Advanced Digital Image Process

HW#7

作業#7

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### Development environment：

OS：unbuntu18.04

Editing tools：VScode

complilation tools：CMake

opencv version：3.2.0

1.Periodic Noise

1. Use Notch filtering to remove the periodic noise in the frequency domain. Show the clean image.

|  |  |
| --- | --- |
| origin image | origin image DFT |
|  |  |

We use a notch filter to remove the periodic noise. After DFT the image, we can see two crosses on the image. This probably is the noise source so we try to remove the cross, but it isn’t very good. As shown on the below.

|  |  |
| --- | --- |
| after line removal DFT | IDFT |
|  |  |

We can see Kirby's face is a little dirty, and there was some line still didn’t removed.

So we just remove the 2\*2 points at the upper left and lower right point, the result is very good.

|  |  |
| --- | --- |
| After Notch Filtering DFT | After Notch Filtering IDFT |
|  |  |

1. Use band reject filtering to remove the periodic noise in the frequency domain. Show the clean image.

|  |  |
| --- | --- |
| after band reject filter DFT | IDFT |
|  |  |

As we can see we still got noise on the Kirby. If we give a bigger d0 we will get the noise off but a lot of details. So the Kirby image will become dirty.

1. Discuss and compare the effects of different methods.

The difference between band reject filter and Notch filter is the former will take a lot of detail of, so it will have a lot of dirty lines on the image, and the latter one can just take off what you don’t want, so it can make the image more clean.

2.Debluring

Perform inverse filter and Wiener filter separately on motion\_flower.raw to unblur the image which is blurred by motion as g(x,y) function. Show the output images and discuss the visual difference between the result images.

|  |  |
| --- | --- |
| motion flower | DFT |
|  |  |

1. Inverse filter

|  |  |
| --- | --- |
| inverse filter H(u,v) | DFT |
|  |  |

We saw the motion flower’s DFT has some unnatural dark region, so we thought if we increase the dark part then we can have a deblur image.

result

|  |  |
| --- | --- |
| before deblur | after deblur |
|  |  |

As we can see after we deblur there is some weird effect, but the edge of the image is more intense, especially at the stamen.

1. Wiener filter

|  |  |
| --- | --- |
| before deblur | after deblur |
|  |  |

Same as inverse filter we enhance the dark region at DFT. Let see the effect.

|  |  |
| --- | --- |
| before deblur | after deblur |
|  |  |

The wiener filter can enhance the edge too but inhibition the noise.but it is not obvious at this image because the image didn’t have a right noise.

The difference between inverse and wiener is the former cannot predict the SNR of the image but the latter can. So when the inverse filter H(u,v) is very small the noise will dominate the image, so we need to set a lower limit, but the wiener filter can predict the SNR so we can set the parameter k to remove the noise.

We can’t see the difference between these two images because the teaching assistant didn’t put a gaussian noise on the blur image.

Image link: [google drive](https://drive.google.com/drive/folders/1fxsQhLq92E-ZNpWeufCDo3-1GBgfpC2F?usp=sharing)