Project 2: Image restoration

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Instructions

- **This Project counts 10% of the total score.**

1. Implement a blurring filter using the equation (5.6-11) in textbook, and blur the test image 'book_cover.jpg' using parameters a=b=0.1 and T=1. (2%)

2. Add Gaussian noise of 0 mean and variance of 500 to the blurred image. (1%)

3. Restore the blurred image and the blurred noisy image using the inverse filter. (3%)

4. Restore the blurred noisy image using the parametric Wiener filter with at least 3 different parameters, and compare and analyse results with that of 3.(4%)

- **Requirement**

1. You should finish this project by yourself and package your code and report in one folder, named after 'hm4_name_number'.

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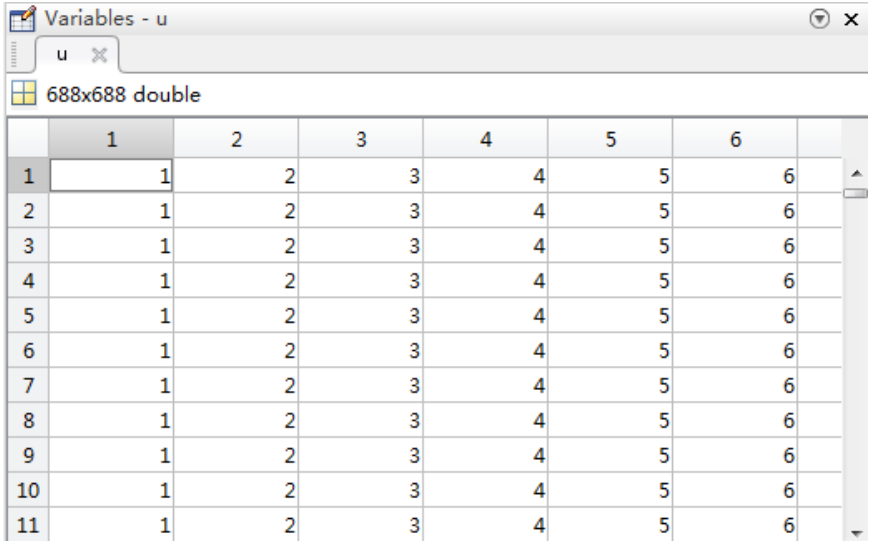
Part 1: Implement a blurring filter

- equation (5.6-11)

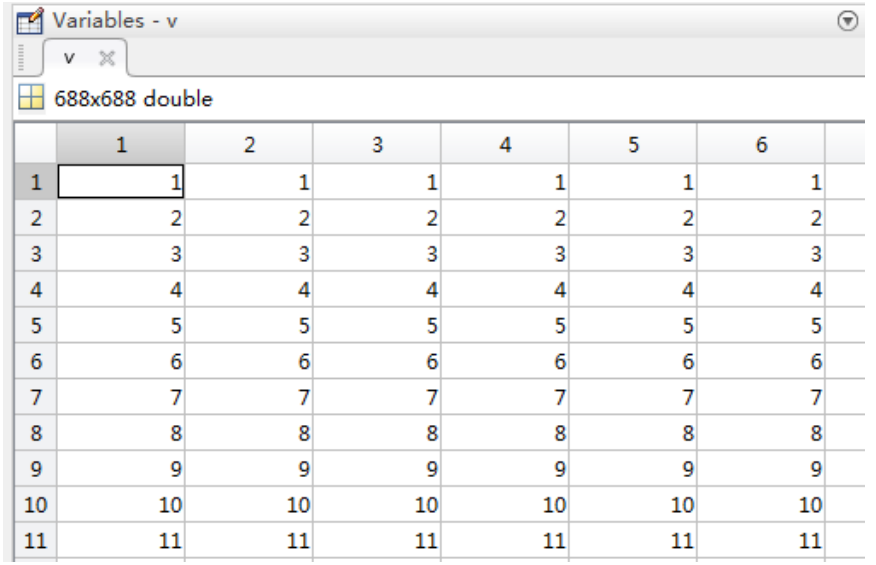
$$H(u,v) = \frac{T}{\pi(ua+vb)}\sin[\pi(ua+vb)]e^{-j\pi(ua+vb)}$$

Code for the equation

```
u=1:m; v=1:n;   %[m,n]: size of the input image
[u,v]=meshgrid(u,v);
uv=u.*a+v.*b+eps;
H=T.*sin(pi.*uv).*exp(-1i.*pi.*uv)./(pi.*uv);
```



	1	2	3	4	5	6
1	1	2	3	4	5	6
2	1	2	3	4	5	6
3	1	2	3	4	5	6
4	1	2	3	4	5	6
5	1	2	3	4	5	6
6	1	2	3	4	5	6
7	1	2	3	4	5	6
8	1	2	3	4	5	6
9	1	2	3	4	5	6
10	1	2	3	4	5	6
11	1	2	3	4	5	6

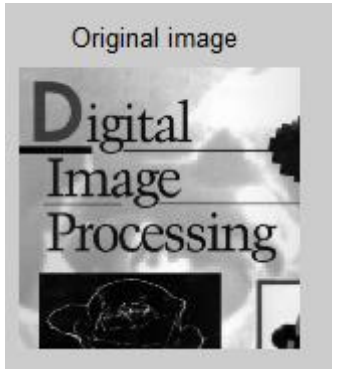


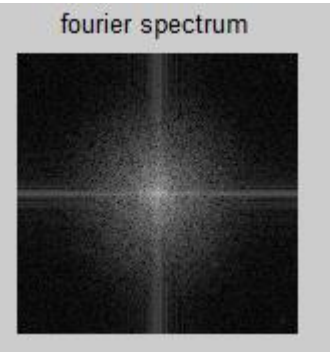
	1	2	3	4	5	6
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9
10	10	10	10	10	10	10
11	11	11	11	11	11	11

Part 2: blur the test image

- fourier transform

```
im=imread('book_cover.jpg');   % uint8
I=im2double(im);
F=fft2(I);
% F: shift to center
imshow(log(1+abs(F)),[]);    % abs: fft2 and ifft2
```





- blurred filter

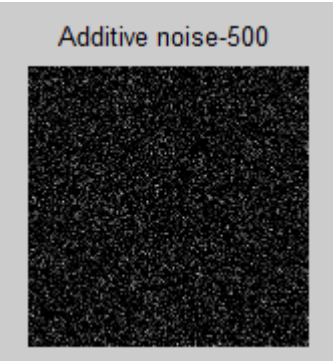
```
uv=..............(shift to the center)+eps;
H=T.*sin(pi.*uv).*exp(-1i.*pi.*uv)./(pi.*uv);
G=H.*F;
```

Part 3: Add Gaussian noise

- Gaussian noise

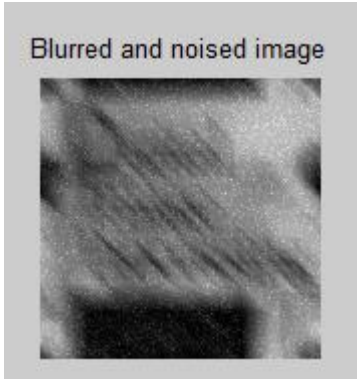
```
variance=500/255^2;
```

```
Generate gaussian noise function: imnoise
```



- Add Gaussian noise to the blurred image

```
f_blurred_noised=abs(f_blurred)+noise;
```



Part4 : Image restoration by direct inverse filtering

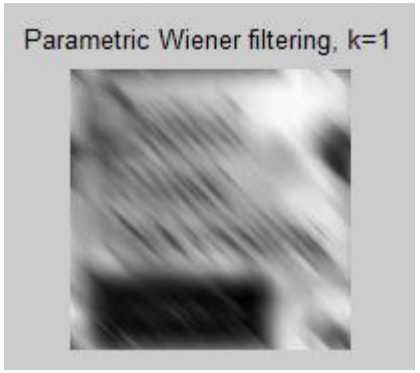
- direct inverse filtering

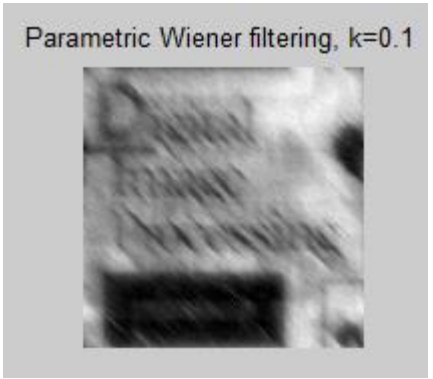
```
G=fft2(f_blurred)
F_inverse=G./H;
```

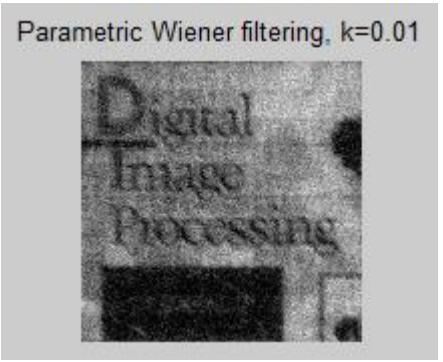
Part5：Image restoration by Parametric Wiener filtering

- Parametric Wiener filtering: equation (5.8-6)

$$\hat{F} = \left[\frac{1}{H(u,v)} \times \frac{|H(u,v)|^2}{|H(u,v)|^2 + k} \right] \cdot G(u,v) \qquad |H(u,v)|^2 = H \cdot H^T$$







要求：

（1）三个部分，算法描述和文档、代码和有关结果图像

（2）语言：Matlab

（3）学术规范：自己独立完成，抄袭者和被抄袭者的成绩一律按原成绩的50%计。

project提交方式和完成时间：

（1）文档、代码和图像以 WINZIP 打包，文件名为：hm4-姓名-学号，交作业邮箱：dip2016@126.com

（2）project完成时间：课堂完成并发送Email，其后收到的不计成绩。