Survey on Various Image Deblurring Technique

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Abstract: In image processing image deblurring is important technique. The actual work in deblurring is enhancing the clarity of a picture. This paper surveys on various blind image deblurring techniques normalizes sparsity measure, low rank prior, Alternating direction method of multipliers For comparison various metrics are used. A low rank prior is method is usually used inorder to deblur a blurred image. In this paper with low rank prior method an ADMM is used. The main aim of this paper is to estimate a high resolution image from a set of low resolution images. The task is computationally costly and is a highly ill posed problem.

Keywords: ADMM, Low Rank Prior, Normalized Sparsity Measure, Blind Deblurring

1. Introduction

Today the use of social medias are in its peak. They are mainly deals with images. A camera can be used to record the faithful representation of scenes that we see but every image is more or less blurry. An image can get be blurred due to many reasons, that can be shaking of camera, presence of any obstacle in front of the camera etc. so the image deblurring is introduced to make the pictures to sharp and useful.

Images can be composed of picture elements called pixels. Each pixels can be assigned by intensity used to characterize the color of small rectangular segments. A small image always contain around 65536 pixels while a high resolution image can contain 5 to 10 million pixels. Blurring can be arises in the recording of a digital image that means some times the pixel may spills over the neighboring pixels.

In image deblurring the main task is to recover the original, sharp image. Three technique is comparing here. In Normalized sparsity measure blind image deconvolution is used and it is a highly ill posed problem[1].

The blind and non-blind cases. In non-blind deconvolution, the motion blur kernel is assumed to be known or computed elsewhere; the only task remaining is to estimate the unblurred latent image[4].

2. Normalized Sparsity Measure

Blind image deconvolution is used to deblur the image. Many common forms of image prior used in this setting have a major drawback that the minimum of the resulting cost function does not correspond to the true sharp solution[5]. Many methods are used to get a better result. Here introduces an image regularization technique.

The algorithm used in this technique is simple and fast. The mathematical representation can be:

\[ g = ku + N \]

(1)

This convolution model can also be written as a matrix-vector product [7].

\[ B = KL + N \]

(2)

where \( u \) and \( k \) are sharp image and blur matrix respectively. \( N \) is the sensor noise.

Image deconvolution can be further separated into two

First, the blur kernel is estimated from the input image. The estimation process is performed in a coarse-to-fine fashion in order to avoid local minima. Second, using the estimated kernel, apply a standard deconvolution algorithm to estimate the latent (unblurred) image[6].

Kernel estimation takes place only on high frequency of the image. Filters can be used to generate a high frequency versions[5]. The filters can be \( \Delta x = [1, 1] \) and \( \Delta y = [1, 1] \), the cost for spatially invariant blurring can be:

\[ \min_{x, k} \lambda \| x \times k \|_2^2 + \| |x_1| / |y_1| + \varphi \| k \|_1 \]  \quad (3) \]

This equation can have 3 terms. First can be the formation model of equation (1). Second term is the regularizer that helps to scale invariant sparsity in reconstruction. \( \lambda \) and \( \varphi \) helps to control the strength of the kernel. This is a non convex problem and can be solve by optimizing the values of \( k \) and \( x \).

Then the updation by these values can be done. That is given by:

\[ \min_{x, k} \lambda \| x \times k - y \|_2^2 + \| |x_1| / |y_1| \]  \quad (4) \]

This subproblem can be non convex due to the presence of regularization term[5]. The denominator can fix the sub problem then it becomes convex regularized problem. Once the kernel is estimated then a verity of deconvolution method can be used to recover the original image.

3. Low Rank Prior

This approach proposes a novel low rank prior for blind image deblurring[2]. That means information about the blur is not known. It is based on directly applying a simple low rank model to a blurry input image and thus reduce the blur effect by protecting the edge information. This method for image deblurring is done by combining the low rank prior of similar patches from both blurry image and gradient map. A weighed nuclear norm minimization is also used to enhance the result of the deblurring technique.
where b, l and n are vector forms of b, l and n m. is the camera pose and $H_m$ is transformation matrix.

4. Alternating Direction Method Of Multipliers

The demand of high resolution image is increasing now a days. This technique can able to extract high resolution(HR) image or super resolution images from low resolution images(LR).super resolution is a process of combining a sequence of low resolution(LR)noisy blurred images to produce a higher resolution (HR)image or sequence[9]. The general equation of deblurring introduced here is

$$\min||Ax-y||^2 + \tau \Phi(x)$$  \hspace{1cm} (8)

First part of the equation for image deblurring and second part is called regularizer. ADMM can perform on images with unknown boundaries. Unknown boundary means that while deblurring the image can be divided to blocks. these blocks can have fixed width. while deblurring all other methods create artifacts along these widths. ADMM avoids this problem. by adding a new weight factor in error minimizing term.

$$\min||A^* w^* - y||^2 + \tau \Phi(x)$$  \hspace{1cm} (9)

This technique introduces a multi frame super resolution (MFSR) to estimate high resolution image from a low resolution images[8]. This MSFR problem can be reformulated into a problem of multi frame blind deblurring(MFDB). This technique adopt a matrix vector notation[10].

5. Discussion

Three algorithms are compared here. Among that better one has to find out. So their performance can be compared.

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6. Conclusion

Image deblurring have a important role today. Three techniques were compared above among that ADMM shows a better performance. ADMM can be combine with low rank prior method and it can show better performance. ADMM also support for rich texture images.

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