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# A Comprehensive Study on Significance of Image De-Noiseing and De-Blurring Applications in Computed Tomography

Somashekhar Swamy, P.K.Kulkarni

Ph.D. Scholar, V.T.U. Belagavi, Karnataka, India

Professor and Head, Department of EEE, Poojya Doddappa Appa College of Engineering, Kalaburgi, karnataka, India

**ABSTRACT:** De-noising and De-blurring is the technique that uses procedures to subsidize and remove the strange and useless content in the images De-noising and de-blurring is very beneficial for detecting the diseases like cancers, tumors in human body. But noise and Blur are the major factors that degrade the quality of images and makes difficult to diagnose. Reconstructing the images is the way to overcome these problems. This paper presents the study of various applications that are suitable to reconstruct the images. This survey mainly focuses on most prominent applications in the field of image processing and how its applications are critical enough to avoid dissatisfied results. The aim of this survey is to provide useful information on various de-blurring and de-noising applications and to motivate research to implement the effective algorithm.

**KEYWORDS:** Computed Tomography, De-noising, De-blurring

### I. APPLICATION OF IMAGE DE-NOISING

Computed tomography, more commonly known as a CT or CAT scan, is similar to X-rays for the diagnosing medical test, CT produces series of images or pictures of the body. CT scan has got significant role in medical field for detecting and analysing diseases. CT scan is used to examine the chest, injuries, kidney, etc. CT images provide detailed, cross-sectional views of all types of tissue in our body, this makes easier to diagnose. But many of CT images suffer from deterioration in the quality of the image because of noise, blur deficiency. These degradations makes hard to analyze. Analysis of CT image is very essential to take decision. Bad analysis results in wrong decision, which results failure in detection. Removing noise and blur is very crucial. Researchers have been working for decades on reconstruction of CT images.

Image noise usually happens when the illumination or pixel data gets transferred with the intermediate or neighbouring pixel which results in an image that is corrupted with unwanted data which we term it as noise. In this way noise is scattered all over the image. Source of noise generally comes from cameras and poor illumination. Noisy images provide less information. Blurs occur because of poor illumination, camera movement when capturing or object movement when capturing. Removing noise and blur is big challenge in image reconstruction.

Most of the algorithms have disadvantage of information loss like, edge information, small spatial structures, etc. Preserving edges and small spatial structures in CT reconstruction is challenging task for researchers. Identifying tumours, cancer cells or small injuries is the main objective of analyst. But finding tumours or cancer cells in early stage is difficult, because in early stage spatial structure of tumour is very tiny in size probably that would be estimated as noise. Hence using suitable filtering methods we can avoid noise and obtain the required result.

Various types of filtering technique used as a de-noising tool such as wavelet based filtering [5, 7, 16, 19, 22], Median filtering [18], etc. Filtering is process of removing noisy components from the transformed image. For de-blurring

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process sharpening the image to get clear structure of the object is included. All the researchers' goal is to achieve high efficiency and accuracy in the performance of algorithm. But most of their respective algorithms have their own pros and cons also. Filtering is an important tool which helps out in restoring the useful portion of the image else there would be chance that noise would be identified as the interested region which leads to an inaccurate results thus resulting in a wrong proportional results.

Hence image de-noising is one of the foremost and fundamental challenges in image processing and computer vision areas, where the underlying goal is to estimate the original image by suppressing the noise from a noise-contaminated version of the image. Image noise may be caused due to different intrinsic (i.e., sensor) and extrinsic (i.e., environment) conditions which cannot be avoided in the practical situations. Therefore, image de-noising has an important role in wide range of applications such as image restoration, visual tracking, image registration, image segmentation, and image classification, where obtaining the original image content is crucial for strong performance. While many algorithms have been proposed for the purpose of image de-noising, the problem of image noise suppression remains as an open challenge, especially in the situations where images are acquired under poor conditions where the noise level is very high. Let us look on with a brief overview on applications on image de-noising.

## II. IMAGE RESTORATION

The image gets overshadowed by the noise which enables it to be untuneful for the further process. Hence image de-noising will be used as a protocol for applications such as image restoration. The purpose of image restoration is to minimize the defects which degrade an image i.e by compensating for or undoing the defects. Degradation may occur in many ways such as motion blur, noise, and camera misfocus. During the cases like motion blur, it is possible to bring out very good estimate of the actual blurring function thereby minimizing the blur to restore the original image. The image may be corrupted by noise under such cases, the only way is to compensate for the degradation it caused.

Image restoration and Image enhancement both are different, in that the Image enhancement is designed to emphasize certain features of the image that make the image more pleasing to the one who observes it, but may not to produce realistic data from a scientific point of view. Some of the image enhancement techniques (contrast stretching / de-blurring by a nearest neighbour procedure) provided by "Imaging packages" use no a priori model of the process which has created the image. With image enhancement techniques it is possible to remove the noise by sacrificing some resolution, but this may not be acceptable in many applications. Some of the most advanced image processing techniques must be applied to recover the object.

Image is worth thousand words, which is used to record or display useful information. Due to imperfections which are inherent in the imaging and also the capturing process, however, the recorded/captured image invariably represents a degraded version of the original. The undoing or minimizing of these imperfections is crucial to many of the subsequent image processing tasks. Apart from these there also exists a wide range of different degradations which need to be taken into account, covering for instance noise, geometrical degradations (pin cushion distortion), illumination and colour imperfections (under/over-exposure, saturation), and blur.

All these degradations can occur due to relative motion between the camera and the original scene, or by an optical system that is out of focus. When some aerial photographs are captured for remote sensing purposes, at that time blurs are introduced by atmospheric turbulence, aberrations in the optical system, and also the relative motion between the camera and the ground. Such blurring is not confined to optical images, for example electron micrographs are corrupted by spherical aberrations of the electron lenses, and CT scans suffer from X-ray scatter. In addition to these blurring effects, noise always corrupts any recorded image. Noise may be introduced by the medium through which the image is created (random absorption or scatter effects), by the recording medium (sensor noise), by measurement errors due to the limited accuracy of the recording system, and by quantization of the data for digital storage. The field of image restoration (sometimes referred to as image de-blurring or image de-convolution) is concerned with the reconstruction or estimation of the uncorrupted image from a blurred and noisy one. Essentially, it tries to perform an

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operation on the image that is the inverse of the imperfections in the image formation system. In the use of image restoration methods, the characteristics of the degrading system and the noise are assumed to be known a priori. In practical situations, however, one may not be able to obtain this information directly from the image formation process. The goal of blur identification is to estimate the attributes of the imperfect imaging system from the observed degraded image itself prior to the restoration process. The combination of image restoration and blur identification is often referred to as blind image de-convolution. Image restoration algorithms distinguish themselves from image enhancement methods in that they are based on models for the degrading process and for the ideal image. For those cases where a fairly accurate blur model is available, powerful restoration algorithms can be arrived at. Unfortunately, in numerous practical cases of interest the modelling of the blur is unfeasible, rendering restoration impossible. The limited validity of blur models is often a factor of disappointment, but one should realize that if none of the blur models described in this chapter are applicable, the corrupted image may well be beyond restoration. Therefore, no matter how powerful blur identification and restoration algorithms are, the objective when capturing an image undeniably is to avoid the need for restoring the image.

### III. IMAGE REGISTRATION

Image registration is the process of transforming different sets of data into one coordinate system. Data may be made available from different aspects which includes from multiple photographs, times, depths, or viewpoints. This infrastructure finds its applications in medical imaging, biological imaging and brain mapping, military automatic target recognition, and compiling and analysing images and data from satellites. Registration is needed in order to compare or integrate the data obtained from different measurements of interest like remote sensing images of different sort and transformations can be fused together with respect to the reference image. Due to the vast applications in which image registration can be employed, it is impossible to develop a general method that is optimized for all uses. Medical image registration (for data of the same patient taken at different points in time such as change detection or tumour monitoring) often additionally involves elastic (also known as non-rigid) registration to cope with deformation of the subject (due to breathing, anatomical changes, and so forth). Non-rigid registration of medical images can also be used to register a patient's data to an anatomical atlas for neuro-imaging. Astrophotography finds its applications in image de-noising, usually the images obtained from the space about the interstellar have to be aligned by performing transformations on one image to make major features align with the successive image.

Image de-noising is an essential part of panoramic image creation. There are many different techniques that can be implemented in real time and run on embedded devices like cameras and camera-phones. Image de-noising exists in many variants one is with respect to include intensity and feature based models involving the noise based image aligning precisely with the reference image.

### IV. IMAGE SEGMENTATION

In computer vision bifurcation has its own identity in reproducing the images which involves in subsidizing a digital image into a set of small individual segments (sets of pixels) of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process in which a label is assigned to every pixel of the image with the same label sharing certain characteristics.

The result of image segmentation is a set of segments that will collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristics. When applied to a stack of images, typical in medical imaging, the resulting contours after image segmentation can be used to create 3D reconstructions with the help of interpolation algorithms like marching cubes.

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Segmentation obtains its major support from pre-processing stage of de-noising or de-blurring (based on the application implemented). The segmentation of a subsidy or portion from the original data or image will not hold its originality without de-noising thus resulting in weak segmented part with the large portion of unwanted partitions (usually termed as noise). Hence de-noising is a mandatory process to obtain a good segmented portion of the data.

## V. IMAGE DE-BLURRING

It is difficult to avoid image blur in many situations and can often ruin a photograph. De-blurring an image is an inherent problem. The blurred image can only provide a partial constraint on the solution with no additional constraints, there are infinitely many blur kernels and images that can be convolved together to match the observed blurred image. Even if the blur kernel is known, there still could be many sharp images that when convolved with the blur kernel can match the observed blurred and noisy image. One of the central challenges in image de-blurring is to develop methods that can disambiguate between potential multiple solutions and bias a de-blurring processes toward more likely results given some prior information.

At present, image de-blurring is as prosperous as it were fifty years ago in the area of astronomical imaging. It is important because in these fields the resolution and recording limitations are severe. In imaging for ground based system, the constantly changing refractive index of the atmosphere would bring blurring effect to the resulting images. Images of Earth and other planets in the solar system obtained from spacecrafts suffer from fast motion blur due to the large speed difference of the camera shutter and the spacecraft. However, image de-blurring techniques have shown us with incredible images of our planet. Coming from astronomical imaging, image de-blurring has spread into many other areas. For example, image de-blurring plays an important role in the area of medical imaging, as well as in medicine in the area of quantitative autoradiography (QAR). Apart from these, image de-blurring has been integrated more and more with our culture and arts. Nowadays, digital image de-blurring techniques are used to enhance historically important photographs and to restore the aging movies. The fascinating factors are that not only can motion picture restoration remove the stain and scratches from old movie frames, but it can also turn the original black-and white movie into a colorized one. Image restoration, especially image de-blurring, has been used in many other applications as well. For instance, it has been used to restore blurry X-ray images of aircraft wings to improve federal aviation inspection procedures. It is used for restoring uniformly blurred television pictures. Moreover, it has applications in analysing, images of unique events such as satellite photographs, medical spiral CT images, images of biological tissues, and electron microscopy images coming from scientific experiments.

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## VI. CONCLUSION

For accurate information, de-noising and de-blurring is very much essential. The applications in this paper discuss about the major approaches and their applications, particularly in all fields and concepts of image processing. All the algorithms are efficient to improve the quality of degraded image. Algorithm has to be still more effective to obtain more accurate diagnostic information. Also there is a need to improve algorithms to make system robust. In view of this sufficient information about various methodologies in de-noising and de-blurring of different types of medical images are presented in this paper.

## REFERENCES

1. Gerald Zauner, Michael Reiter and Johann Kastner, "Denoising of Computed Tomography Images using Multiresolution Based Methods", ECNDT, 2006.
2. Zohair Al-Ameen, Ghazali Sulong and Gapar Johar, "Reducing The Gaussian Blur Artifact From Ct Medical Images By Employing A Combination Of Sharpening Filters And Iterative De-blurring Algorithms", Journal of Theoretical and Applied Information Technology, Volume 46, Issue 1, 2012..
3. V N Prudhvi Raj and T Venkateswarlu, "De-noising Of Medical Images Using Total Variational Method", International Journal (SIPIJ), Volume 3, Issue 2, 2012.
4. Ashish Khare and Uma Shanker Tiwary, "A New Method for De-blurring and De-noising of Medical Images using Complex Wavelet Transform", IEEE, 2005.
5. Ming Jiang, Ge Wang, Margaret W. Skinner, Jay T. Rubinstein and Michael W. Vannier, "Blind deblurring of spiral CT images—comparative studies on edge-to-noise ratios", Medical Physics, Volume 29, Issue 5, 2002.
6. Issam El Naqa, Daniel A. Low, Jeffrey D. Bradley, Milos Vacic, and Joseph O. Deasy, "Deblurring of breathing motion artifacts in thoracic PET images by deconvolution methods", Medical Physics, Volume 33, Issue 10, 2006.
7. V.Thavavel and R. Murugesan, "Regularized Computed Tomography using Complex Wavelets", International Journal of Magnetic Resonance Imaging, Volume 1, Issue 1, 2007.
8. Daniel E Yu and Jeffrey A. Fessler, "Edge-Preserving Tomographic Reconstruction with Nonlocal Regularization", IEEE, volume 21, 2, 2002.
9. Suman Shrestha, "Image Denoising Using New Adaptive Based Median Filter" An International Journal (SIPIJ), Volume 5, Issue 4, 2014.
10. Shruti bhargava and Ajay Somkuwar, "Hybrid Filters based Denoising of Medical Images using Adaptive Wavelet Thresholding Algorithm", International Journal of Computer Applications Volume 83, Issue 3, 2013.
11. Liyan Ma, Lionel Moisan, Jian Yu and Tiejong Zeng, "A Dictionary Learning Approach for Poisson Image Deblurring", IEEE, Volume 32, Issue 7, 2013.
12. Sachin D Ruikar and Dharmal D Doye, "Wavelet Based Image Denoising Technique", International Journal of Advanced Computer Science and Applications, Volume 2, issue 3, 2011.
13. S.Kother Mohideen, S. Arumuga Perumal and M.Mohamed Sathik, "Image De-noising using Discrete Wavelet transform", International Journal of Computer Science and Network Security, Volume 8, Issue 1, 2008.
14. Kanwaljot Singh Sidhu, Baljeet Singh Khaira and Ishpreet Singh Virk, "Medical Image Denoising In The Wavelet Domain Using Haar And DB3 Filtering", International Refereed Journal of Engineering and Science, Volume 1, Issue 1, 2012.

## BIOGRAPHY

**Somashekhar Swamy** completed B.E.Electrical Engineering from Siddaganga Institute of Technology Tumkur and M.E.in Power Electronics from P.D.A.College of Engineering Kalaburgi. Currently he is pursuing Ph.D in VTU Belagavi, Karnataka, India. His research area of interest is Biomedical Image Processing and power electronics.

**P.K.Kulkarni** completed B.E.Electrical Engineering from H.K.E.Society's Engineering College in the year 1983 and masters in Instrumentation from I.I.T.Kharagpur in the year 1989 and Ph.D.in the area of biomedical instrumentation from university of Roorke in the year 1998.Presently he is working as professor & Head Department of Electrical & Electronics Engineering Poojya Doddappa Appa college of Engineering Kalaburgi, Karnataka,India.He is currently working in the area of biomedical signal & image processing. He has to his credit 30 publications in the reputed national / international journals / conferences. He has visited Malaysia & France for presenting papers in the international conference & also chaired technical sessions. He has worked as reviewer for conference as well as reputed journals.