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Deblurring the Image by Derivative Compressed Sensing

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ABSTRACT: A number of real-world problems from astronomy to consumer imaging find applications for image restoration algorithms. Image deblurring (or restoration) is a common problem in image processing. This problem can often be solved in a unique and stable manner, provided appropriate assumptions on the nature of the images to be recovered. A more challenging setting is considered, in which accurate knowledge of the point spread function (PSF) is lacking which results in necessity to recover the original image from its blurred and noisy observations. Derivative compressed sensing (DCS) is used for the estimation of PSF and the original image is recovered through the process of deconvolution. Later the deconvolved image is given for the alone from the whole image.

KEYWORDS: derivative compressed sensing, point spread function, deconvolution.

I. INTRODUCTION

Digital image processing is the use of computer algorithms to perform image processing on digital images. A digital image is restricted in both its spatial coordinates and in its allowed intensities. A number of real-world problems from astronomy to consumer imaging find applications for image restoration algorithms [1] – [4]. Image deblurring (or restoration) is a common problem in image processing. Digital images are prone to a variety of types of noise. Noise is the result of errors in the image acquisition process that result in pixel values that do not reflect the true intensities of the real scene. When using the deblurring functions, note the following: Deblurring is an iterative process. You might need to repeat the deblurring process multiple times, varying the parameters you specify to the deblurring functions with each iteration, until you achieve an image that, based on the limits of your information, is the best approximation of the original scene. Along the way, you must make numerous judgments about whether newly uncovered features in the image are features of the original scene or simply artifacts of the deblurring process. The quality of the deblurred image is mainly determined by the knowledge of the PSF [5]. To determine the size of the PSF, examine the blurred image and measure the width of a blur (in pixels) around an obviously sharp object. Because the size of the PSF is more important than the values it contains, you can typically specify an array of 1's as the initial PSF. The deconvblind function, by default, performs multiple iterations of the deblurring process. You can stop the processing after a certain number of iterations to check the result, and then restart the iterations from the point where processing stopped. .The deconvblind function returns the output image and the restored PSF as cell arrays suing the derivative compressed sensing algorithm [6]. Later the output image is given for the process of recognizing the object alone from the whole image which is carried out by the following steps like background subtraction, object segmentation and lastly identification of the object. A background subtraction technique which is one of the basic automatic object segmentation methods is the difference between the original image and a reference image [10]. Many image segmentation methods are based on two basic properties of pixels in relation to their local neighborhoods: similarity and discontinuity [10], [15]. Pixel similarity gives rise to region-based methods whereas pixel discontinuity gives rise to boundary-based methods. Moreover, this method depends on the number of images that are used for the training set in order to improve the efficiency. However, this method requires more memory requirement because it needs a lot of images for training set and needs more time to calculate the eigen values of whole image thus decrease the speed of execution process.

II. PROBLEM STATEMENT

The problem of reconstruction of digital images from their blurred and noisy measurements is unarguably one of the central problems in imaging sciences [1] – [4]. Despite its ill-posed nature, this problem can often be solved in a unique and stable manner, provided appropriate assumptions on the nature of the images to be recovered. Digital images are prone to a variety of types of noise. Noise is the result of errors in the image acquisition process that result in pixel

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values that do not reflect the true intensities of the real scene. There are several ways that noise can be introduced into an image, depending on how the image is created. The blurring, or degradation, of an image can be caused by many factors: Movement during the image capture process, by the camera or, when long exposure times are used, by the subject, Out-of-focus optics, use of a wide-angle lens, atmospheric turbulence, or a short exposure time, which reduces the number of photons captured, Scattered light distortion in confocal microscopy. There are many applications today where a camera is used to capture a scene which includes objects of interest such as video surveillance and web cameras [16]. Further processing on these objects would be a much more computationally efficient task if it could be made to focus on the object alone as opposed to the whole scene. The most important operation in image analysis and computer vision is segmentation [11]. Detecting foreground objects is an important step for analyzing night surveillance videos. Though many efforts have been made for developing robust background subtraction algorithms and robust object detection algorithms, both the background subtraction task and object detection task remain difficult for night surveillance [13,14,15,16]. Many existing background subtraction methods and object detection methods suffer much from either heavy false alarm due to dramatic lighting changes or missing detection as the foreground color is very closed to the background in local due to low contrast. So, for the first problem as a solution we deblur the image and for the problem of identifying or recognizing we go for background subtraction and segmentation.

III. EXISTING SYSTEM

In classical compressed sensing central to signal processing is the Shannon–Nyquist theorem [7], which specifies conditions on which a band-limited signal can be stably and uniquely recovered from its discrete measurements. However, in around 2005, a different sampling theorem was formulated that, in some cases, abrogates the fundamentals of its predecessor. This new theory, nowadays known as compressed sensing, asserts that signals, which admit a sparse representation in a predefined basis, can be recovered from their discrete measurements, whose number is proportional to the l_0–norm of the coefficients of the sparse representation. In such a case, the sparser the representation of the signal is, the smaller the number of measurements required for signal reconstruction can be. As a result, cases are numerous in which the sampling efficiency of compressed sensing far supersedes that of the classical Shannon–Nyquist sampling [8], [9]. Because of the property of the linear system in of being underdetermined, the recovery of from is impossible unless it is known that is sparse and hence has a relatively low value.

IV. PROPOSED SYSTEM

The problem of reconstruction of digital images from their blurred and noisy measurements was considered as the central problems [3]. Reconstruction of the original image from can be carried out within the framework of image deconvolution. A more challenging setting is considered, in which accurate knowledge of the PSF is lacking which results in the necessity to recover the original image from its blurred and noisy observations alone[5]. Such a reconstruction problem is commonly referred to as the problem of blind deconvolution. We follow the hybrid blind deconvolution, whose main idea is to leverage any partial information on the PSF to improve the accuracy of image restoration. Derivative compressed sensing (DCS) is used for the estimation of PSF and the original image is restored through the process of deconvolution [6]. This reconstruction is expected to have accuracy and also superior quality.

Later this initial output image is taken for the work of recognizing or identifying the object alone from the whole image. The main purpose of this proposed approach is to allow identification of an object in an image automatically instead of a

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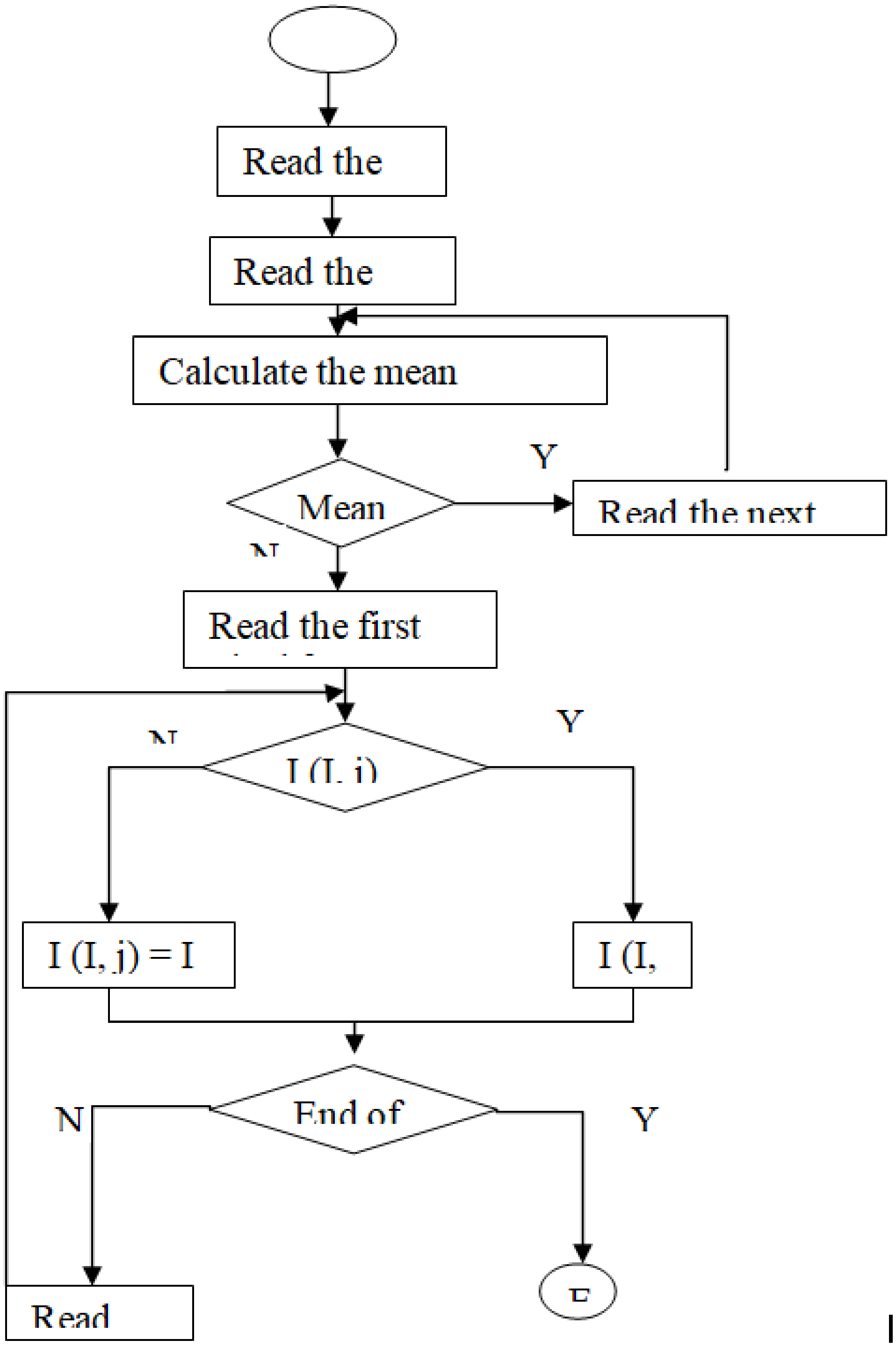

Fig 1. Process of background subtraction and image segmentation

manual [10]. The idea of estimating the background and then subtracting it from the original image is used in the proposed approach in order to segment objects in static images. The algorithm starts by reading an image and then selecting the first 5-by-5 block of the image [13]. The threshold value is set as the mean of the intensity of the pixels. The mean of the intensity of these pixels of the block is then calculated. By this the threshold value is set and then, a comparison between each pixel and the mean is performed. If this pixel is less than the mean this pixel is set to zero. Otherwise this pixel is given a value of the intensity minus the mean. This step is applied to all the pixels in the image. Then, the mean of the intensity for each non-zero pixel is calculated. Then, a comparison between each pixel and the

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mean is performed. If this pixel is less than mean this pixel is set to zero. Otherwise this pixel is given the value 255 [11]. Then, dilation of image is applied in order to fill the interior gaps and to smooth the object. The proposed technique calculates only the mean of each block which is the only parameter required for this method whereas other methods that require more than one parameter.

V. CONCLUSION

Here, the applicability of DCS to the problem of reconstruction of optical images has been demonstrated. As opposed to CCS, however, the proposed method performs the PSF estimation along with the deconvolution process. More over, the PSF estimation is done by making the use of oversized and undersized values, then by finding the appropriate value that is suitable for the given image. Further the estimated PSF value is used for the deconvolution which is carried by blind deconvolution. The proposed scheme also presents the enhancement of background subtraction technique in order to improve the efficiency and the accuracy of image segmentation methods. It can be concluded that the proposed scheme is successful in detecting the object as well.

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