Motion Blur Deblurring

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Abstract- Trying to predict accurate angle and length of a motion blurred image to predict a PSF, for deconvolution for deblurring.

Keyword - Selective, Blurring, Gaussian, Motion, Defocus

1. INTRODUCTION

Motion blur is the most frequent type of image deterioration when taking pictures with handheld cameras. When the camera and the item being captured move in relation to one another during the exposure time, motion blur results. The point spread function (PSF) is convolved with the original image to produce a motion blurred image. The original image can be easily recovered from the blurred one if the blur kernel, or PSF, is known beforehand. However, in the blind deconvolution issue, both the blur kernel and the original image must be estimated from a single blurred image because both unknowns are unknown.

$$g(x, y) = f(x, y)*h(x, y) + n(x, y)$$

2. MOTION BLUR ATTRIBUTES

In order to implement various blurring effects, kernel corresponding to each blur is designed as per the user's need. The kernel, later, is convolved over the image. Let us examine Blur Kernels for various blur effects.

$$h(x,y) = \begin{cases} \dfrac{1}{L}, & \text{if } \sqrt{x^2+y^2} \le \dfrac{L}{2},\ \dfrac{x}{y} = -\tan(\phi), \\ 0, & \text{otherwise.} \end{cases}$$

The frequency response of h is a SINC function. This implies that "if an image is affected only by motion blur and there is no additive noise, then we can see dominant parallel dark lines in its frequency response

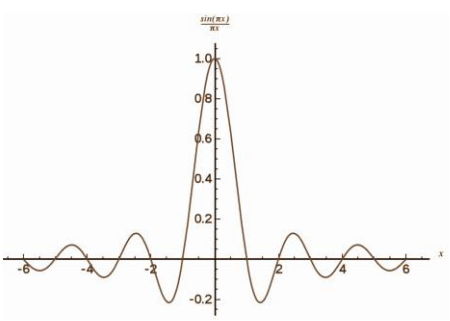


Fig 1 Sinc Function

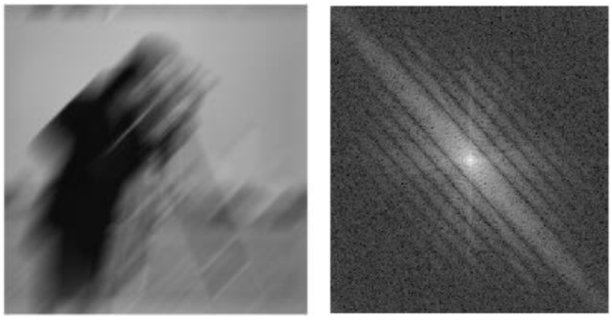


Fig 2. Spectral lines (l=45,Φ=45)

In this section, we propose a solution for cases in which the image is corrupted by degradation function without additive noise (i.e., n(x, y) = 0). In the absence of noise, (3) concludes that

$$G(u,v) = F(u,v) \cdot H(u,v),$$

3. IMPLEMENTATION

3.1 Proposed angle estimation scheme

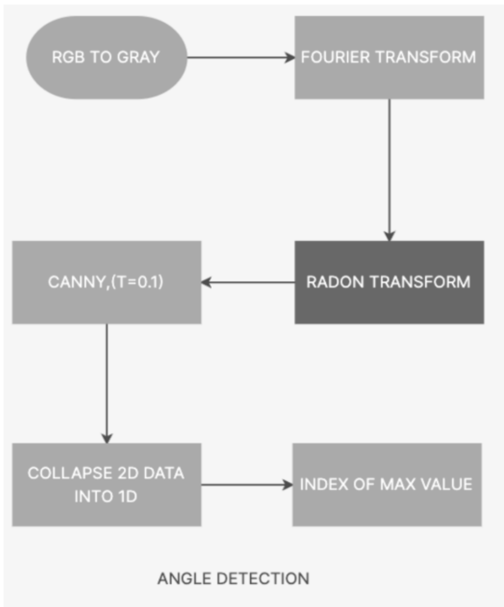


Fig 3 Angle Detection Flowchart

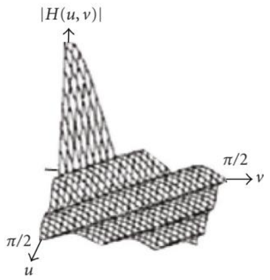


Fig 4 Frequency response(SINC function)

Convert any motion blurred image, to gray scale image and apply the fourier transform , and log shift the fourier spectrum to see the spectrum clearly, then transform the image using ra don transform , which converts any image into 180 columns, which is good to detect the slope of spectral lines.

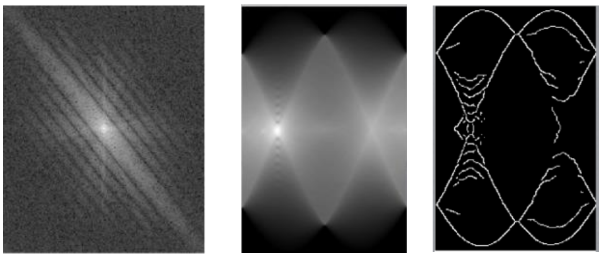
3.1.1 Radon transform

The Radon transform is an integral transform made up of a function's integral along straight lines. A real-valued function (x, y) defined over R at an angle and a distance from the origin has the following Radon transform:

$$R(\phi, \rho, \theta) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \phi(x, y) \cdot \delta(\rho - x \cos\theta - y \sin\theta) dx dy,$$

After performing the Radon transform, apply canny edge detector tion technique (T=0.1) to get the best result, after that you can

calculate the variance along the 180 columns and the Index of the column which has the maximum variance will be our desired angle.



(1)Spectral (2)Radon (3)Canny

3.2 Blur length estimation scheme

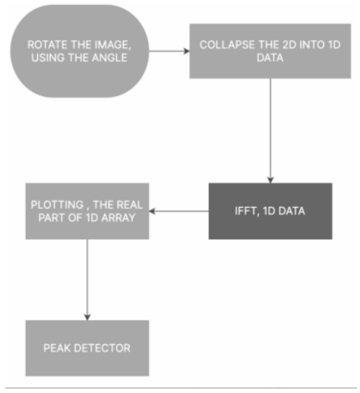


Fig 4 Length Detection Flowchart

For predicting the length of our Motion Blur, first we need to correctly predict the angle of the image and rotate the spectral lines to make them straight (90*) and then convert this image into 1D data , by taking the sum of the column and then taking the inverse Fourier transform, and plotting the value of the 1D plot, we can observee the first negative peak is the length our blur.

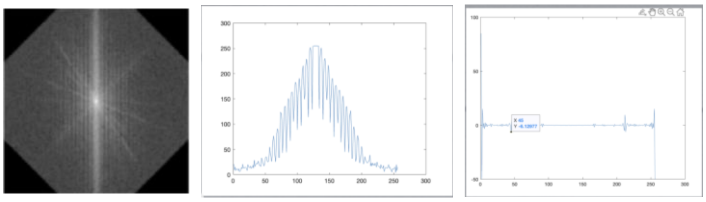


Fig 4 Length Detection

Here we can see the first negative peak value of the 1D plot is at (L=45), Hence we can assume the length of the blur is 45.

3.3 PSF Estimation

After Correctly predicting the length and the angle of blur we now create a PSF using these two parameters and try to unblur the image using a wiener filter using the deconv function.one can reduce the noise by applying median and mean filters on the image

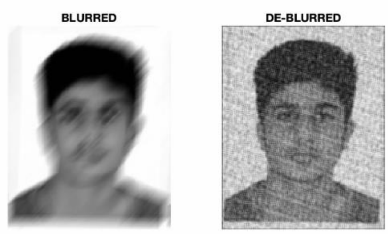


Fig 7 (1) Blurred (2) Unblur

I. ANALYSIS

There are various ways to correctly predict the angle and length of the image, in this report the method for angle estimation has an accuracy of 97.3% for values of L>10 and about 93% for L<10. Also, the overall time taken compare to the cepstrum approach is less.

II. CONCLUSION

In this paper we discussed one more method to effectively calculate the motion blur and to predict the angle of the image. One more method could be by using the Radon transform of the image . In this transform the specified values are the downturn of the sinc function and have the least values in the

Fig 7 Radon Transforms

region, we can clearly see that the y-coordinate of all of these values is same, considering that the length of the blur is same. and we have varied the nagle from 15-100 degrees. From this we can effectively calculate the motion blur of the image.

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