数字图像处理　Problem5(1)

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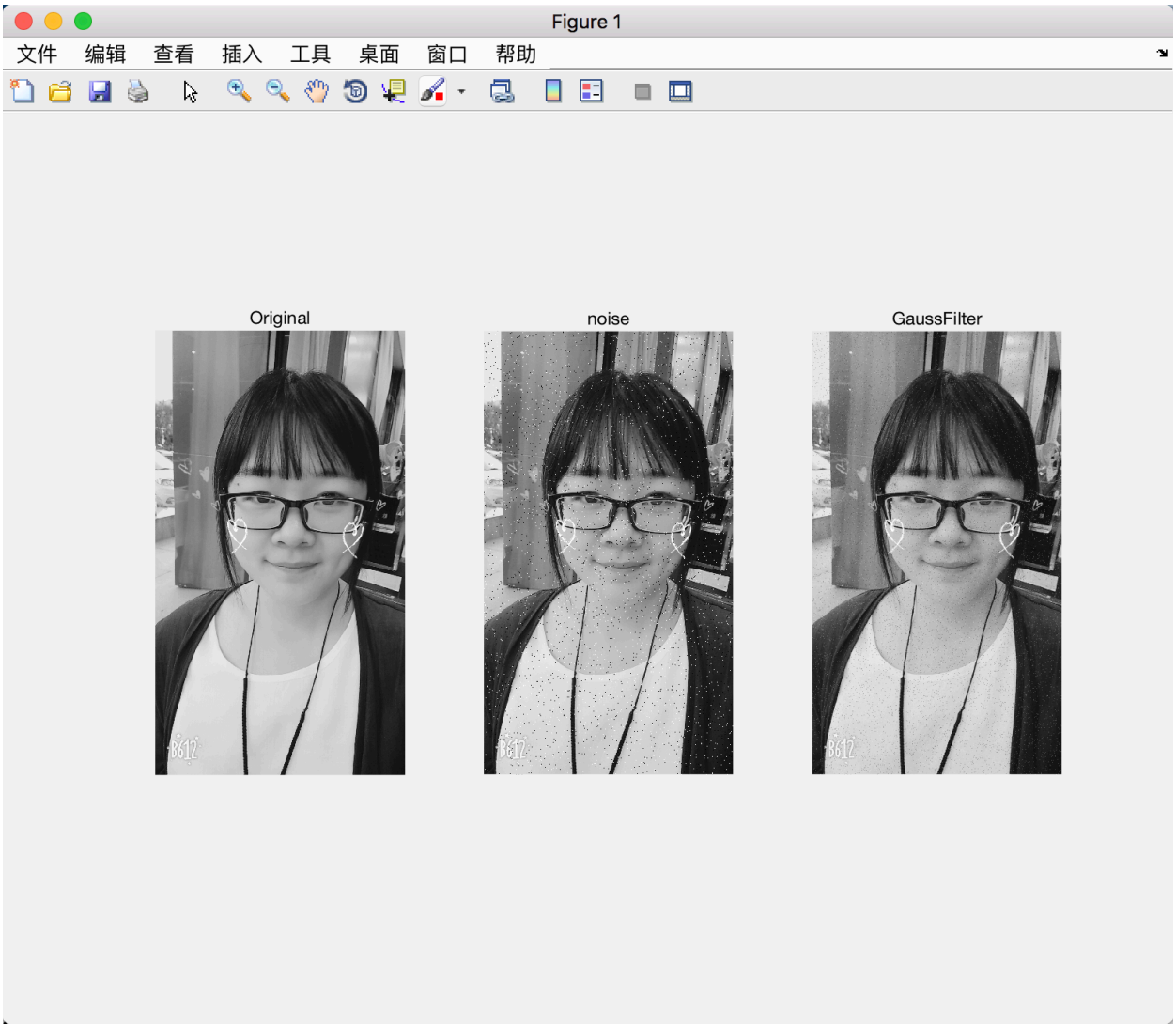
(1) Create a gauss filter of size 4*4, and apply the filter to the image with convolution, padding

✥result image:

Analysis:

According to ***the rule of thumb***: set filter half-width to about 3σ, and the required size is 4, so I set the sigma to 2/3;

The picture on the right is the result image after GaussFilter.



✥code:

Here I provide 3 implements code using different methods:

- Impletment using ***imfilter***:

```
img=imread('cui.jpg');
img_gray = rgb2gray(img);
figure;

% add noise
img_noi = imnoise(img_gray,'salt & pepper',0.02);

% Rule of thumb: set filter half-width to about 3σ
sigma = 0.5;
% create a Gauss filter of size 4x4
gausFilter = fspecial('gaussian', [3,3], sigma);

% Gauss filtering
gaus= imfilter(img_noi, gausFilter, 'replicate');

subplot(1,3,1);
imshow(img_gray);
title('Original')

subplot(1,3,2);
imshow(img_noi);
title('noise')

subplot(1,3,3);
imshow(gaus);
title('GaussFilter')
```

- Impletment using ***conv2***:

```
img=imread('cui.jpg');
img_gray = rgb2gray(img);
figure;

% add noise
img_noi = imnoise(img_gray,'salt & pepper',0.02);

% Rule of thumb: set filter half-width to about 3σ
sigma = 0.5;
% create a Gauss filter of size 4x4
gausFilter = fspecial('gaussian', [3,3], sigma);
% convolution and padding
img_convo = conv2(double(img_noi),gausFilter,'same');
img_convo = uint8(img_convo);

subplot(1,3,1);
imshow(img_gray);
title('Original')

subplot(1,3,2);
imshow(img_noi);
title('noise')

subplot(1,3,3);
imshow(img_convo);
title('GaussFilter')
```

- Impletment convolution and padding by myself:

```
img=imread('cui.jpg');
img_gray = rgb2gray(img);
figure;

% add noise
img_noi = imnoise(img_gray,'salt & pepper',0.02);
img_gaus = img_noi;

% Rule of thumb: set filter half-width to about 3σ
sigma = 0.5;
% create a Gauss filter of size 4x4
gausFilter = fspecial('gaussian', [3,3], sigma);

[m ,n] = size(img_noi);
% padding
padding_width = 2;
img_noi = padarray(img_noi,[padding_width padding_width],0);
% rotate the gausFilter
gausFilter = rot90(gausFilter,2);
% convolution
for i = padding_width+1:padding_width+m
    for j = padding_width+1:padding_width+n
        temp = img_noi(i-1:i+1,j-1:j+1);
        img_gaus(i-padding_width,j-padding_width) =
sum(sum(double(temp).*gausFilter));
    end
end

subplot(1,3,1);
imshow(img_gray);
title('Original')

subplot(1,3,2);
imshow(img_noi);
title('noise')

subplot(1,3,3);
imshow(img_gaus);
title('GaussFilter')
```