数字图像处理第四次实验

实验五 图像分割与图像特征描述

实验内容

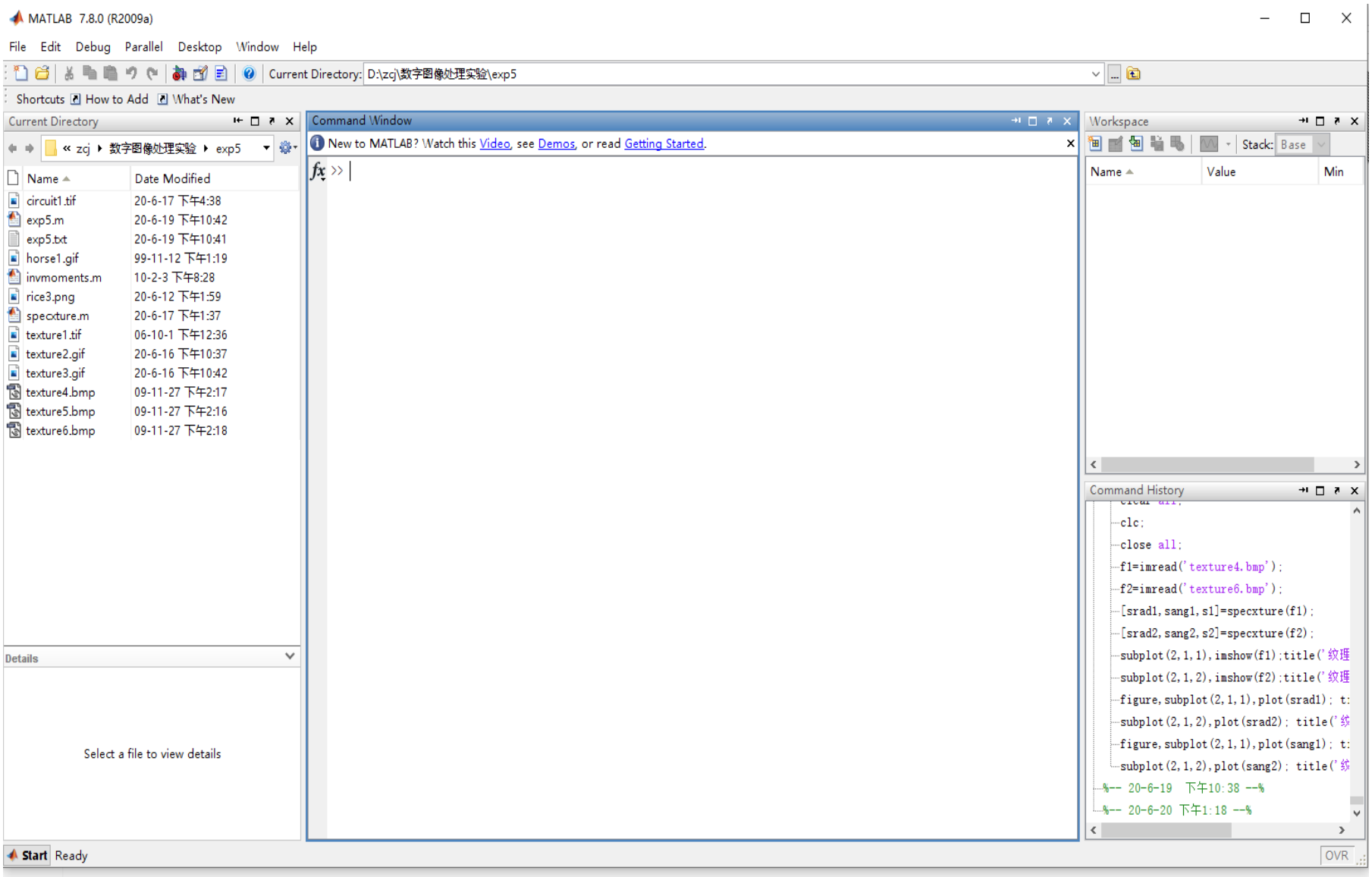
1、阈值法图像分割

2、图像边缘检测

3、不变矩的形状特征描述

4、基于频谱法的纹理图像特征描述

实验五 图像分割与图像特征描述



实验五 图像分割与图像特征描述

Editor - D:\zcj\数字图像处理实验\exp5\exp5.m

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```
%实验五 图像分割与图像特征描述

%1.基于阈值法的图像分割和边缘检测
%(1)查看图像的直方图，确定合适的阈值进行图像分割
clear all;
clc;
I = imread('rice3.png');
imshow(I,[]);title('原图')
figure,imhist(I,256);title('原图的直方图')
T=125;
level=T/255;
BW1=im2bw(I,level);
figure,imshow(BW1,[]);title('阈值法的图像分割')
T,

%(2)采用最大类间方差阈值法进行图像分割
clear all;
clc;
I = imread('rice3.png');
imshow(I,[]);title('原图')
figure,imhist(I,256);title('原图的直方图')
level = graythresh(I);  %取最大类间方差阈值
BW1=im2bw(I,level);     %图像二值化
figure,imshow(BW1,[]);title('最大类间方差阈值法的图像分割')
T=level*255;
T,

%(3)迭代法确定阈值法进行图像分割
```

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(1)查看图像的直方图，确定合适的阈值进行图像分割

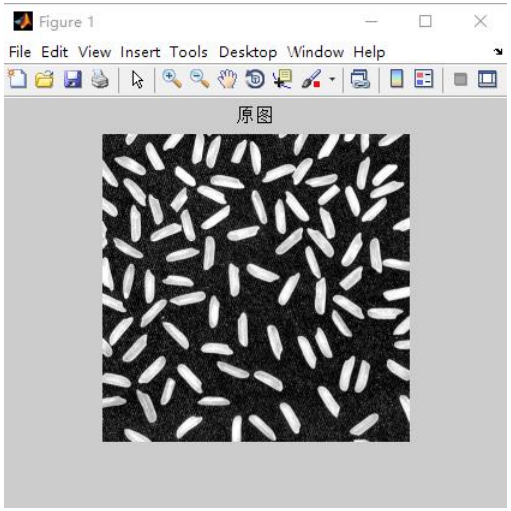
实验步骤

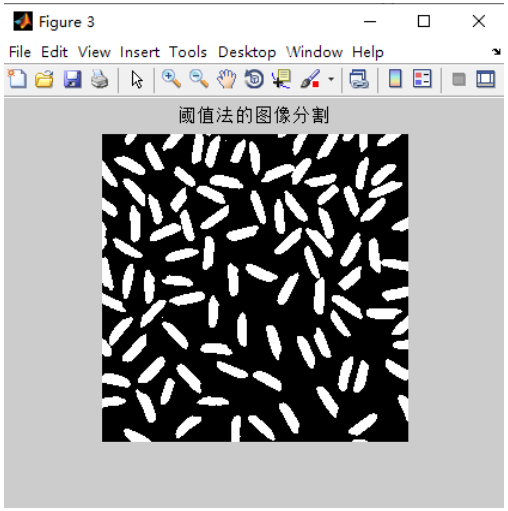
1.阈值法图像分割和图像边缘检测

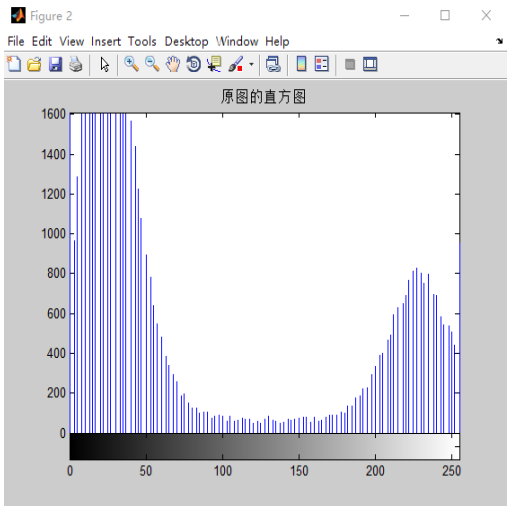
(1)查看图像的直方图，确定合适的阈值进行图像分割

```
clear all;
clc;
I = imread('rice3.png');
imshow(I,[]);title('原图')
figure,imhist(I,256);title('原图的直方图')
T=125;
level=T/255;
BW1=im2bw(I,level);
figure,imshow(BW1,[]);title('阈值法的图像分割')
T,
```

(1)查看图像的直方图，确定合适的阈值进行图像分割





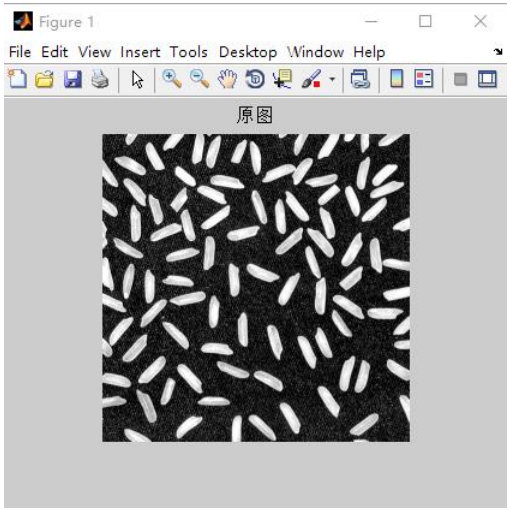


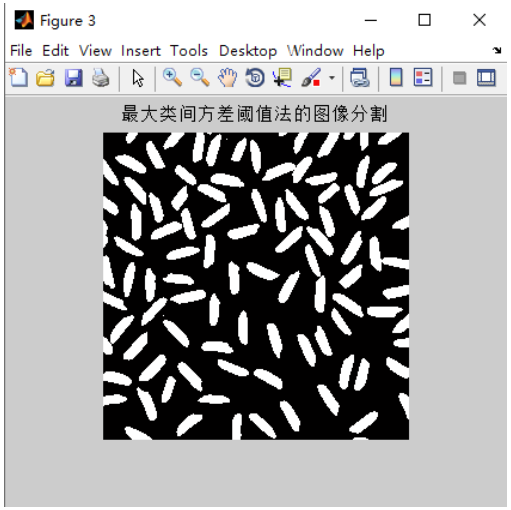

```
T =

   125
```

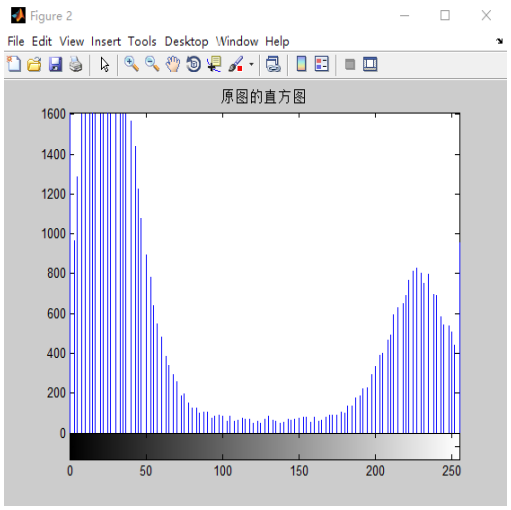
(2)采用最大类间方差阈值法进行图像分割

```
clear all;
clc;
I = imread('rice3.png');
imshow(I,[]);title('原图')
figure,imhist(I,256);title('原图的直方图')
level = graythresh(I);  %取最大类间方差阈值
BW1=im2bw(I,level);    %图像二值化
figure,imshow(BW1,[]);title('最大类间方差阈值法的图像分割')
T=level*255;
T,
```

(2)采用最大类间方差阈值法进行图像分割







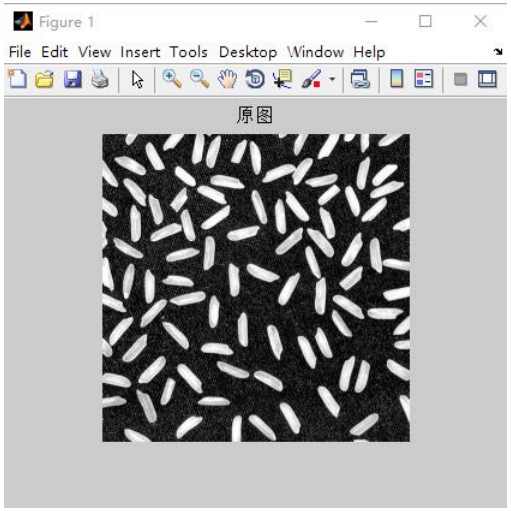

```
T =

   123.5000
```

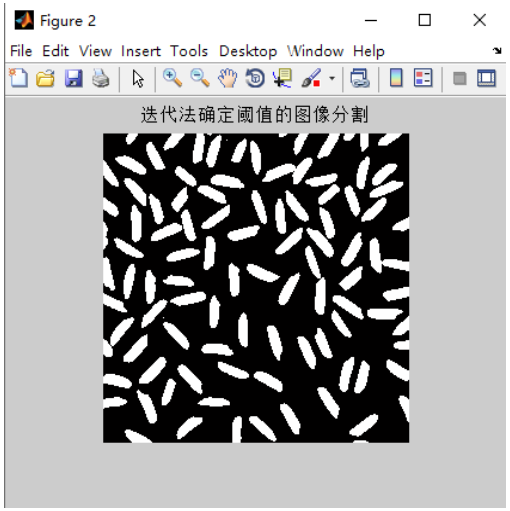
(3)迭代法确定阈值法进行图像分割

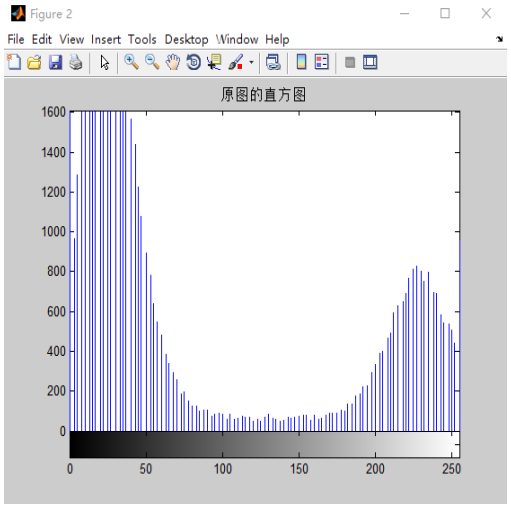
(3)迭代法确定阈值法进行图像分割

```
clear all;
clc;
I = imread('rice3.png');
imshow(I,[]);title('原图')
figure,imhist(I,256);title('原图的直方图')
T1=0.5*(double(min(I(:)))+double(max(I(:))));
done=false;
while ~done
   g=I>=T1;
   T2=0.5*(mean(I(g))+mean(I(~g)));  %迭代法确定阈值法
   done=abs(T1-T2)<0.5;
   T1=T2;
  end
level=T1/255;
BW1=im2bw(I,level);
figure,imshow(BW1,[]);title('迭代法确定阈值的图像分割')
T1,
```

(3)迭代法确定阈值法进行图像分割





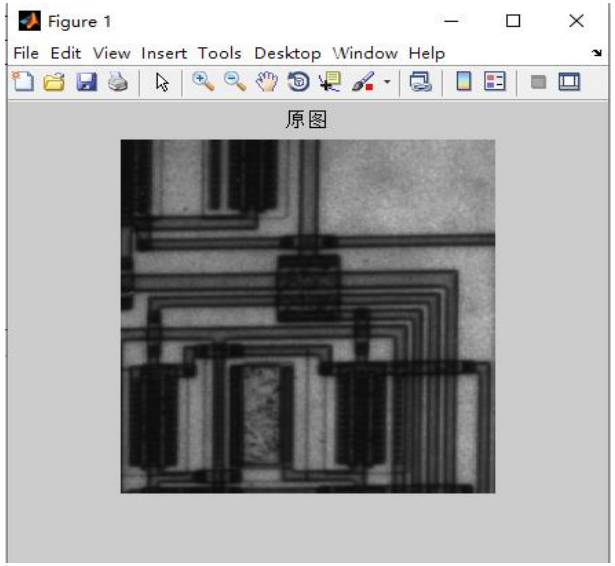


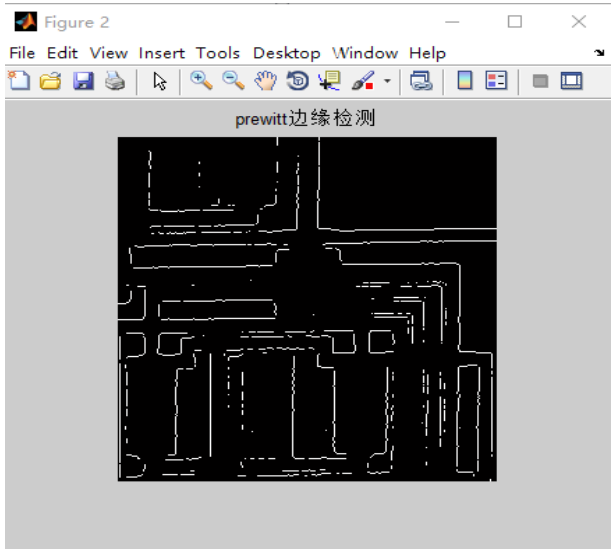

```
T1 =

   124.1010
```

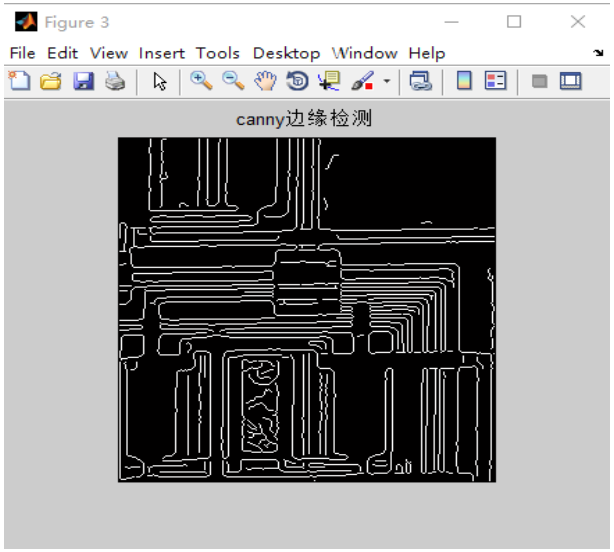
(4)比较prewitt算子与canny的边缘检测效果

```
clear all;
clc;
I = imread('circuit1.tif');
BW1 = edge(I,'prewitt');
BW2 = edge(I,'canny');
imshow(I);title('原图')
figure,imshow(BW1);title('prewitt边缘检测')
figure, imshow(BW2);title('canny边缘检测')
```

(4)比较prewitt算子与canny的边缘检测效果



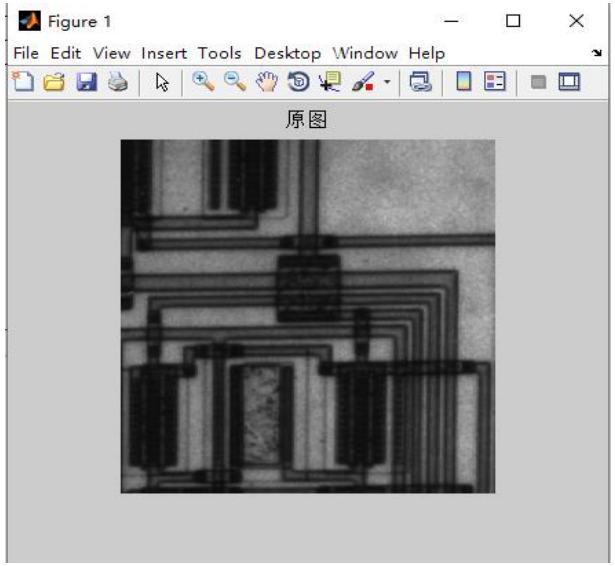


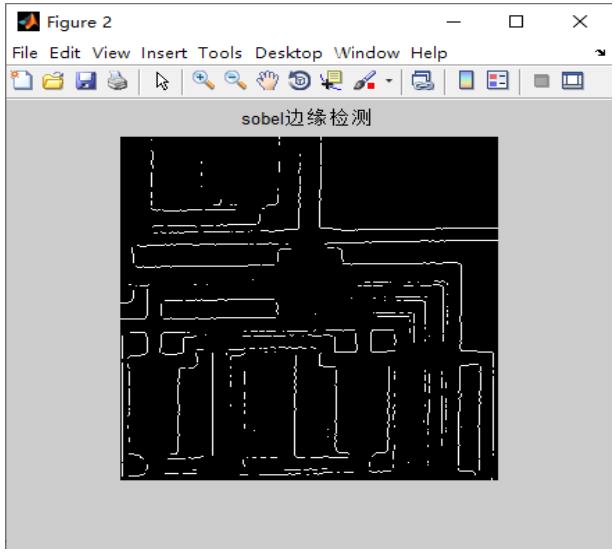


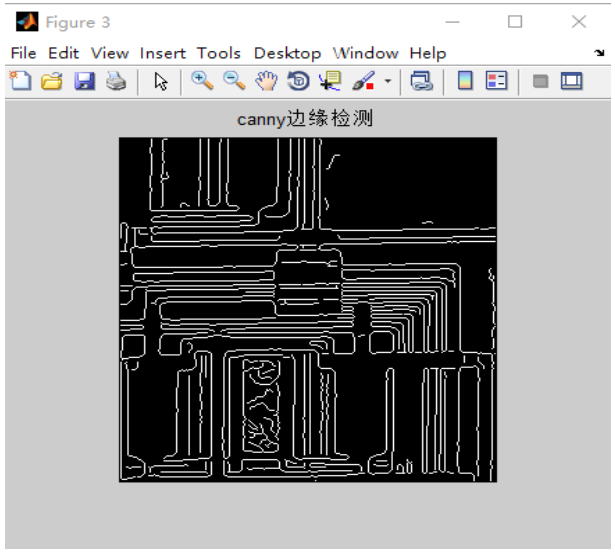
(5)比较sobel算子与canny的边缘检测效果

```
clear all;
clc;
I = imread('circuit1.tif');
BW1 = edge(I,'sobel');
BW2 = edge(I,'canny');
imshow(I);title('原图')
figure,imshow(BW1);title('sobel边缘检测')
figure, imshow(BW2);title('canny边缘检测')
```

(5)比较sobel算子与canny的边缘检测效果



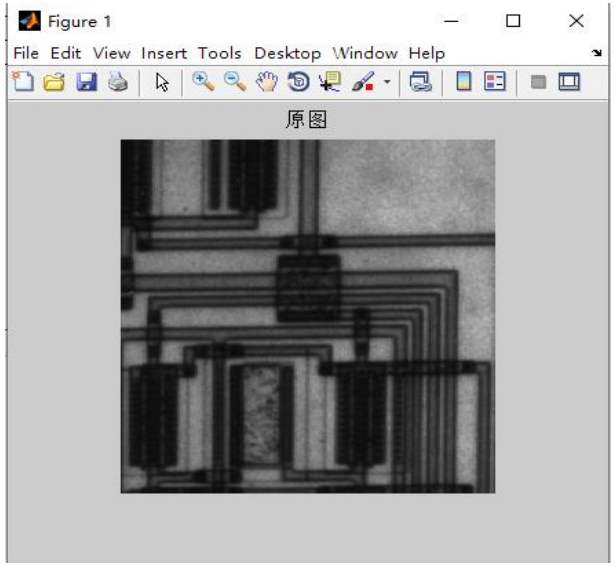


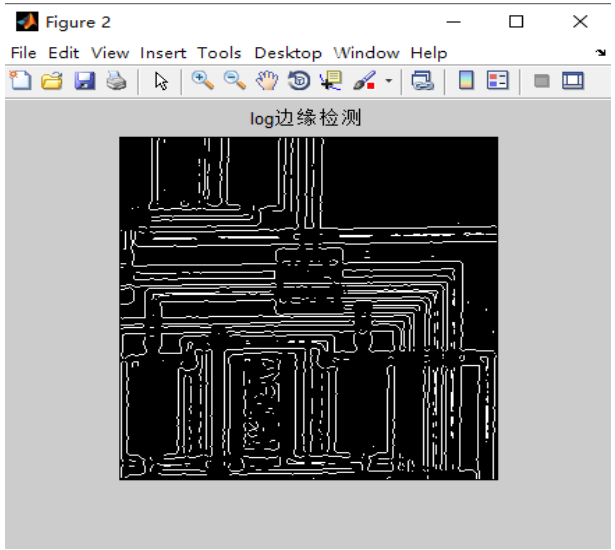


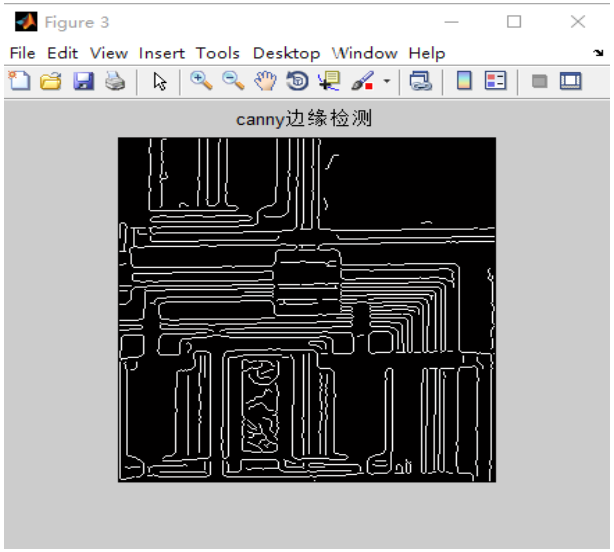
(6)比较LOG算子与canny的边缘检测效果

```
clear all;
clc;
I = imread('circuit1.tif');
BW1 = edge(I,'log');
BW2 = edge(I,'canny');
imshow(I);title('原图')
figure,imshow(BW1);title('log边缘检测')
figure, imshow(BW2);title('canny边缘检测')
```

(6)比较LOG算子与canny的边缘检测效果





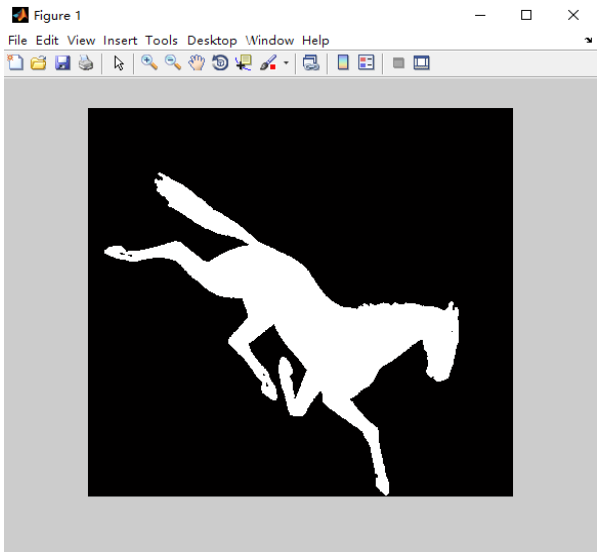


2.不变矩的形状特征描述

(1)提取形状的不变矩特征,比较原目标与目标旋转后的形状特征。

```
clear all;
clc;
H=imread('horse1.gif');
imshow(H,[ ]);
F1=invmoments(H);
J=imrotate(H,90);
F2=invmoments(J);
K=imrotate(H,180);
F3=invmoments(K);
F1,
F2,
F3,
```

(1)提取形状的不变矩特征,比较原目标与目标旋转后的形状特征



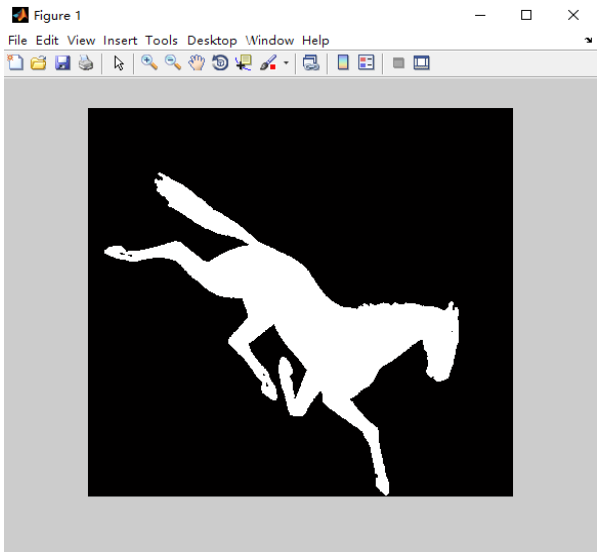

```
F1 =

    0.3601    0.0570    0.0149    0.0024    0.0000    0.0005   -0.0000

F2 =

    0.3601    0.0570    0.0149    0.0024    0.0000    0.0005   -0.0000

F3 =

    0.3601    0.0570    0.0149    0.0024    0.0000    0.0005   -0.0000
```

2.不变矩的形状特征描述

(2)目标缩小，比较原目标与目标缩小后的形状特征。

```
clear all;
clc;
I=imread('horse1.gif');
H=imresize(I,0.5);
J=imresize(I,0.25);
imshow(H,[ ]);
F1=invmoments(I);
F2=invmoments(H);
F3=invmoments(J);
F1,
F2,
F3,
```

(2)目标缩小，比较原目标与目标缩小后的形状特征。



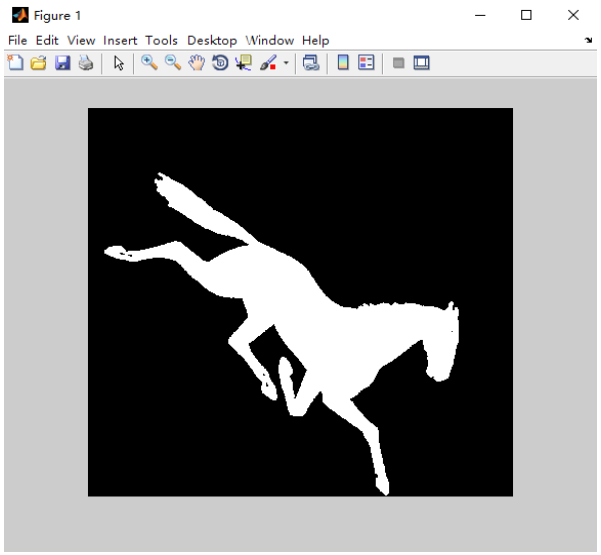

```
F1 =

    0.3601    0.0570    0.0149    0.0024    0.0000    0.0005   -0.0000

F2 =

    0.3566    0.0557    0.0142    0.0023    0.0000    0.0005   -0.0000

F3 =

    0.3570    0.0559    0.0142    0.0023    0.0000    0.0005   -0.0000
```

2.不变矩的形状特征描述

(3)目标缩小并旋转，比较原目标与目标缩小和旋转后的形状特征。

```
clear all;
clc;
I=imread('horse1.gif');
H=imresize(I,0.25);
imshow(H,[ ]);
F1=invmoments(I);
J=imrotate(H,90);
F2=invmoments(J);
K=imrotate(H,180);
F3=invmoments(K);
F1,
F2,
F3,
```

(3)目标缩小并旋转，比较原目标与目标缩小和旋转后的形状特征。




```
F1 =

    0.3601    0.0570    0.0149    0.0024    0.0000    0.0005   -0.0000

F2 =

    0.3570    0.0559    0.0142    0.0023    0.0000    0.0005   -0.0000

F3 =

    0.3570    0.0559    0.0142    0.0023    0.0000    0.0005   -0.0000
```

2.不变矩的形状特征描述

(4)目标左右翻转，比较原目标与目标左右翻转后的形状特征。

```
clear all;
clc;
I=imread('horse1.gif');
H=fliplr(I);
imshow(H,[ ]);
F1=invmoments(I);
F2=invmoments(H);
F1,
F2,
```

2.不变矩的形状特征描述

(5)目标左右翻转并缩小，比较原目标与目标左右翻转并缩小后的形状特征。

```
clear all;
clc;
I=imread('horse1.gif');
H1=fliplr(I);
H=imresize(H1,0.5);
imshow(H,[ ]);
F1=invmoments(I);
F2=invmoments(H);
F1,
F2,
```

2.不变矩的形状特征描述

(6)目标上下翻转，比较原目标与目标上下翻转后的形状特征。

```
clear all;
clc;
I=imread('horse1.gif');
H=flipud(I);
imshow(H,[ ]);
F1=invmoments(I);
F2=invmoments(H);
F1,
F2,
```

3.基于频谱法的纹理图像特征描述

对具有不同的周期和方向的纹理图像，显示其频谱信息，
通过功率谱的径向和角向的分布特性分析纹理图像的周期和方向

(1)纹理图像1的频谱法特征描述

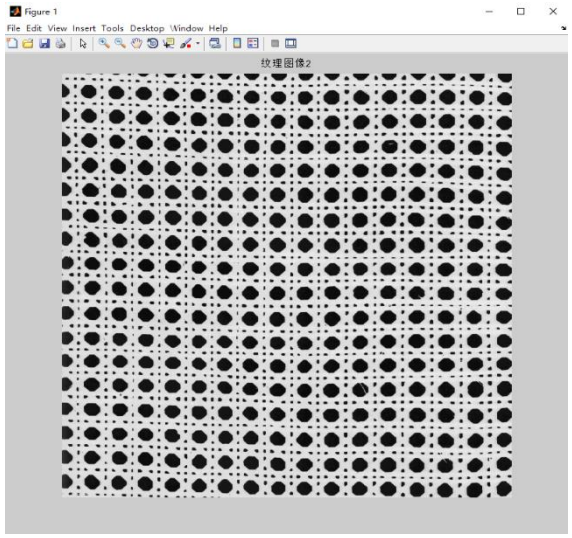
```
clear all;
 clc;
 close all;
 f1=imread('texture1.tif');
 [srad1,sang1,s1]=specxture(f1);          %计算图像的频谱，s(r),s(a)
imshow(f1);title('纹理图像1');
figure,imshow(s1,[]);title('纹理图像1的频谱');
figure,plot(srad1); title('纹理图像1的s(r)曲线');
figure,plot(sang1); title('纹理图像1的s(a)曲线');
```

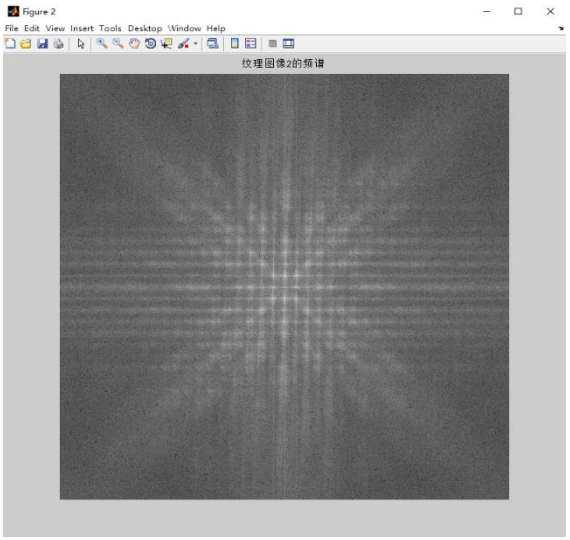
3.基于频谱法的纹理图像特征描述

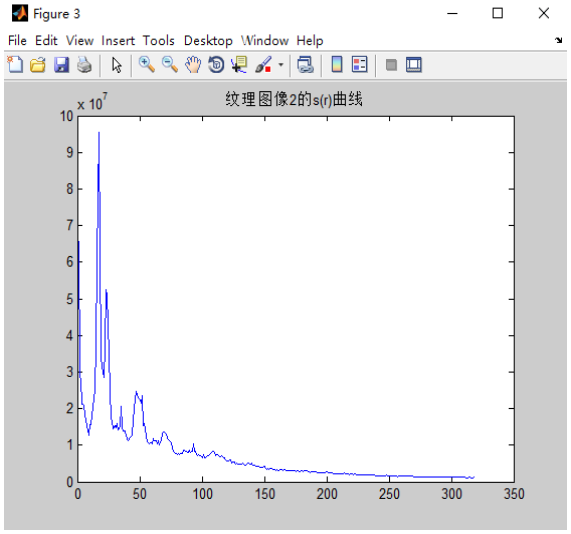
(2)纹理图像2的频谱法特征描述

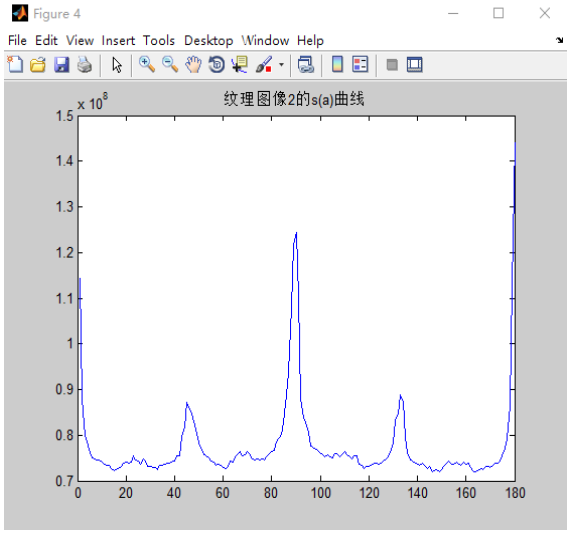
```
clear all;
 clc;
 close all;
 f1=imread('texture2.gif');
 [srad1,sang1,s1]=specxture(f1);          %计算图像的频谱，s(r),s(a)
imshow(f1);title('纹理图像2');
figure,imshow(s1,[]);title('纹理图像2的频谱');
figure,plot(srad1); title('纹理图像2的s(r)曲线');
figure,plot(sang1); title('纹理图像2的s(a)曲线');
```

(2)纹理图像2的频谱法特征描述









3.基于频谱法的纹理图像特征描述

(3)纹理图像3的频谱法特征描述

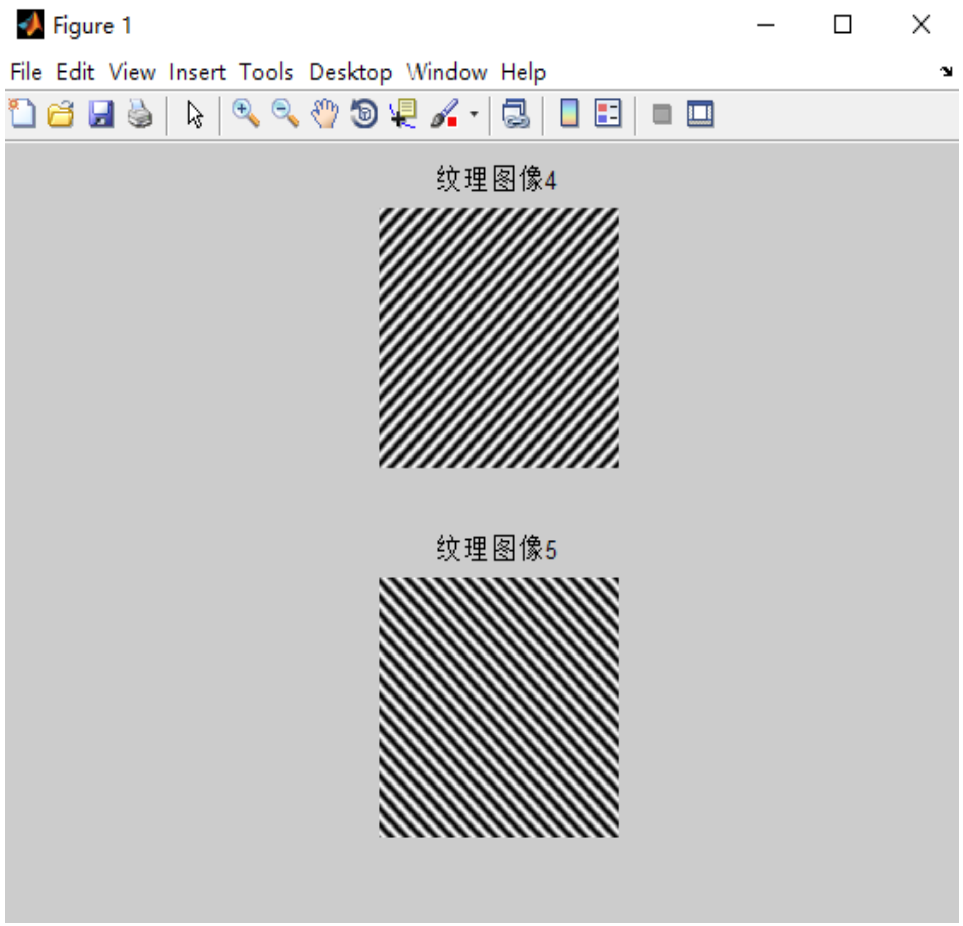
```
clear all;
clc;
close all;
f1=imread('texture3.gif');
[srad1,sang1,s1]=specxture(f1);            %计算图像的频谱，s(r),s(a)

imshow(f1);title('纹理图像3');
figure,imshow(s1,[]);title('纹理图像3的频谱');
figure,plot(srad1); title('纹理图像3的s(r)曲线');
figure,plot(sang1); title('纹理图像3的s(a)曲线');
```

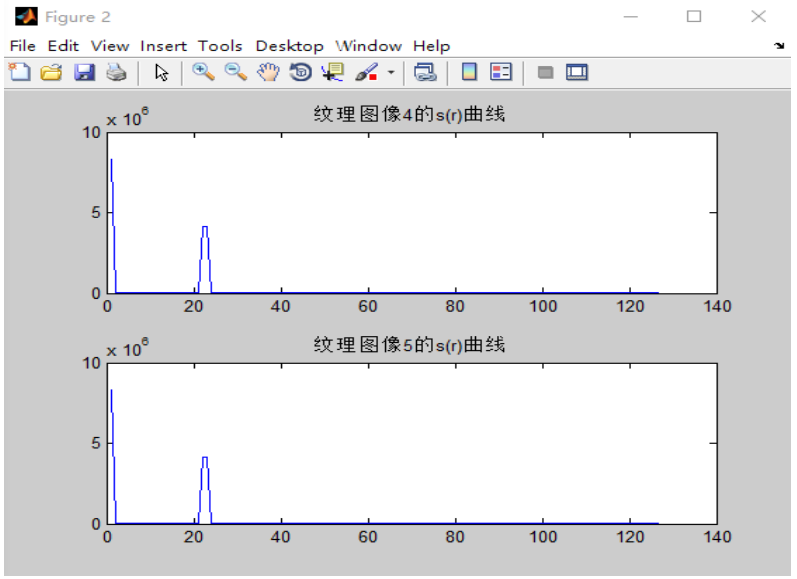
3.基于频谱法的纹理图像特征描述

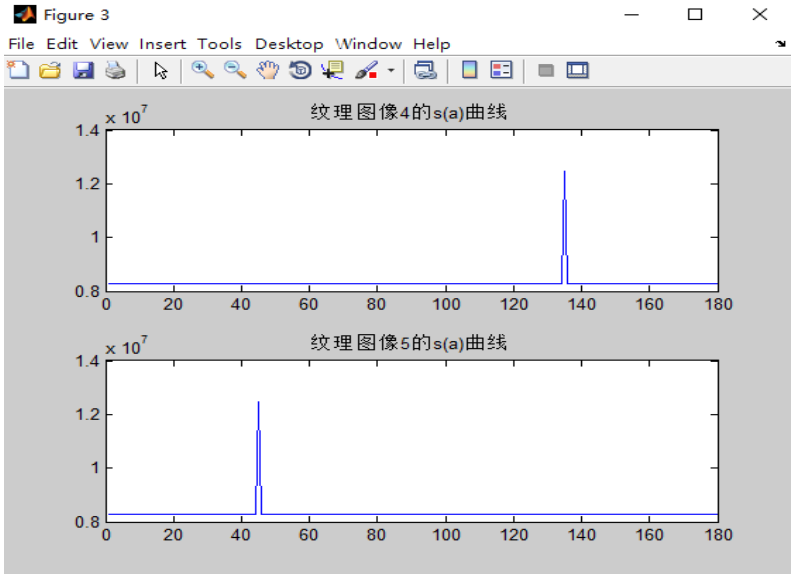
(4)周期相同,方向不同，纹理图像的频谱法特征描述

```
clear all;
 clc;
 close all;
 f1=imread('texture4.bmp');
 f2=imread('texture5.bmp');
 [srad1,sang1,s1]=specxture(f1);          %计算图像的频谱，s(r),s(a)
 [srad2,sang2,s2]=specxture(f2);

subplot(2,1,1),imshow(f1);title('纹理图像4');
subplot(2,1,2),imshow(f2);title('纹理图像5');

figure,subplot(2,1,1),plot(srad1); title('纹理图像4的s(r)曲线');
subplot(2,1,2),plot(srad2); title('纹理图像5的s(r)曲线')

figure,subplot(2,1,1),plot(sang1); title('纹理图像4的s(a)曲线');
subplot(2,1,2),plot(sang2); title('纹理图像5的s(a)曲线');
```

(4)周期相同,方向不同，纹理图像的频谱法特征描述





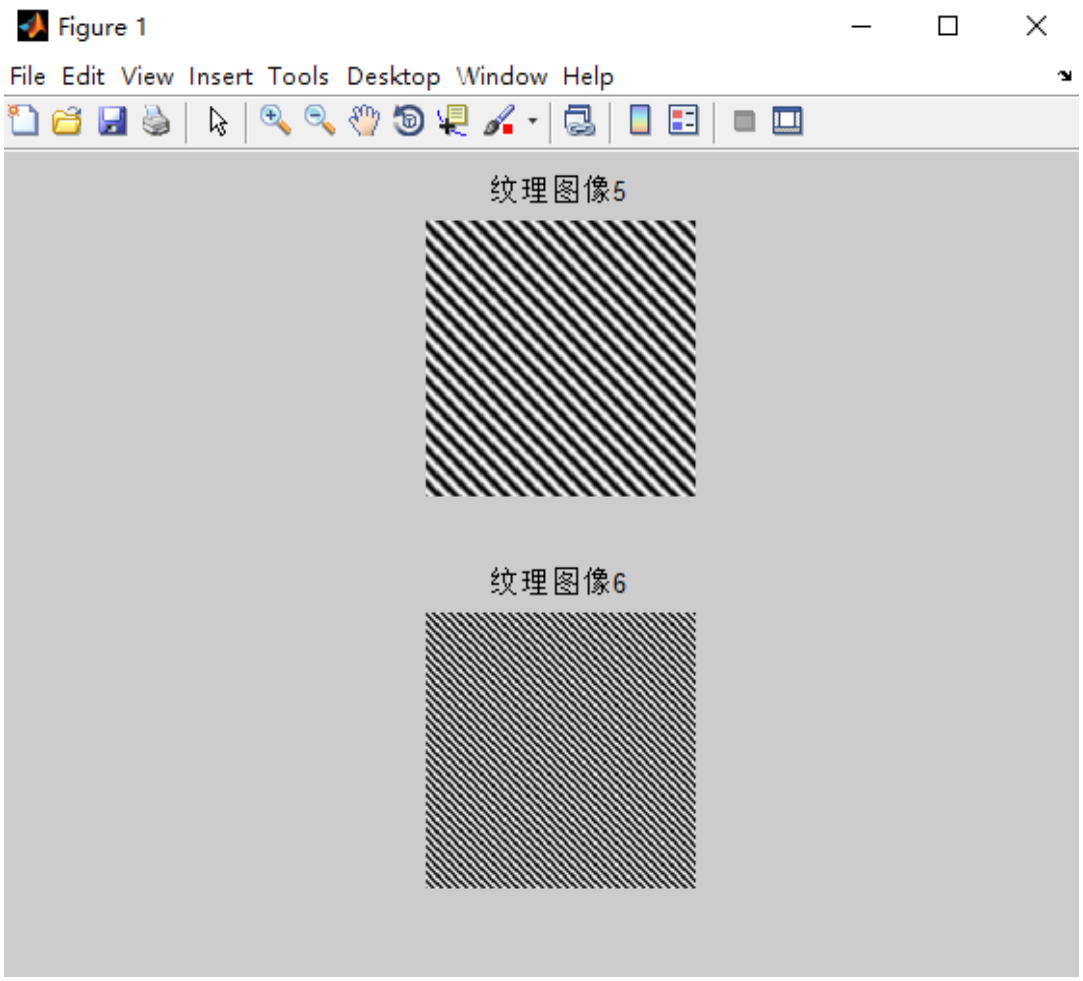


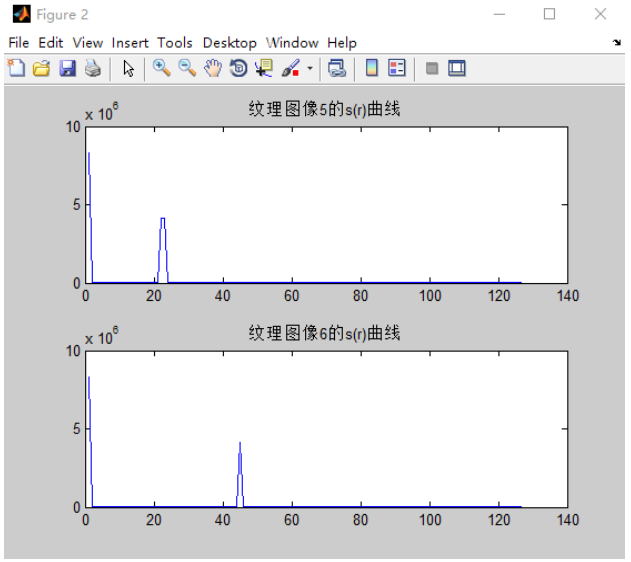
3.基于频谱法的纹理图像特征描述

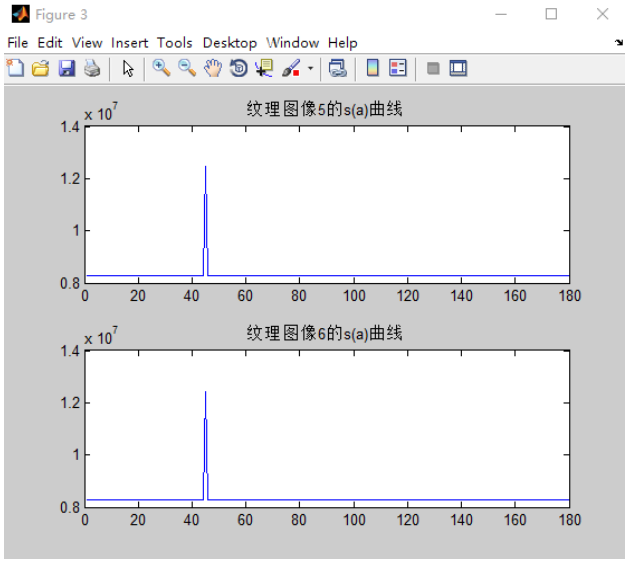
(5)周期不同，方向相同,纹理图像的频谱法特征描述

```
clear all;
 clc;
 close all;
 f1=imread('texture5.bmp');
 f2=imread('texture6.bmp');
 [srad1,sang1,s1]=specxture(f1);          %计算图像的频谱，s(r),s(a)
 [srad2,sang2,s2]=specxture(f2);

subplot(2,1,1),imshow(f1);title('纹理图像5');
subplot(2,1,2),imshow(f2);title('纹理图像6');

figure,subplot(2,1,1),plot(srad1); title('纹理图像5的s(r)曲线');
subplot(2,1,2),plot(srad2); title('纹理图像6的s(r)曲线')

figure,subplot(2,1,1),plot(sang1); title('纹理图像5的s(a)曲线');
subplot(2,1,2),plot(sang2); title('纹理图像6的s(a)曲线');
```

(5)周期不同，方向相同,纹理图像的频谱法特征描述







3.基于频谱法的纹理图像特征描述

(6)周期不同，方向不同,纹理图像的频谱法特征描述

```
clear all;
 clc;
 close all;
 f1=imread('texture4.bmp');
 f2=imread('texture6.bmp');
 [srad1,sang1,s1]=specxture(f1);          %计算图像的频谱，s(r),s(a)
 [srad2,sang2,s2]=specxture(f2);

subplot(2,1,1),imshow(f1);title('纹理图像4');
subplot(2,1,2),imshow(f2);title('纹理图像6');
figure,subplot(2,1,1),plot(srad1); title('纹理图像4的s(r)曲线');
subplot(2,1,2),plot(srad2); title('纹理图像6的s(r)曲线')
figure,subplot(2,1,1),plot(sang1); title('纹理图像4的s(a)曲线');
subplot(2,1,2),plot(sang2); title('纹理图像6的s(a)曲线');
```

实验五 图像分割与图像特征描述

六、思考题

1、最大类间方差阈值法图像分割中，怎样确定图像分割阈值？

2、Canny算子是怎样实现单像素宽度的边缘检测？

3、目标产生缩小或旋转时，其对应的不变矩形状描述是否变化？当目标产生平移时，为什么其对应的不变矩形状描述是不变的？

4、在频谱法的纹理特征描述中，怎样表征纹理图像的纹理周期和纹理方向？

实验五 图像分割与图像特征描述

七、实验报告要求

1、写出图像分割的基本概念，最大类间方差阈值法的基本思想，边缘检测的原理。

2、写出Canny算子的边缘检测算法的具体步骤。

3、回答思考题。