Advanced Digital Image Process

HW#7

作業#7
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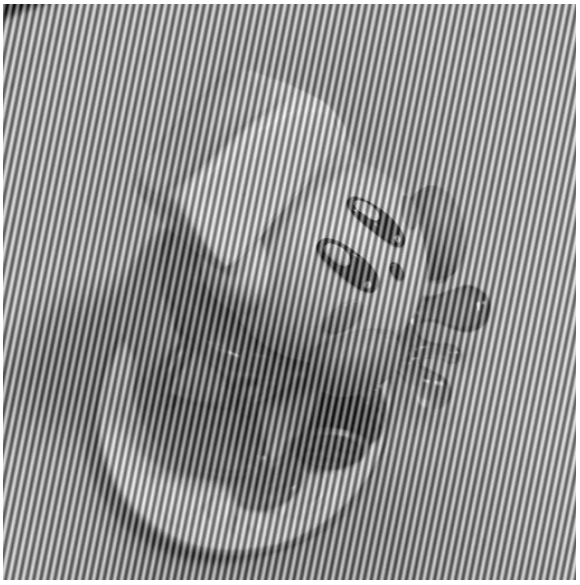
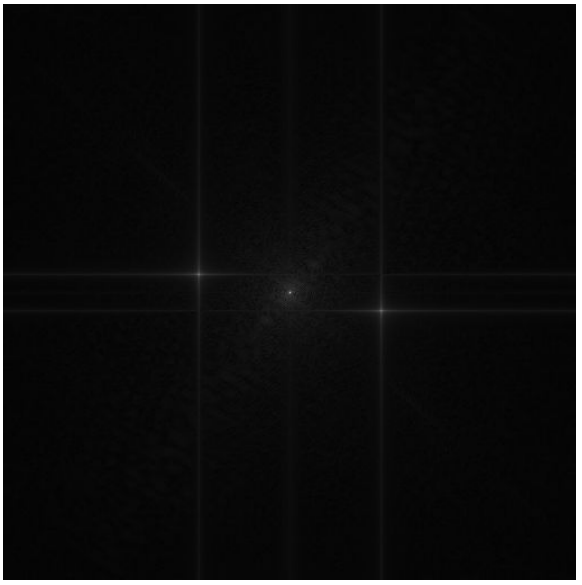
Development environment：

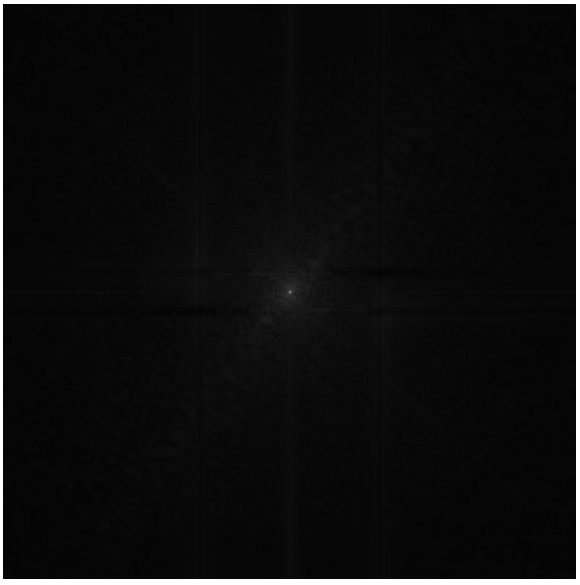
OS：unbuntu18.04
Editing tools：VScode
complilation tools：CMake
opencv version：3.2.0

1.Periodic Noise

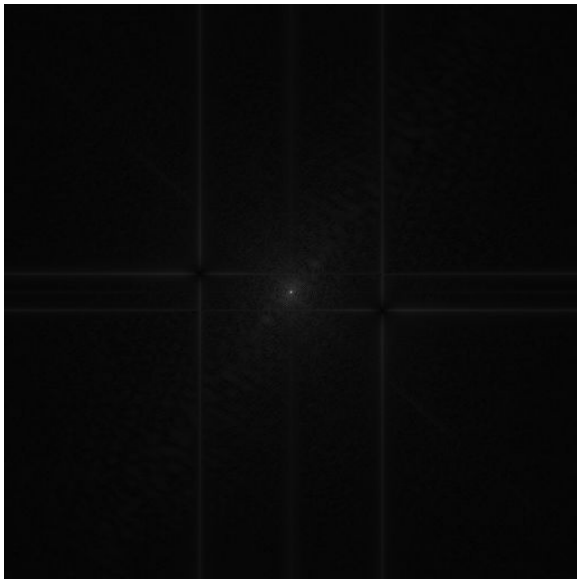
(a) Use Notch filtering to remove the periodic noise in the frequency domain. Show the clean image.

origin image	origin image DFT
	

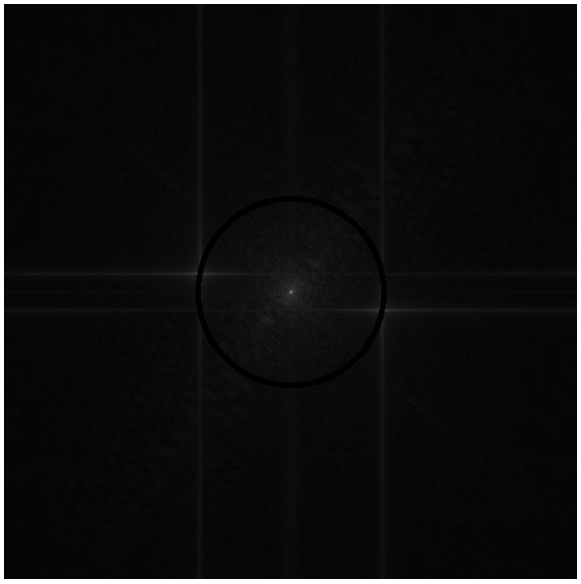
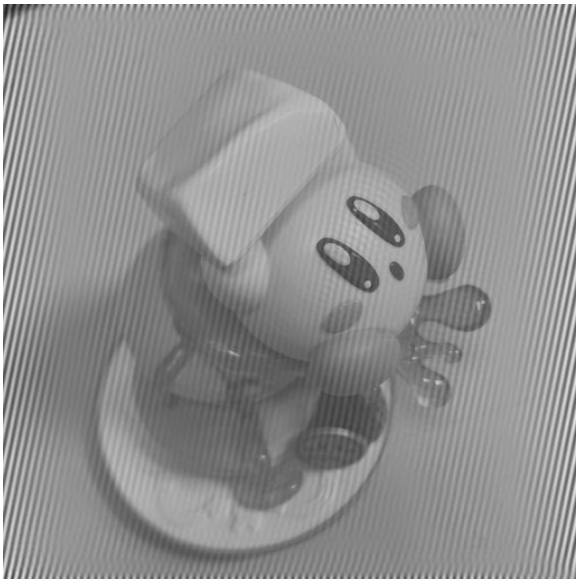
We use a notch filter to remove the periodic noise. After DFT the image, we can see two crosses on the image. This probably is the noise source so we try to remove the cross, but it isn't very good. As shown on the below.

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
	

(b) 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.

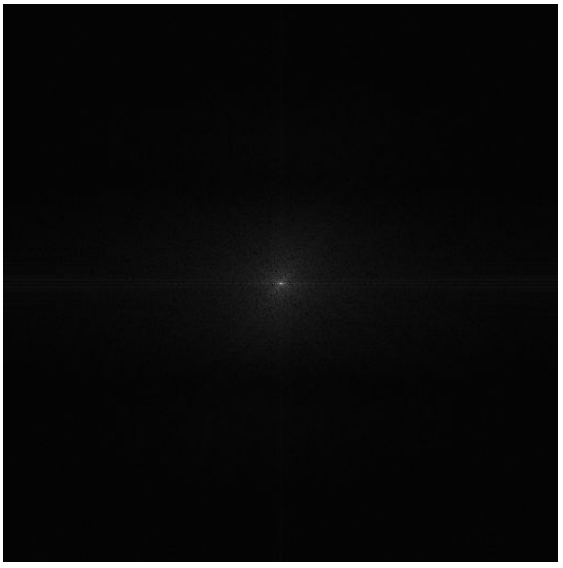
(c) Discuss and compare the effects of different methods.

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.

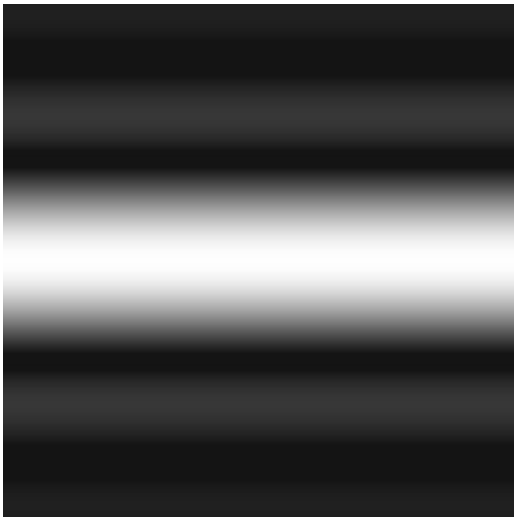
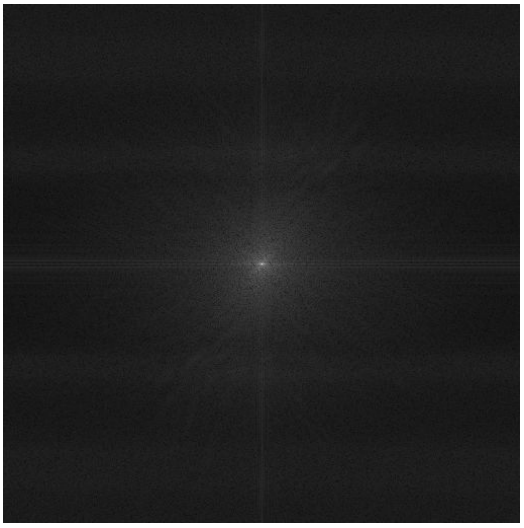
2.Debluring

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.

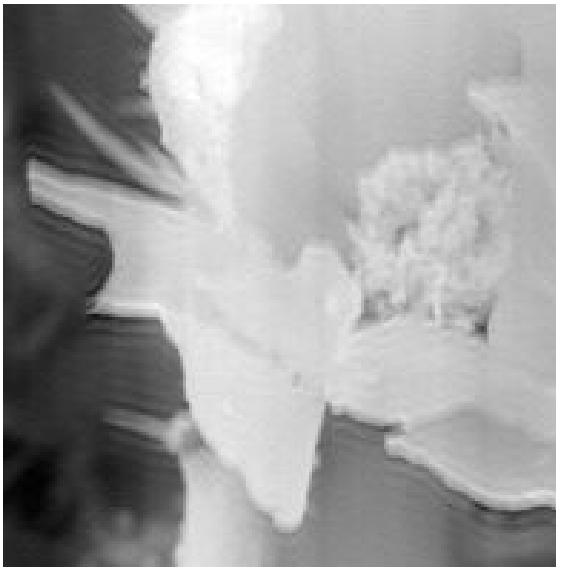
$$g(x,y) = \int_0^1 f(x, y + 0.01t)dt$$

motion flower	DFT
	

(a) Inverse filter

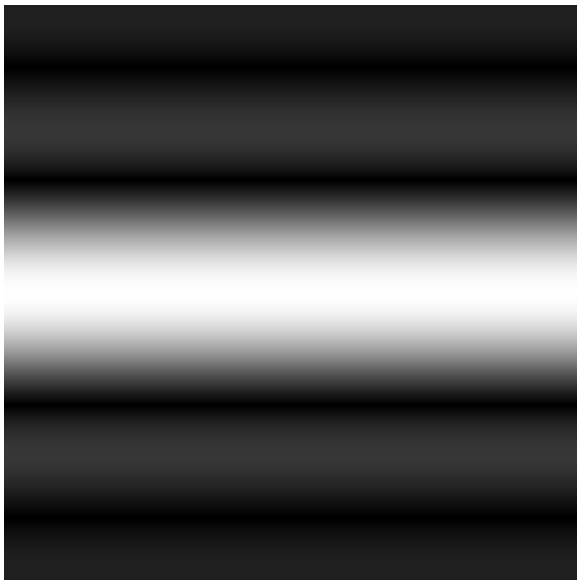
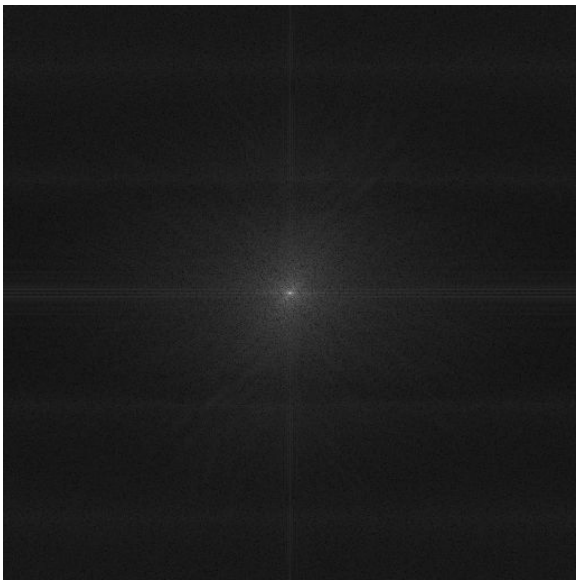
inverse filter H(u,v)	DFT
	

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.

(b) 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