Digital Image Processing

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Problem 8 Requirement new

8. Morpholigical Processing

Implement the "*Opening by reconstruction*", "*Filling holes*" *and* "*Border clearing*" operations on pages 681-683, and reproduce the results in Figure 9.29, Figures 9.31, and Figure 9.32. (The images fig9.29(a) and fig9.31(a) are provided in ftp address)

Problem 8 Requirement old

8. Morpholigical Processing

a). Implement the morphological operations: erosion, dilation, opening and closing, and use the noisy_fingerprint.tif to check your implementation.

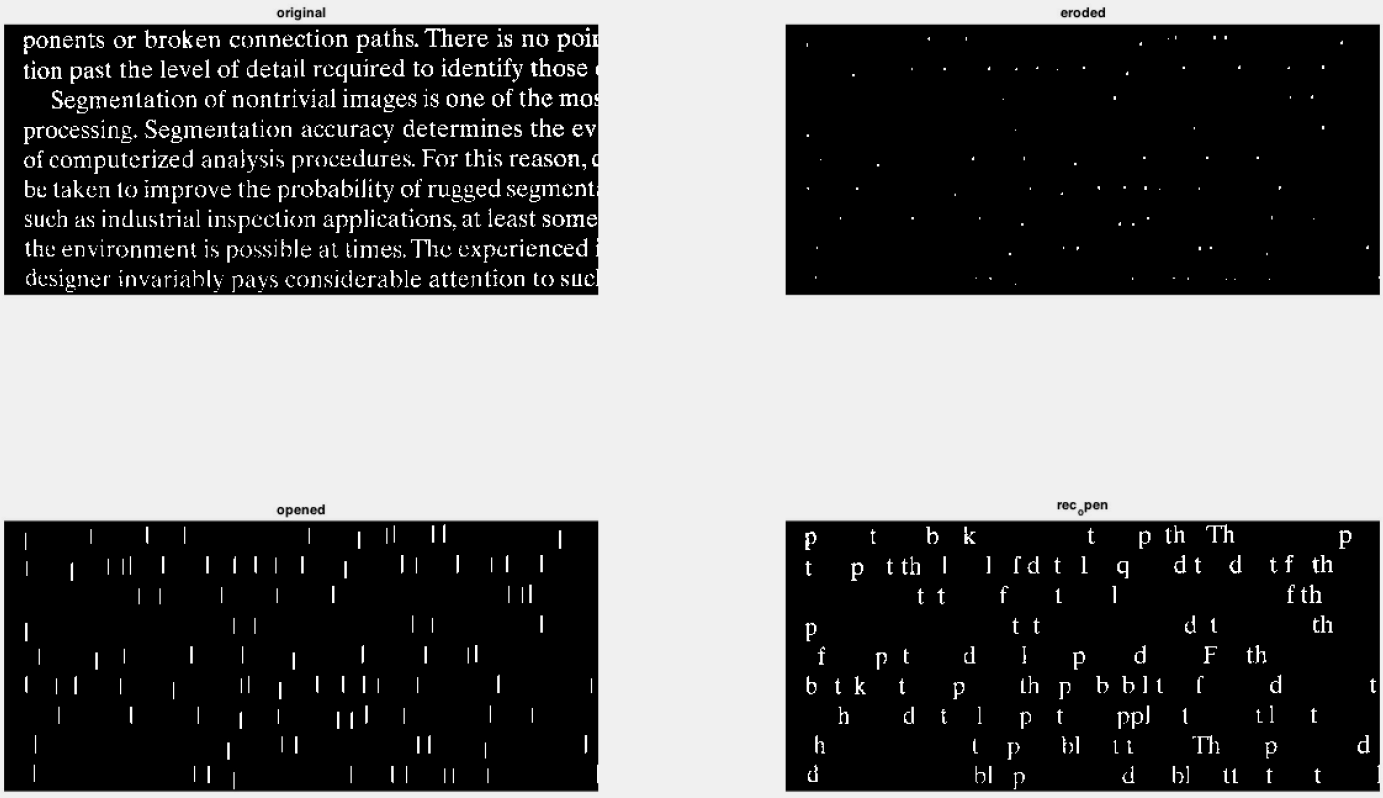
b). Implement boundary extraction, hole filling, connected component extraction. Using licoln_from_penny.tif, region_filling_refletion.tif and chickenfilet_with_bones.tif to very the results, respectively.

Problem 8 solution new

opening by reconstruction

```matlab
img = imread('Fig0929(a)(text_image).tif');
se = strel('rectangle',[51 1]);
eroded = imerode(img,se);
opened = imopen(img,se);
rec_open = imreconstruct(eroded,img);

subplot(2,2,1),imshow(img);title('original');
subplot(2,2,2),imshow(eroded);title('eroded');
subplot(2,2,3),imshow(opened);title('opened');
subplot(2,2,4),imshow(rec_open);title('rec_open');
```



filling holes

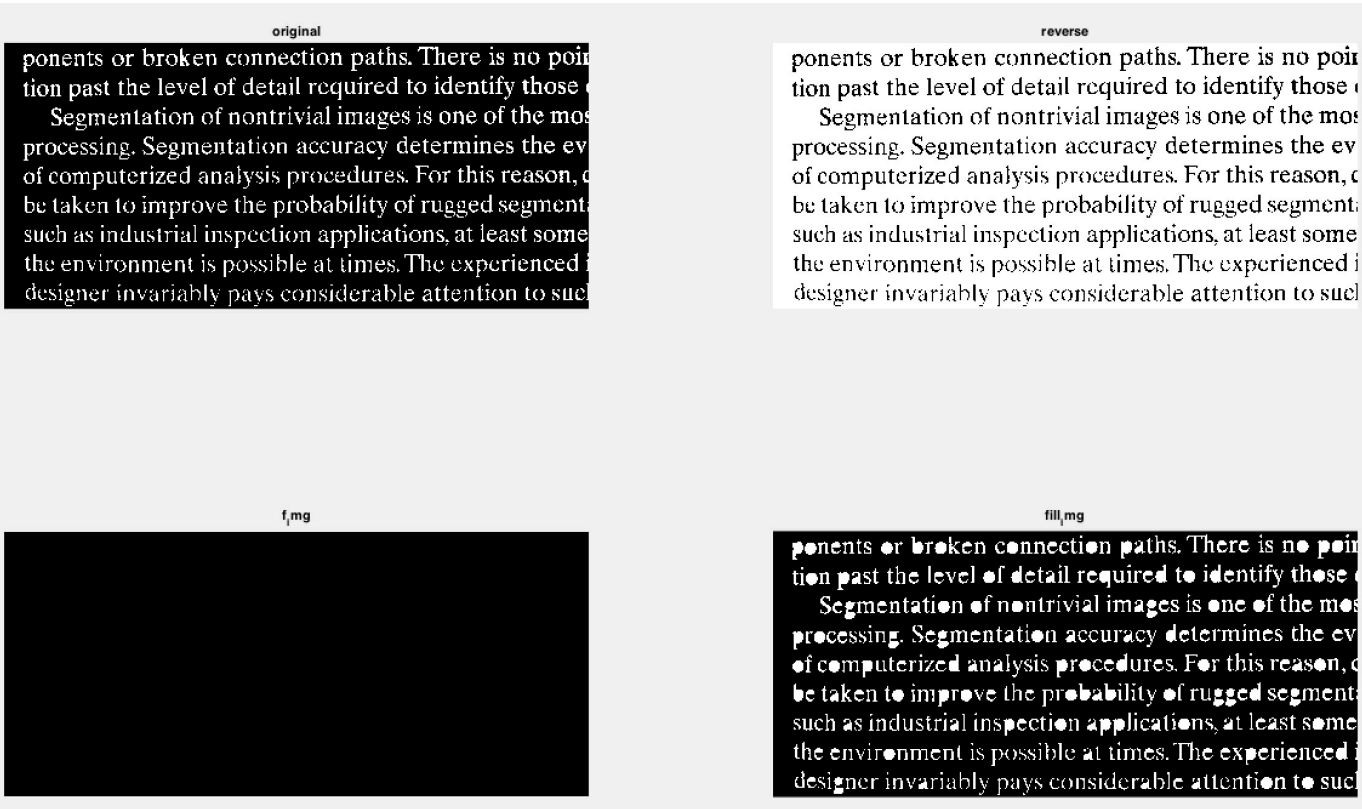
MATLAB

```
img = imread('Fig0929(a)(text_image).tif');
f_img = zeros(size(img));
[M,N] = size(img);

f_img(1,:) = 1-img(1,:);
f_img(M,:) = 1-img(M,:);
f_img(:,1) = 1-img(:,1);
f_img(:,N) = 1-img(:,N);

se = strel('square',3);
fill_img = imadd(logical((~(logical(imdilate(logical(f_img),se)).*(~img))).*(~img)),ir

subplot(2,2,1),imshow(img);title('original');
subplot(2,2,2),imshow(~img);title('reverse');
subplot(2,2,3),imshow(f_img);title('f_img');
subplot(2,2,4),imshow(fill_img);title('fill_img');
```



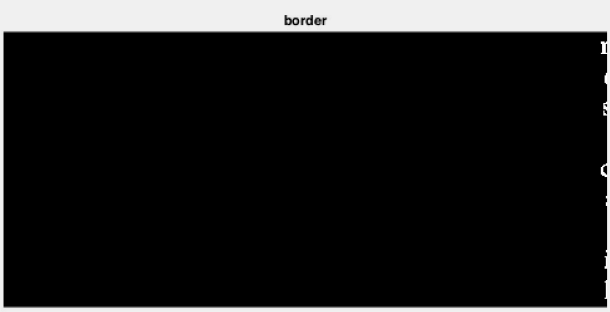
Border clearing

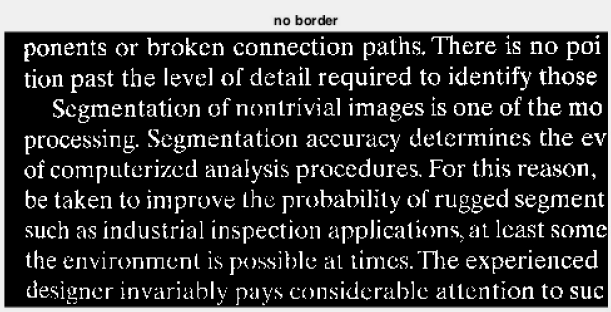
```matlab
img = imread('Fig0931(a)(text_image).tif');
f_img = zeros(size(img));
[M,N] = size(img);

f_img(1,:) = 1-img(1,:);
f_img(M,:) = 1-img(M,:);
f_img(:,1) = 1-img(:,1);
f_img(:,N) = 1-img(:,N);

se = strel('square',3);
eroded = imdilate(f_img,se);
border = imreconstruct(logical(eroded),img);

subplot(1,2,1),imshow(border);title('border');
subplot(1,2,2),imshow(imsubtract(img,border));title('no border');
```





Problem 8 solution old

close&open.m

```matlab
img = imread('noisy_fingerprint.tif');
se = strel('square',3);
eroded1 = imerode(img,se);
dilated1 = imdilate(eroded1,se);
close_img = imclose(dilated1,se);
imshow(close_img);title('close-dilate+enrode');
```

boundary_extraction.m

```MATLAB
img = imread('licoln_from_penny.tif');
se = strel('square',3);
eroded = imerode(img,se);
boundary = imsubtract(img,eroded);
subplot(1,2,1),imshow(img);title('original');
subplot(1,2,2),imshow(boundary);title('boundary');
```

hole_fill.m

```MATLAB
img = imread('region_filling_reflections.tif');
fill_img = imfill(img,'holes');
subplot(1,2,1),imshow(img);title('original');
subplot(1,2,2),imshow(fill_img);title('fill image');
```

connected_extraction.m

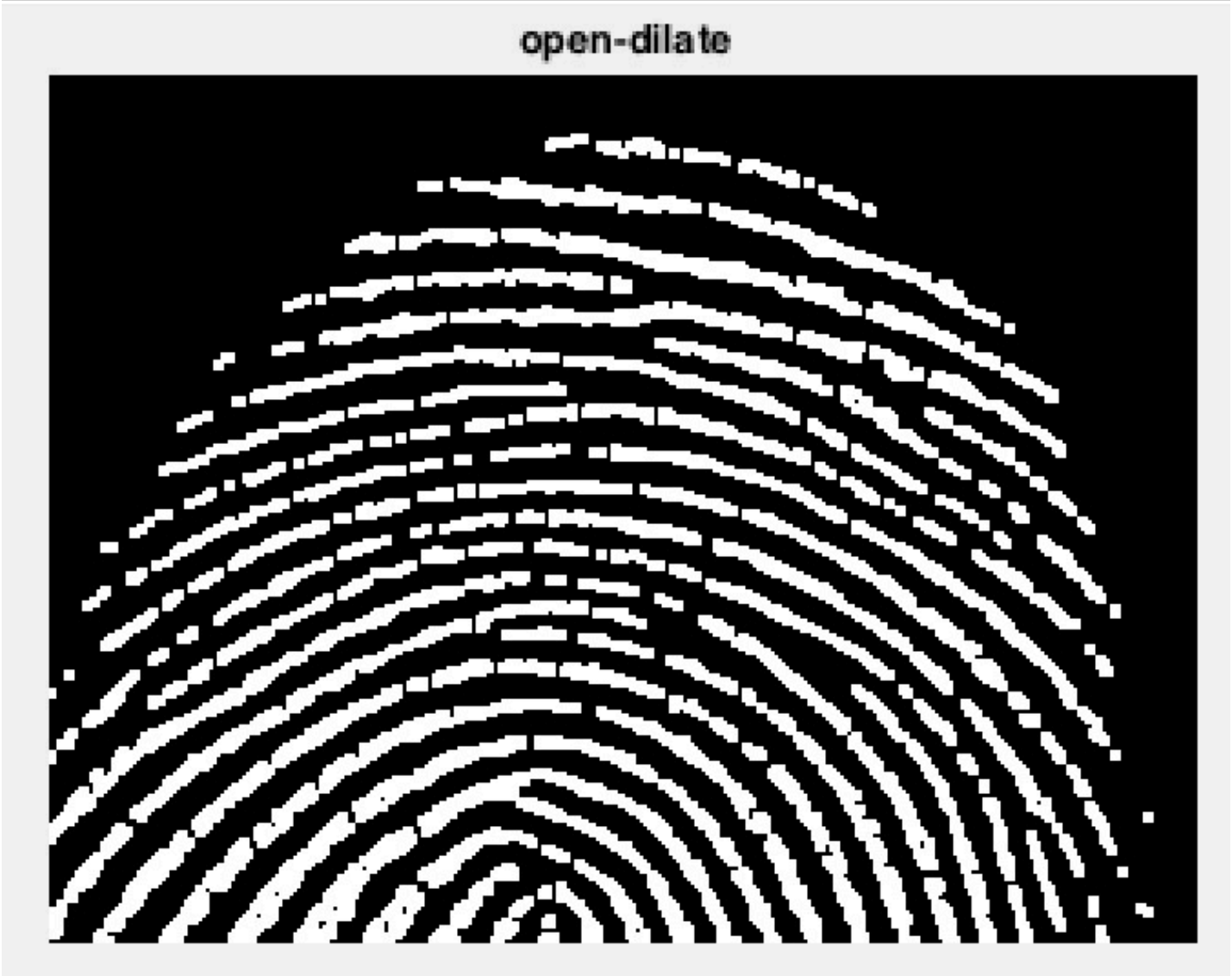
```MATLAB
img = im2bw(imread('chickenfilet_with_bones.tif'),0.8);
se = strel('square',5);
enroded = imerode(img,se);
connected_info = bwconncomp(enroded,8)
```

Result

original fingerprint

open-enrode

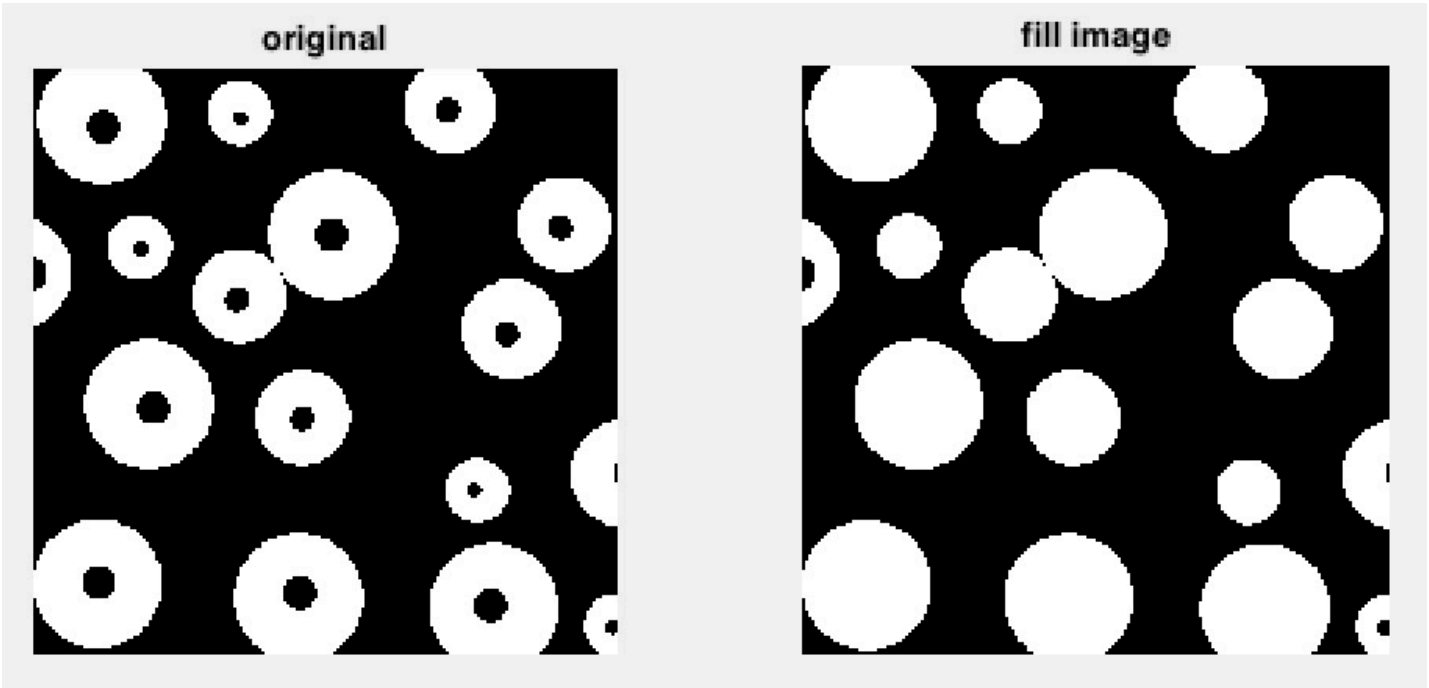
open-dilate



close-dilate+enrode

boundary extraction

hole filling



connected component extraction

threshold

enroded

statistics result

```MATLAB
connected_info =

    Connectivity: 8
       ImageSize: [321 712]
      NumObjects: 17
    PixelIdxList: {1x17 cell}

>> connected_info.PixelIdxList

ans =

  Columns 1 through 6

    [6x1 double]    [7x1 double]    [39x1 double]    [128x1 double]    [91608]    [935

  Columns 7 through 12

    [21x1 double]    [599x1 double]    [7x1 double]    [11x1 double]    [7x1 double]

  Columns 13 through 17

    [112839]    [4x1 double]    [19x1 double]    [664x1 double]    [80x1 double]
```