Deblurring Images using a Wiener Filter

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ABSTRACT

This paper basically represents how to deblurring images using a wiener filter [1]. Basically wiener filter is used to produce an estimate of a desired or target random process by linear time-invariant filtering [2] of an observed noisy process, assuming known stationary signal and noise spectra, and additive noise. The Wiener filter minimizes the mean square error between the estimated random process and the desired process. In here it has been introduced about the image processing capabilities in MATHLAB. Dividing some steps it has been shown how an image can be processed with the help of MATHLAB [3][4] command. Moreover how image can be effected by noise & how noise can be removed from image this also described in this paper properly

Keywords
Wiener filter, Motion Blur, Image Processing, Blurred Image, Quantized Image, NSR

1. INTRODUCTION

Image processing is nothing but a procedure or process in which the data from an image are digitized and various mathematical operations are applied to the data, generally with a digital computer, for creating an enhanced image which is more applicable or pleasing to a human observer or to perform some of the interpretation and recognition tasks usually performed some of the interpretation and recognition tasks usually performed by humans [5]. Objectives of this paper are to i) Read image and simulate a motion Blur ii) Restore the blurred image, simulate Blur and Noise iii) Restore the Blurred and noisy image [10] iv) Restore the Blurred, Quantized image using computed NSR. All are simplified by MATHLAB commands properly. These commands will clear the deblurring technique using which others can get help in future for any research of image processing

2. MATHLAB COMMANDS

```
I=im2double(imread('12345.jpg'));

imshow(I);

title('Original Image(courtesy of MIT)');

figure()

LEN= 45;

THETA= 15;

PSF=fspecial('motion', LEN, THETA);

blurred=imfilter(I,PSF, 'conv', 'circular');

imshow(blurred);

figure();

title('Blurred Image');
```

```
wnr1= deconvwnr(blurred,PSF,0);

imshow(wnr1);

title('Restored Image');

figure();

noise_mean = 0;

noise_var=0.0001;

blrred_noisy=imnoise(blurred,'gaussian', noise_mean, noise_var);

imshow(blurred_noisy)

title('Simulate Blur and Noise');

figure()

wnr2= deconvwnr(blurred_noisy,PSF,0);

imshow(wnr2);

title('Restoration of Blurred ,Noisy Image Using NSR=0');

figure ();

signal_var= var(I(:));

wnr3= deconvwnr(blurred_noisy, PSF, noise_var / signal_var);

imshow(wnr3);

title('Restoration of Blurred ,Noisy Image Using Estimated NSR');

figure ();

I=imread('12345.jpg');

class(I)

blurred_quantized=imfilter(I,PSF, 'conv', 'circular');

class(blurred_quantized)

wnr4= deconvwnr(blurred_quantized, PSF, 0);

imshow(wnr4);

title('Restoration of Blurred ,quantized image using NSR=0');

figure ();

uniform_quantization_var=(1/256)^2/12;

signal_var= var(im2double(I(:)));

wnr5=deconvwnr(blurred_quantized,PSF,uniform_quantization_var / signal_var);

imshow(wnr5);

title('Restoration of Blurred,Quantized Image Using Computed NSR');
```

3. EXPLANATION OF EACH COMMAND

Wiener deconvolution can be useful when the point-spread function and noise level are known or can be estimated.

3.1 Imread

Imread command is used to read an image.

I=imread('12345.jpg'): the example reads one of the sample images included with the toolbox, 12345.jpg and stores it in array named I.

3.2 Imshow

imshow is the toolbox's fundamental image display function.

3.3 Blurred Image

Simulate a blurred image that you might get from camera motion. Create a point-spread function, PSF, corresponding to the linear motion across 31 pixels(LEN=31),at an angle of 11 degrees(THETA=11).To simulate the blur, convolve the filter with the image using imfilter.

3.4 Restore the Blurred Image

The simplest syntax for deconvwnr is deconvwnr (12345,PSF,NSR), where 12345 is the blurred image, PSF is the point-spread function and NSR is the noise-power to signal power ratio. The blurred image formed in Step 2 has no noise so we'll use 0 for NSR.

3.5 Subsequent Pages

In this state we simulate blur and in the image 12345 with the help of MATHLAB command

 title ('Blurred Image');

 wnr1= deconvwnr (blurred,PSF,0);

 imshow(wnr1);

3.6 Restore the Blurred and Noisy Image

First Attempt: In our first restoration attempt, we'll tell deconvwnr that there is no noise (NSR=0). When NSR=0, the Wiener restoration filter is equivalent to an ideal inverse filter. The ideal inverse filter can be extremely sensitive to noise in the input image.

Second Attempt- In our second attempt we supply an estimate of the noise-power to signal power ratio.

3.7 Simulate Blur and 8-Bit Quantization Noise

Even a visually imperceptible amount of noise can affect the result. Let's try keeping the input image in unit8 representation instead of converting it to double.

3.8 Restore the blurred, Quantized Image

First Attempt- Again we 'll try first telling deconvwnr that there is no noise. Restore the Blurred,Quantized Image: Second Attempt- Next we supply an NSR estimate to deconvwnr.

4. MATHLAB SIMULATION RESULTS

Original image (courtesy of MIT)

Figure1. Original image (courtesy of MIT)

Blurred Image

Figure2. Blurred Image

Restored Image

Figure3. Restored Image

Simulated Blur and Noise

Figure4. Simulated Blur and Noise

Restoration of Blurred, Noisy Using SNR=0

Figure5. Restoration of Blurred, Noisy Using SNR=0

Restoration of Blurred, Noisy Image Using Estimated SNR

Figure6. Restoration of Blurred, Noisy Image Using Estimated SNR

Restoration of Blurred, Quantized Image Using SNR=0

Figure7. Restoration of Blurred, Quantized Image Using SNR=0

Restoration of Blurred, Quantized Image Computed SNR

Figure8. Restoration of Blurred, Quantized Image Computed SNR

5. IMPORTANCE OF IMAGE PROCESSING SYSTEM

Image processing involves changing the nature of an image in order to either:

I). Improve its pictorial information for human interpretation [6]-[9]

ii). Render it more suitable for autonomous machine perception

iii). Enhancing the edges of an image to make it appear sharper; sharpening edges is a vital component of printing: in order for an image to appear at its best on the printed page; some sharpening is usually performed.

iv). Removing noise from an image ; noise being random errors in the image. Noise is a very common problem in data transmission: all sorts of electronic components may act data passing through them and the results may be undesirable

v). Removing motion blur from an image. Motion blur may occur when the shutter speed of the camera is too long for the speed of the object in photographs of fast moving objects: athletes, vehicles for example the problem of blur may.

vi). Obtaining the edges of an image. This may be necessary for the measurement of objects in an image.

6. CONCLUSION

This paper is going to introduce to the image processing capabilities in MATHLAB. How an image can be processed with the help of MATHLAB and how an image can be affected by noise and how that noise is partially removed from image it is observed clearly from this paper. It has been used a wiener filter. This filter minimizes the mean square error between the estimated random process and the desired process. It is very important and widely used process in which images are processed to retrieve information that is not visible to the naked eye.

7. REFERENCES

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