56046680

Question 21

6 pts

Point out by what kinds of noises the images shown in the following image are corrupted. Which methods can be used to remove noises? (6 points)

(a) (b) (c)

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12pt Paragraph B I U A T²

A

Noises: Impulse (salt-and-pepper)

Methods: Applying Median Filter or Alpha-trimmed Mean

B

Noises: Periodic noise

Methods: Notch Filters

C

Noises: Motion blur

Methods: Weighted Smoothing Filters

Question 22 — 4 pts

Whether the adaptive filter could enhance edges? Please illustrate the reasons. (4 points)

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12pt Paragraph

Yes, it can enhance edges from salt & pepper noises image, as if the it is a zero noise case, the input value g(x,y) will equal to f(x,y), and if the local variance is high relative to the noise variance, it is associated with edges.

p 48 words

Question 23 — 6 pts

There is an image shown as follows because of the noise interruption. How do you process the noisy image? Show the result. (6 points)

1	1	1	8	7	4
2	255	2	3	3	3
3	3	255	4	3	3
3	3	3	255	4	6
3	3	4	5	255	8
2	3	4	6	7	8

After Replicate-padding

1	1	1	1	8	7	4	4
1	1	1	1	8	7	4	4
2	2	255	2	3	3	3	3
3	3	3	255	4	3	3	3
3	3	3	3	255	4	6	6
3	3	3	4	5	255	8	8
2	2	3	4	6	7	8	8
2	2	3	4	6	7	8	8

After Harmonic Mean Filter

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

p

4 114 words </>

Question 24

10 pts

A 5*5 grayscale image is given by

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

(a) Please calculate the results with a Midpoint filter after replicate padding (filter size 3*3). (5 points)

(b) Please calculate the results with a Median filter after zero padding (filter size 3*3). (5 points)

A

After replicate padding

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

After Midpoint filter

4	5	6	4	4
4	5	6	4	4
6	6	5	4	4
7	6	5	3	3
8	6	5	3	2

B

After zero padding

0	0	0	0	0	0	0
0	2	5	5	7	1	0
0	3	4	7	6	2	0
0	4	6	5	4	2	0
0	9	7	4	3	1	0
0	8	6	3	2	3	0
0	0	0	0	0	0	0

After Median filter

0	3	5	2	0
3	5	5	5	2
4	5	5	4	2
6	6	4	3	2
0	4	3	2	0

A 6 x 6 image with eight gray levels is given below:

1	2	1	3	6	6
1	2	2	4	5	7
1	0	2	7	6	5
0	2	3	7	6	6
3	0	4	7	5	4
1	4	3	7	7	5

(a) Obtain the histogram of the image. Noted that histogram is not the pdf. (4 points)

(b) Apply histogram equalization on the above image and determine the new intensity values of the histogram equalized image. (10 points)

A

Gray level	hk	pdf	cdf	sk
0	3	0.083	0.083	1
1	5	0.139	0.222	2
2	5	0.139	0.361	3
3	4	0.111	0.472	3
4	4	0.111	0.583	4
5	4	0.111	0.694	5
6	5	0.139	0.833	6
7	6	0.167	1.000	7

B

New image

2	3	2	3	6	6
2	3	3	4	5	7
2	1	3	7	6	5
1	3	3	7	6	6
3	1	4	7	5	4
2	4	3	7	7	5

Gray level	hk
1	3
2	5
3	9
4	4
5	4
6	5
7	6

Question 26

8 pts

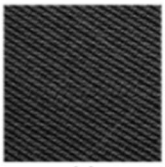
Match the images below to their corresponding Fourier transform spectrum and explain the reason. (8 points)


(a)

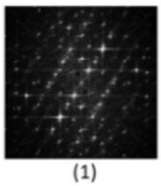

(b)

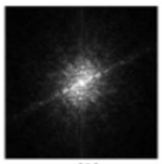

(c)

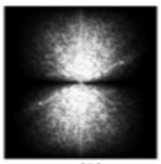

(d)

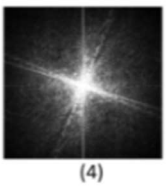

(e)

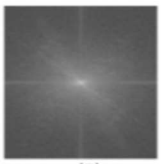

(f)

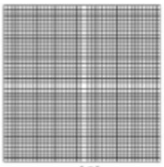

(1)


(2)


(3)


(4)


(5)


(6)

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12pt Paragraph B I U A T²

a -> 2, it is a slowly varying image with low frequency content.

b -> 4, it has a strong directional feature.

c -> 5, the changes in spatial domain of this image is more slowly, so it has more low frequency information in the frequency domain.

d -> 6, it has a shape edge will result in high energy perpendicular to the edge.

e -> 1, it has a periodic pattern.

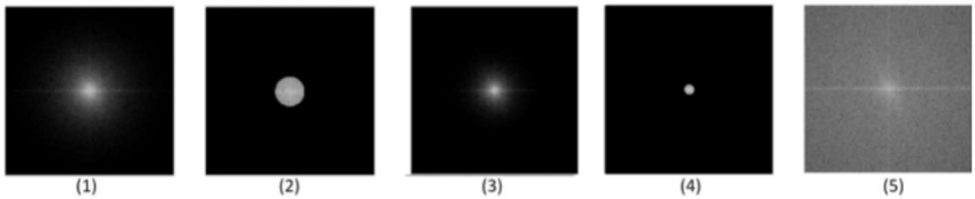
f -> 3, it is a fast varying image with high frequency content.

Question 27

8 pts

Match the images below to their corresponding Fourier transform spectrum and explain the reason. (8 points)

(a) (b) (c) (d) (e)



(1) (2) (3) (4) (5)

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12pt Paragraph B I U A T²

a -> 4, it is a image filtered by ILPF with lower f

b -> 2, it is a image filtered by ILPF with higher f

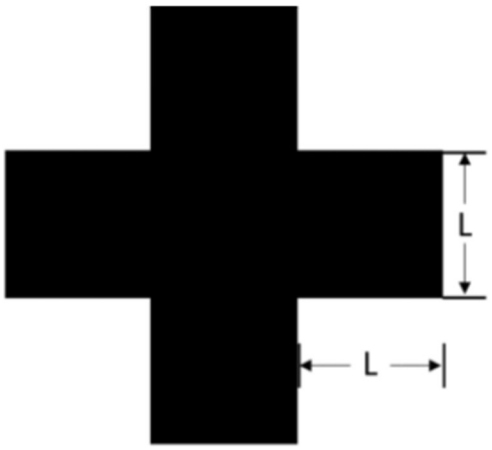
c -> 1, it is a image filtered by BLPF with higher D0

d -> 3, it is a image filtered by BLPF with lower D0

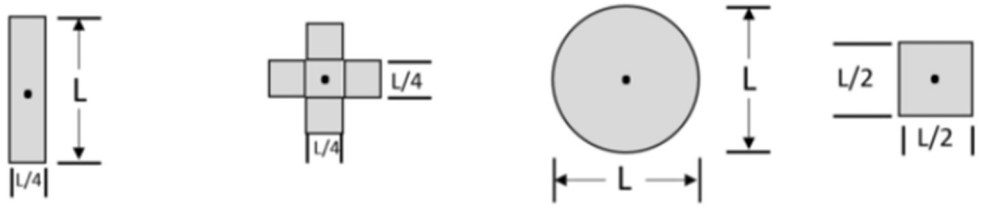
e -> 5, it is the original image that is no filter is applied

Let A denote the set shown shaded in the following figure. Refer to the structuring elements shown (the black dots denote the origin). Sketch the result of the following morphological operations. Please illustrate the steps clearly.

- $Y1 = (A \ominus B^3) \oplus B^2$ where $\ominus$ denotes the morphological erosion operator and $\oplus$ denotes the morphological dilation operator; (4 marks)
- $Y2 = (A \ominus B^1) \oplus B^4$. (4 marks)
- $Y2 = (A \ominus B^3) \oplus B^4$. (6 marks)

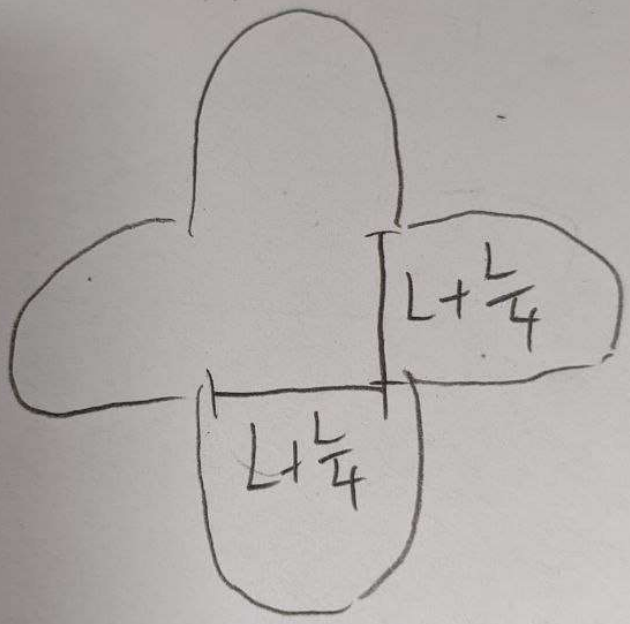


A

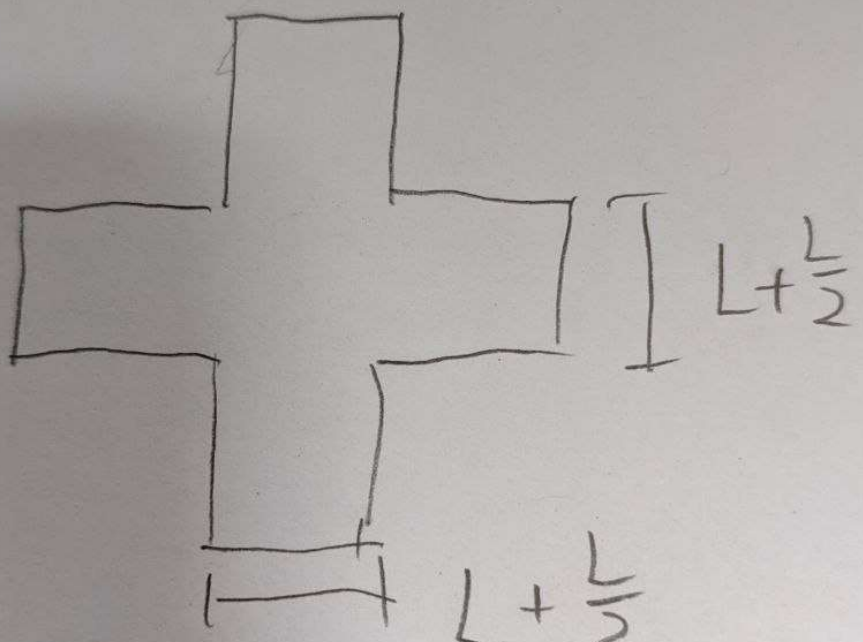


B^1 B^2 B^3 B^4

$$\gamma_1 = (A \ominus B^3) \oplus B^2$$



$$Y_2 = (A \ominus B^1) \oplus B^4$$



$$Y_2 = (A \ominus B^3) \oplus B^4$$