution iteration time and evaluates the image quality after restoration [3-4]

D.Spectral Computed Tomography (SCT) image –

Spectral Computed Tomography (SCT) is very useful in clinical side because it has ability to differentiate and identify different materials by generating the atomic number and electron density of the material. Due to non-availability of sufficient photon count, SCT images suffers from poor signal-to-noise ratio and strong streak artifacts. Initially, in order to restore SCT imaging, Statistical Iterative Reconstruction (SIR) method is used, but this method offers less signal to noise ratio. At present, aviNLM filters are using. These filters perform reconstruction by performing a non-local weighted average operation with non local weight matrix between prior and target images. For a noisy energy specific images, non local weighted operation is performed. This method also performs quantitative and qualitative evaluation on physical phantom, digital phantom and clinical patient data in terms of noise reduction, cross profile, material decomposition assessment and contrast-to-noise ratio. This aviNLM algorithm is more significant performance gains than the existing HYPR-LR and NLM algorithms in terms of various measurement metrics is signal to noise ratio and strong artifacts. This method is useful in clinical applications such as radiotherapy and in myocardial perfusion imaging [5-6].

E.Biomedical Image –

Generally biomedical images are corrupted by Poisson Noise followed by additive Gaussian Noise. Any restoration method, they have to consider PG likely hood function and their own functions. Previously, scaled gradient algorithm and primal dual splitting algorithm are used. The scaled gradient algorithm does not have any regularization and convergence guarantees, whereas primal dual splitting algorithm is slow and depends on step-size. In latest model Neuron iteration is used faster iterations. A Novel variable splitting approach is used for biomedical image restoration, this approach involves, Poisson-Gaussian (PG) likelihood and Total Variation (TV) regularization. This method improves the convergence rate, faster iterations and reduces complexity [7].

F.MRI Images –

Medical Images plays very important role in the diagnosis of the disease. Therefore, a high quality /resolution medical image is required. In MRI images, increasing the resolution, results in reduced signal to noise ratio and increases acquisition time. This issue will be solved by using Super-resolution Reconstruction (SRR), this method combines the different information of Low Resolution (LR) images and reconstructs High Resolution Image (HR) image. This SRR used non-uniform interpolation approach and it is increasing the resolution of image without reducing signal to noise ration and less acquisition time is also required [8].

III.CONCLUSION

This paper addresses the latest methods for image restoration, for MMW image NNSC denoised method and L-R method is used for high resolution image; for Mammographic Images Blind Deconvolution method with various filters are used. The underwater images are restored by using SAA technique, whereas SCT images are restored by using aviNLM algorithm. Variable split approach method is suitable for restoring under-water images and Super-Resolution reconstruction method provides better SNR and gives best results to restore MRI images.

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