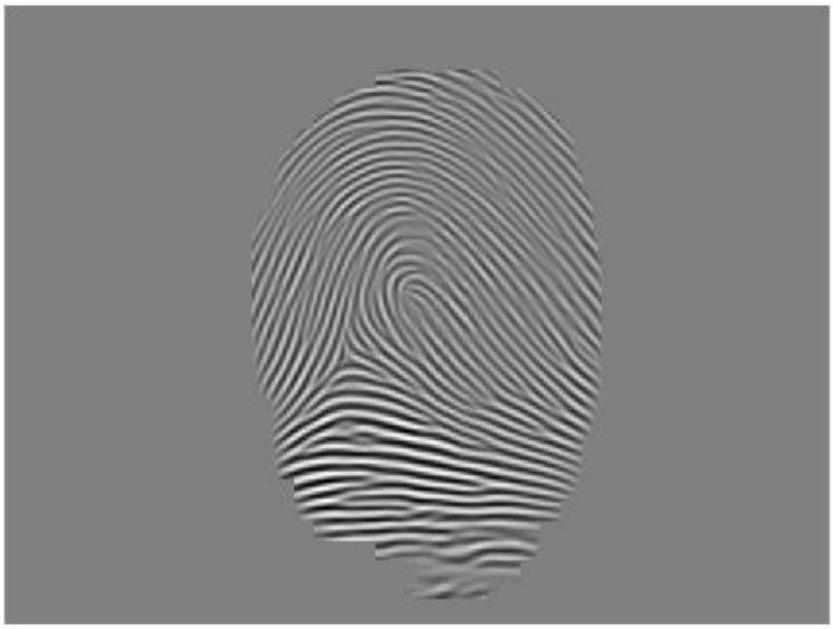
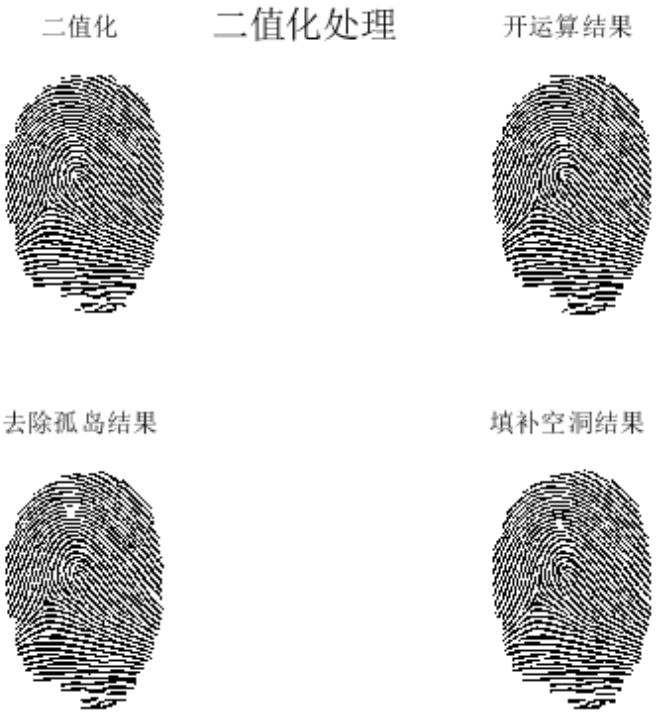
```
close all;

I1 = imread('.\Data\r2_5.bmp');

imshow(I1);

figure(1);

suptitle("原始图像");

imshow(I1);
```



图像二值化 阈值是由调参尝试出来的

```
I1_bw = imbinarize(I1, 0.50196078);

figure(2);

suptitle("二值化处理");

ax(1) = subplot(2,2,1);

plot(rand(1,10), 'Parent', ax(1));

imshow(I1_bw);
```

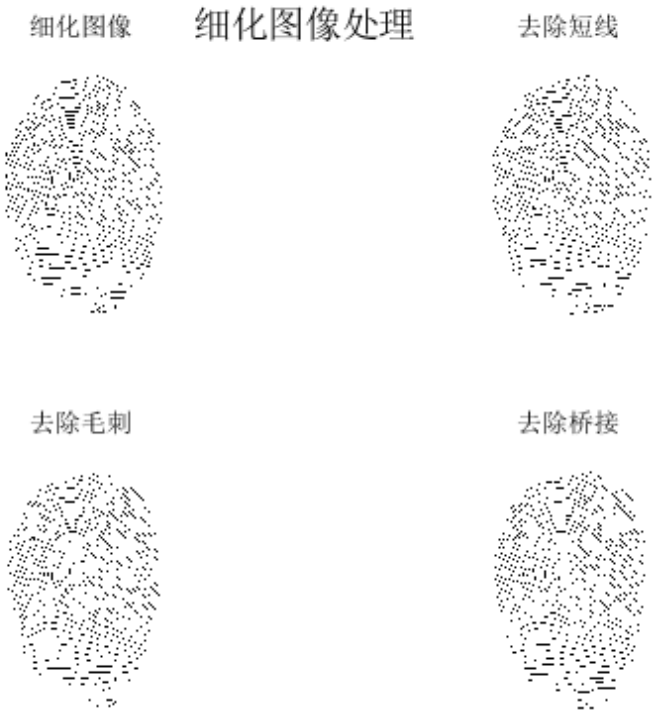
```
title("二值化");
% 由于形态学是对白像素进行操作，所以需要对二值化图像取反
I1_bw = ~I1_bw;
% 先做开运算，将不小心桥接的点分开
% 结构元素为 2*2 的正方形
se = strel('square',2);
I1_bw = imopen(I1_bw, se);
ax(2) = subplot(2,2,2);
plot(rand(1,10), 'Parent', ax(2));
imshow(~I1_bw);
title("开运算结果");
% 去除原图的孤岛
I1_bw = bwareaopen(I1_bw,100,4);
I1_bw = ~I1_bw;
ax(3) = subplot(2,2,3);
plot(rand(1,10), 'Parent', ax(3));
imshow(I1_bw);
title("去除孤岛结果");
% 填补原图的空洞
I1_bw = bwareaopen(I1_bw,100,4);
ax(4) = subplot(2,2,4);
plot(rand(1,10), 'Parent', ax(4));
imshow(I1_bw);
title("填补空洞结果");
linkaxes(ax,'xy');
```



图像细化

```
I1_bw_thin = bwmorph(~I1_bw, 'thin', inf);

figure(3);

suptitle("细化图像处理");

ax(1) = subplot(2,2,1);

plot(rand(1,10), 'Parent', ax(1));

imshow(~I1_bw_thin);

title("细化图像");

% 去除小于 5 个像素的短线

I1_bw_thin = bwareaopen(I1_bw_thin,5,8);

ax(2) = subplot(2,2,2);

plot(rand(1,10), 'Parent', ax(2));

imshow(~I1_bw_thin);
```

```
title("去除短线");

% 去除毛刺

I1_bw_pruning = bwmorph(I1_bw_thin, 'spur',10);

ax(3) = subplot(2,2,3);

plot(rand(1,10), 'Parent', ax(3));

imshow(~I1_bw_pruning);

title("去除毛刺");

% 虽然前面已经对桥接进行开运算避免了，

% 为了保险起见，再进行一次去桥接的运算

I1_bw_hbreak = bwmorph(I1_bw_pruning, 'hbreak');

ax(4) = subplot(2,2,4);

plot(rand(1,10), 'Parent', ax(4));

imshow(~I1_bw_hbreak);

title("去除桥接");

linkaxes(ax, 'xy');
```



特征点提取

```
I1_bw_final = ~I1_bw_hbreak;

feature_point = KeyPoint(I1_bw_final);

[endpoint_r, endpoint_c] = find(feature_point == 1);

[xpoint_r, xpoint_c] = find(feature_point == 3);

figure(4);

suptitle("特征点提取结果");

ax1(1) = subplot(1,2,1);

plot(rand(1,10), 'Parent', ax1(1));

imshow(I1_bw_final);

hold on;

plot(endpoint_c,endpoint_r,'s');

plot(xpoint_c,xpoint_r,'x');
```

```
hold off;

title("初始特征点提取");

feature_point = TrueFeaturePoint(feature_point);

[endpoint_r, endpoint_c] = find(feature_point == 1);

[xpoint_r, xpoint_c] = find(feature_point == 3);

ax1(2) = subplot(1,2,2);

plot(rand(1,10), 'Parent', ax1(2));

imshow(I1_bw_final);

hold on;

plot(endpoint_c,endpoint_r,'s');

plot(xpoint_c,xpoint_r,'x');

hold off;

title("特征点验证（去除边缘伪特征点）");

linkaxes(ax1,'xy');
```

特征点提取结果

初始特征点提取

特征点验证（去除边缘伪特征点）

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