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Denoising of Image Using The LPG-PCA

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Abstract: Image processing plays a very important role in image denoising. As most of the applications make use of images in various such as medical field, satellites images, aerial images, space exploring and many more. This image is disturbed by the various factors and hence leads to the noisy image. This leads to the necessity of the image denoising technique. These noisy images mainly include the noise such as Gaussian noise, salt and pepper noise, speckle noise etc. The technique used to Denoised the image is depending on the type of noise it includes and hence it is compulsory to have the knowledge of the noise present in the image. A large number of algorithms has been developed to remove the noise and enhance the image features. This paper gives the description of noise, types of noise and LPG-PCA algorithm that has been used for denoising the image.

Keywords: noise; types of noise; LPG-PCA algorithm.

I. INTRODUCTION

Images get degraded while receiving, processing and transmitting. Image processing is the plays an important part in signal processing. Whenever signal processing is used which includes image as its input as well as output it is called as Image processing. Large portion of digital image processing is related with image de-noising. It affects the accuracy and efficiency level. This involves research in algorithm and goal oriented image Processing. Image restoration is the reduction of degraded images that are occurred while the image is being obtained. Degradation comes from blurriness as well as unwanted signal due to various sources. Blurring is a form of bandwidth reduction in the image which is caused by the imperfect image formation process like motion between the camera & the object or when an optical system is out of the focus. When aerial photographs are taken, atmospheric turbulence introduces blurs, optical system aberration and movement between camera and the ground.

With these blurring effects, the recorded image can also be corrupted by unwanted signal. A noise can be introduced in the transmission medium due to a noisy channel and errors during the measurement process. Each and every element in the imaging chain such as film, lenses, digitizer, etc. helps in the destruction of image. Image restoration is often used in the various field of photography or publishing where an image is degraded because of various reason, but it needs to be improved. So we need to know about the degradation process in order to design a model for it. When a model is designed for the degradation process, the inverse process is applied to the image to de-noise it back to its original form. It is most often used in space exploration to help eliminate degradation generated in a spacecraft or to reduce distortion in the optical system of a telescope. Image de-noising used in various applications in fields such as astronomy where the resolution is high, the images of unique events is analysed in medical imaging and in the forensic science where useful photographic information is of extremely bad quality. Image denoising is a compromise between noise reduction and preserving image details. To achieve better results, a denoising algorithm has to adapt to image distortion or discontinuities. It compresses the essential information in a signal into relatively few, large coefficients, which represent image details at different resolution scales. The performance of still image denoising is analysed in terms of PSNR. Distortion mostly occurs due to noise. While we focus on the most important types, they are; Gaussian noise, impulse noise, poison noise, salt and pepper noise. To de-noise the image different techniques has been used.

The most frequently used image types are gray-scale, binary and colour images. Binary images are the simple type of images and has only two discrete values, black and white. Black is represented with the value '0' while white is represented with the value '1'. Note that a binary image is generally created from a gray-scale image. Binary image are 1 bit per pixel images. Gray-scale images are one-color images. They do not contain any colour information. They represent the brightness of the image. This image consists of 8 bits/pixel data, which means it can have up to 256 (0-255) different brightness levels. Black is represented with the value '0' while white is represented with the value '255'. In between values from 1 to 254 represent the different gray levels. They are also referred to as intensity images, as they contain the intensity information. Colour images are three band monochrome images, where each band is of a different colour and provides the brightness information respectively and this information correspond to the respective spectral band. Colour images are red, green and blue images and are RGB images. Colour images are referred as 24 bits/pixel image.

II. NOISE

Noise in images represents random fluctuations in brightness or color information. Noise is caused by

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unwanted information hence degrading the image quality. Noise is defined as a procedure that affects the image quality that is being not a part of the original image information. In Digital image noise may occur due to various sources. Noise are introduced in digital images during acquisition process, optical signals are converted into electrical and then digital signal. At each stage of conversion process, every stage experiences a fluctuation that adds a random value to the intensity of a pixel in a resulting image due to natural phenomena. Noise is considered as an undesirable by-product of image that is captured.

The types of Noise are following:-
- Gaussian noise
- Salt-and-pepper noise
- Poisson noise
- Speckle noise

A. Addictive and multiplicative noise
Information about the type of noise present plays a significant role in the image denoising process. As the information about the noise helps to decide the technique, which will be better to remove the noise by preserving the image content. Images are corrupted with noise modelled with either a Gaussian, uniform, or salt or pepper distribution. Speckle noise is multiplicative in nature.
Noise is present in an image is either an additive or multiplicative noise.
An additive noise satisfies the rule
$A = B + C$,
While the multiplicative noise satisfies
$A = B \times C$,
Where B is the original signal, C denotes the noise introduced into the signal to produce the corrupted image A.

III. TYPES OF NOISES

A. Gaussian noise
Gaussian noise is statistical in nature. Its probability density function is equal to that of normal distribution, which is called as Gaussian distribution. In this type of noise, values of the noise are being distributed in a Gaussian manner. One special type of Gaussian noise is white Gaussian noise, in which the image values are statistically independent. For various applications, Gaussian noise is also used as additive white noise to produce additive white Gaussian noise in image. Gaussian noise is defined as the noise with a Gaussian amplitude distribution. Gaussian noise is said as white noise that describes the correlation of various noises. Gaussian noise is equated to be of white Gaussian noise sometimes, but it may not necessarily the case.

B. Salt And Pepper Noise
There is only two possible values a and b in salt & pepper noise model. The probability is less than 0.1 of getting each of them. The salt & pepper noise model would greatly dominate the image. For 8 bit/pixel image, the intensity value for pepper noise and for salt noise typically found nearer to 0 and 255 respectively. It is a form of noise typically seen in images. In image the noise represents as randomly occurring black and white pixels. This noise occurs in images due to quick transients, such as faulty switching. This type of noise can be occurred due to malfunctioning of analog-to-digital converter in cameras, bit errors in transmission, etc. This type of noise can be reduced using the algorithm that involves the usage of a median filter, morphological filter [2], [6].

C. Poisson Noise
Poisson noise is a type of electronic noise also known as shot noise. Poisson noise occur where there is a statistical transients in the measurement caused either due to finite number of particles like electron in a circuit that carry energy, or by the photons in an optical device [2].

D. Speckle Noise
In [2],[7],[5], Speckle noise is a type of granular noise and it causes deterioration in the image quality .Speckle noise damage the image being received from the active radar as well as synthetic aperture radar (SAR) images. Speckle noise occurs due to random changes in the return signal from an object in radar and that is not big as single image-processing element. The mean grey level of a local area increases due to speckle noise. Speckle noise is more serious issue, causing difficulties for image clarification and detailed information in SAR images. It is due to coherent processing of back scattered signals from various distributed targets.

IV. IMAGE DENOISING

Image denoising refers to the restoration of a digital image that has been impure by the noise.

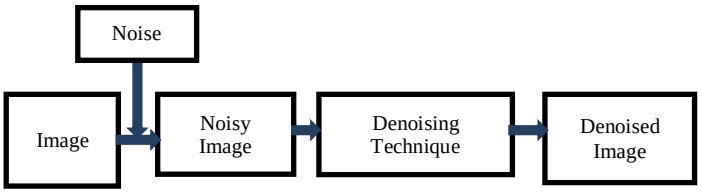

Fig 1: Denoising Concept.

A. Objective Of Image Denoising:
- To suppress the noise in uniform regions.
- To preserve edges and other image characteristics.
- To provide a visually natural appearance [4].

B. LPG-PCA Technique:
The LPG PCA helps in grouping each and every pixel and its neighboring elements, so the process involves every object in the test images, which helps to learn the technique and leads to the improvement in the efficiency of the process. In general, the noise energy will evenly spread over the whole dataset, while the energy of a signal will concentrate on a small subset of the PCA transformed dataset [2]. Therefore, by preserving only the most important subset of the transformed dataset. The noise

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could be significantly reduced while the signal being well recovered by conducting the inverse PCA transform. Since the PCA [2] is applied to the noisy image directly without any data selection, so noise residuals in the image lead to the visual artifacts. So this is avoided by modeling a pixel and its nearest neighbor as the vector variable.
The training samples of vector variable are selected by grouping the pixels with similar local spatial structures to the pixel underlying in the local window. With such an LPG procedure [2], the image edge structures can be well preserved after shrinkage in the PCA domain so the local statistics of the variables can be accurately computed. LPG PCA helps in better characterizing the images since it is a spatially adaptive image representation technique.

C. Flowchart

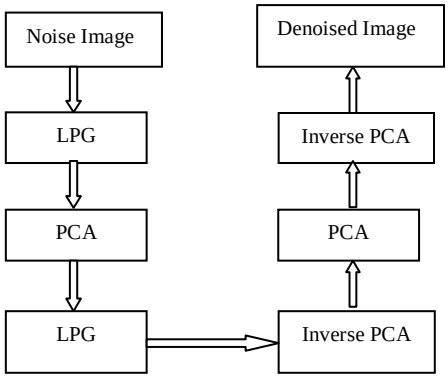

Fig 2. 2- Stage LPG-PCA Denoising Technique

D. Algorithm
Following are steps.
[1] Take a noisy image.
[2] Apply local pixel grouping.
[3] PCA transform and de-noising.
[4] Inverse PCA transforms. Calculate PSNR, and SSIM.
[5] Next update noise level & local pixel grouping.
[6] PCA transform and de-noising.
[7] Inverse PCA transform. Calculate PSNR, and SSIM.
[8] To obtain de-noised image.

E. Experimental Results
The LPG-PCA algorithm that has been proposed is extension of the PCA based de-noising algorithm. The Peak Signal to Noise Ratio use to measure the pixel intensity difference between two images. Generally quality of image can be measured by PSNR. [7] Structural Similarity Index use to measure image visual quality. It shows structural similarity between the target image and reference image.

V. CONCLUSION

The LPGPCA technique used for all types of images like jpg, gif, tiff, bmp etc., it also works with any size of image. Deblurring is done using adaptive regularization along with LPG PCA algorithm for dictionary learning. This was analyzed using various image quality measures but as image size increases it take more time as number of pixels increases, so further improvement can be done in this direction. Additional this paper provides various parameters to measure like (PSNR), (SSIM) and (MSE).

REFERENCES

[1] Y. Murali Mohan Babu, Dr. M.V. Subramanian, and Dr. M.N. Giri Prasad "PCA based image denoising", Signal & Image Processing : An International Journal (SIPIJ) Vol.3, No.2, April 2012.
[2] Charles Boncelet, "Image Noise Models" in Alan C.Bovik, Handbook of Image and Video Processing, 2005.
[3] Lei Zhang, "PCA-Based Spatially Adaptive Denoising of CFA Images for Single-Sensor Digital Cameras", IEEE Transactions on Image processing, vol. 18, no. 4, April 2009.
[4] Yousef Hawwar and Ali Reza, "Spatially Adaptive Multiplicative Noise Image Denoising Technique", IEEE Transaction On Image Processing, December 2002, Vol.11, No. 12.
[5] Sedef Kent, Osman Nuri Oçan, and Tolga Ensari, "Speckle Reduction of Synthetic Aperture Radar Images Using Wavelet Filtering", in Astrium EUSAR 2004 Proceedings, 5th European Conference on Synthetic Aperture Radar, May 25–27, 2004, Ulm, Germany, 2004.
[6] P.Y. Chen, C.Y. Lien, "An efficient edge-preserving algorithm for removal of salt-and-pepper noise", IEEE Signal Processing Letters 15, 833–836, 2008.
[7] M. Rosa-Zurera, A.M. Co´breces-A´lvarez, J.C. Nieto-Borge, M.P. Jarabo-Amores, and D.Mata-Moya. "Wavelet denoising with edge detection for speckle reduction in SAR images" EUSIPCO Poznon, 2007.