EECS225B–Spring 2020 — PROBLEM SET 07

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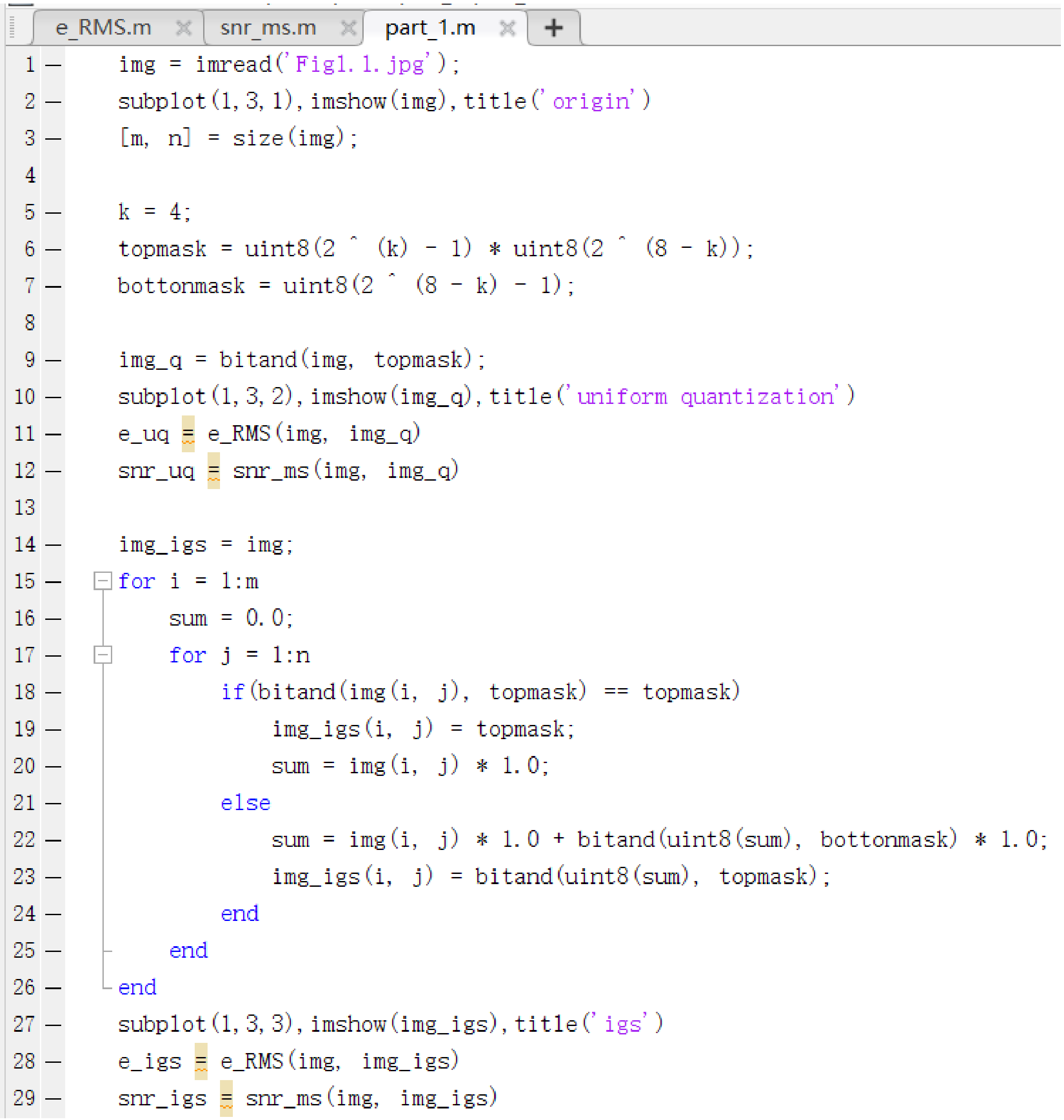
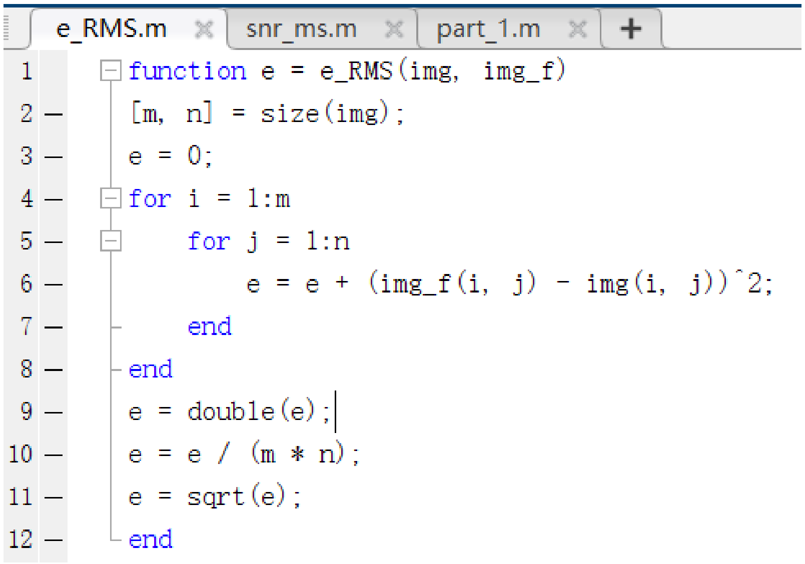
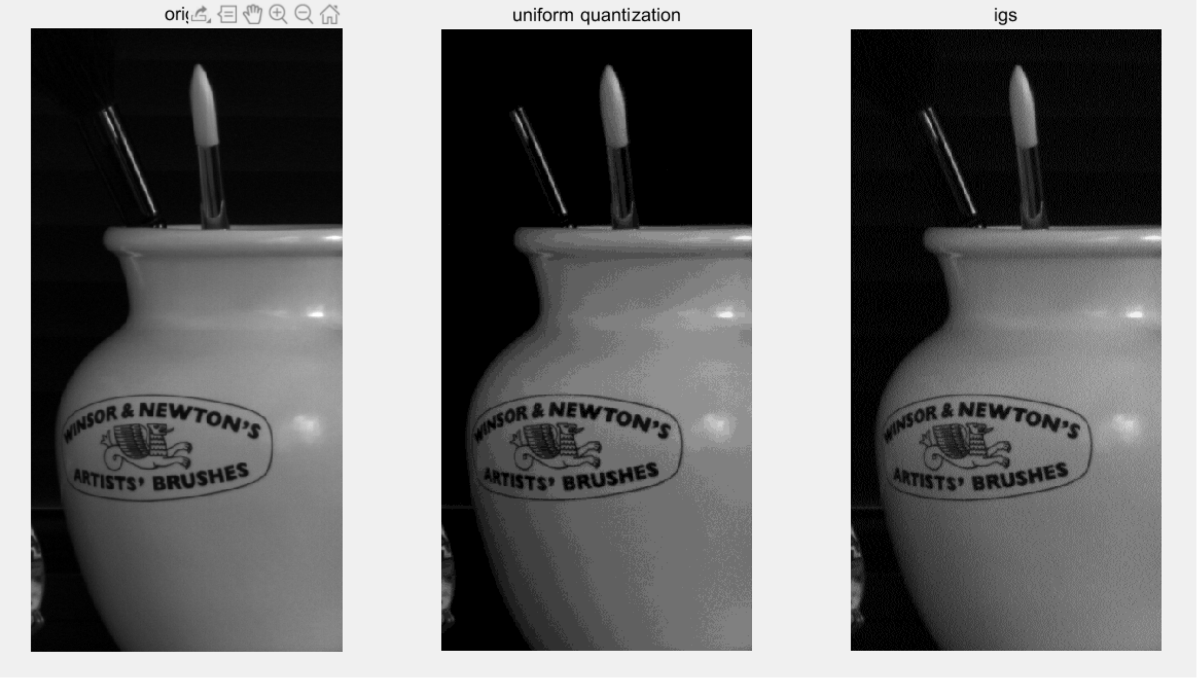
1 part 1

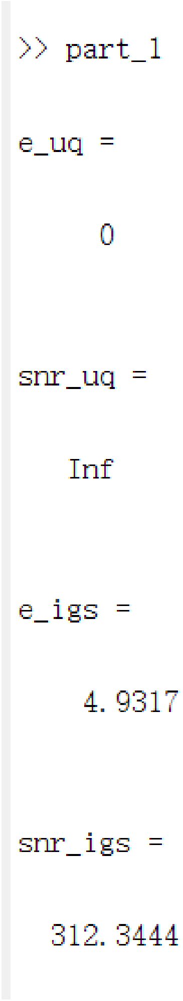


```
img = imread('Fig1.1.jpg');
subplot(1,3,1),imshow(img),title('origin')
[m, n] = size(img);

k = 4;
topmask = uint8(2 ^ (k) - 1) * uint8(2 ^ (8 - k));
bottonmask = uint8(2 ^ (8 - k) - 1);

img_q = bitand(img, topmask);
subplot(1,3,2),imshow(img_q),title('uniform quantization')
e_uq = e_RMS(img, img_q)
snr_uq = snr_ms(img, img_q)

img_igs = img;
for i = 1:m
    sum = 0.0;
    for j = 1:n
        if(bitand(img(i, j), topmask) == topmask)
            img_igs(i, j) = topmask;
            sum = img(i, j) * 1.0;
        else
            sum = img(i, j) * 1.0 + bitand(uint8(sum), bottonmask) * 1.0;
            img_igs(i, j) = bitand(uint8(sum), topmask);
        end
    end
end
subplot(1,3,3),imshow(img_igs),title('igs')
e_igs = e_RMS(img, img_igs)
snr_igs = snr_ms(img, img_igs)
```



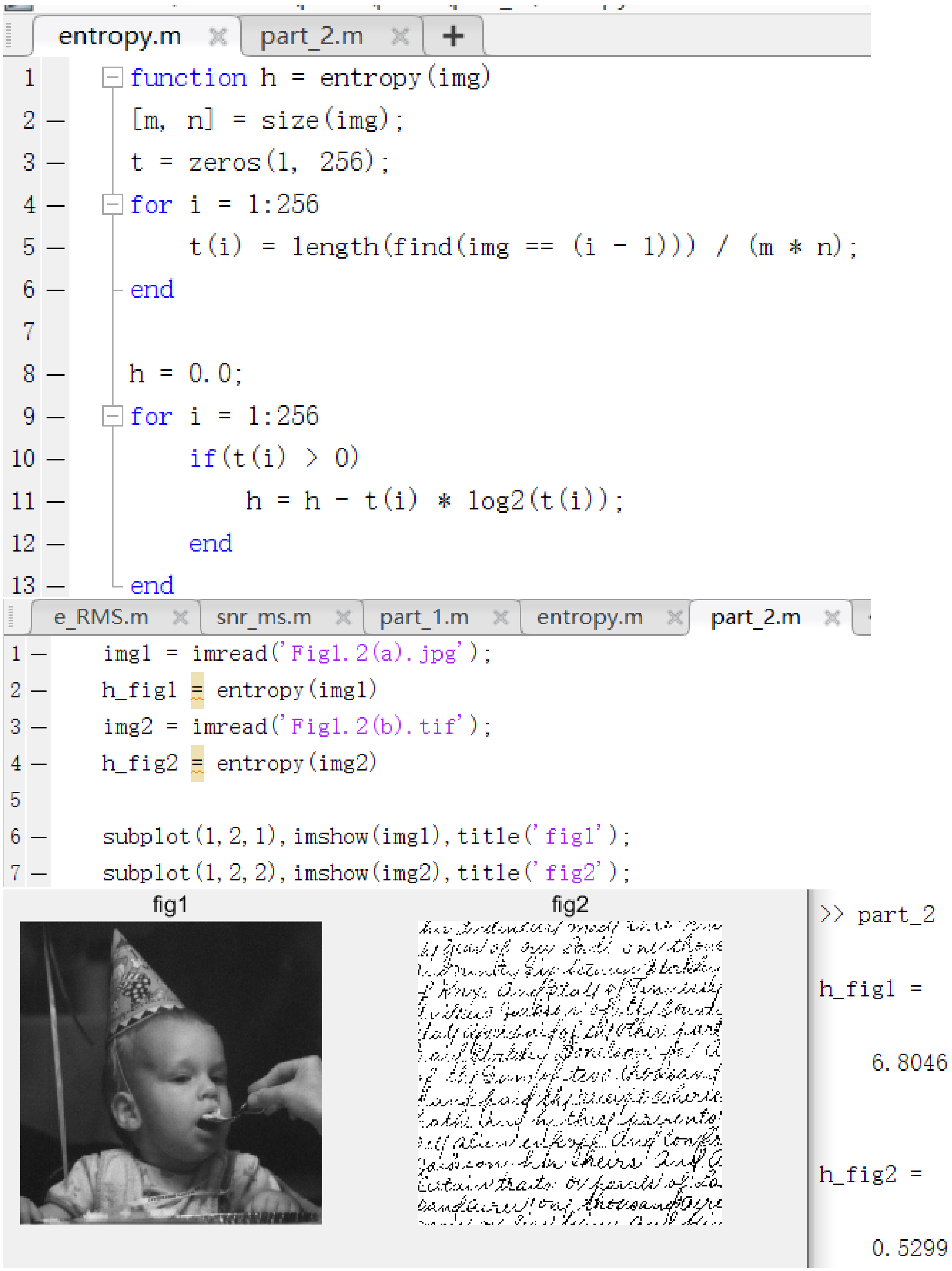
```
function e = e_RMS(img, img_f)
[m, n] = size(img);
e = 0;
for i = 1:m
    for j = 1:n
        e = e + (img_f(i, j) - img(i, j))^2;
    end
end
e = double(e);
e = e / (m * n);
e = sqrt(e);
end
```





```
>> part_1

e_uq =

     0


snr_uq =

   Inf


e_igs =

    4.9317


snr_igs =

  312.3444
```

2 part 2



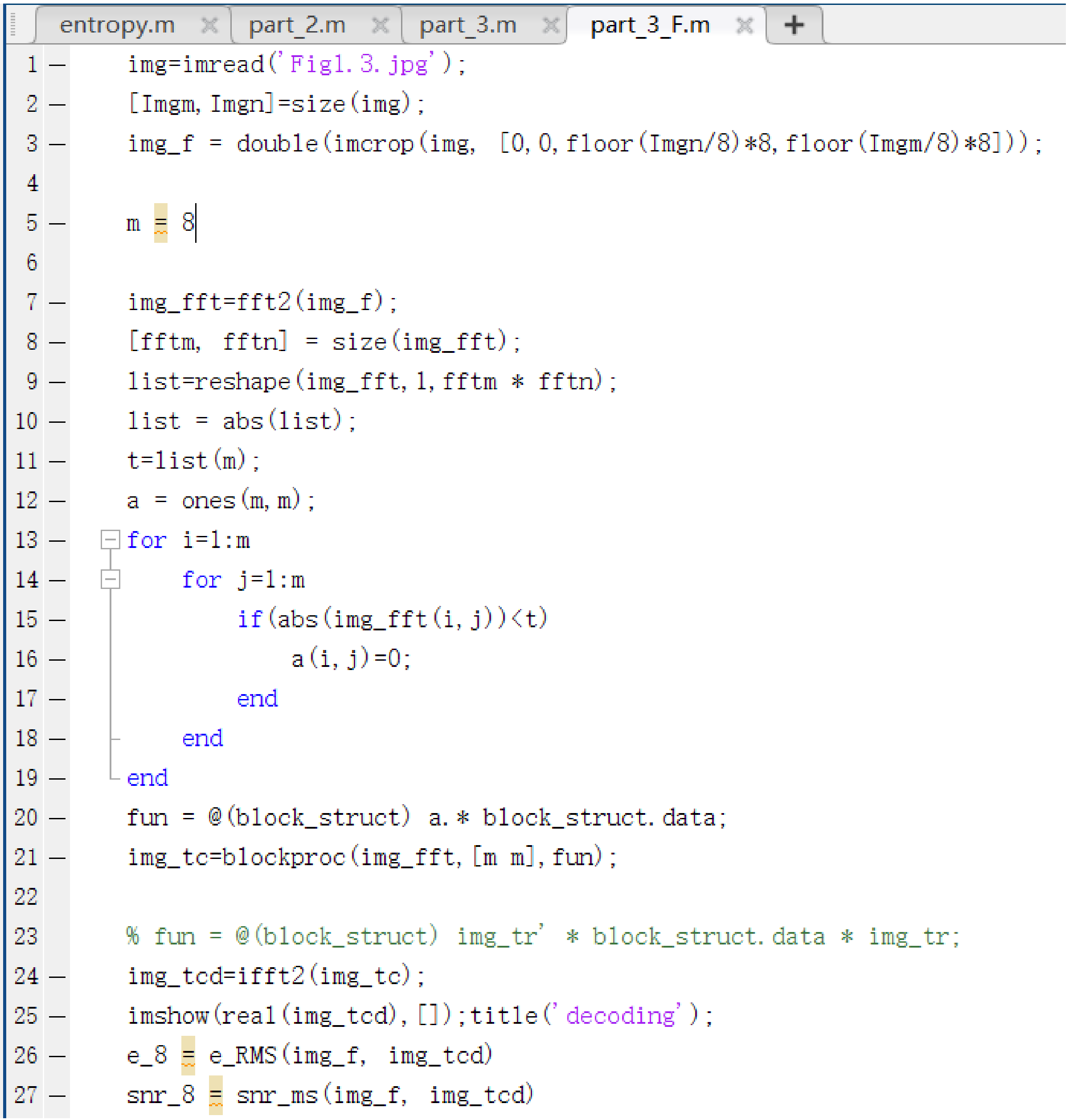
```
function h = entropy(img)
[m, n] = size(img);
t = zeros(1, 256);
for i = 1:256
    t(i) = length(find(img == (i - 1))) / (m * n);
end

h = 0.0;
for i = 1:256
    if(t(i) > 0)
        h = h - t(i) * log2(t(i));
    end
end
```

```
img1 = imread('Fig1.2(a).jpg');
h_fig1 = entropy(img1)
img2 = imread('Fig1.2(b).tif');
h_fig2 = entropy(img2)

subplot(1,2,1),imshow(img1),title('fig1');
subplot(1,2,2),imshow(img2),title('fig2');
```

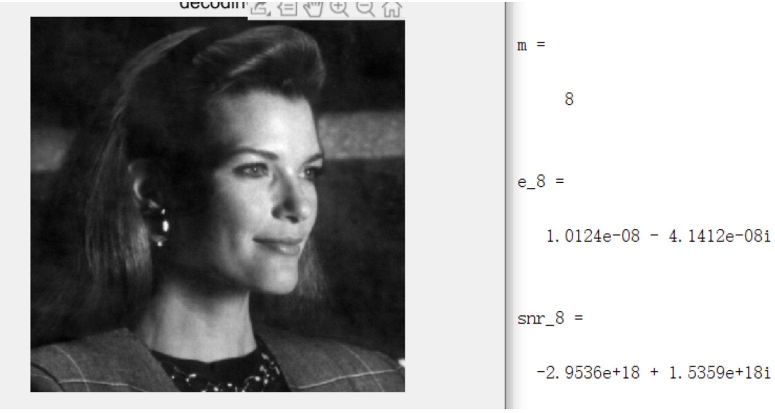
```
>> part_2

h_fig1 =

    6.8046


h_fig2 =

    0.5299
```

3 part 3

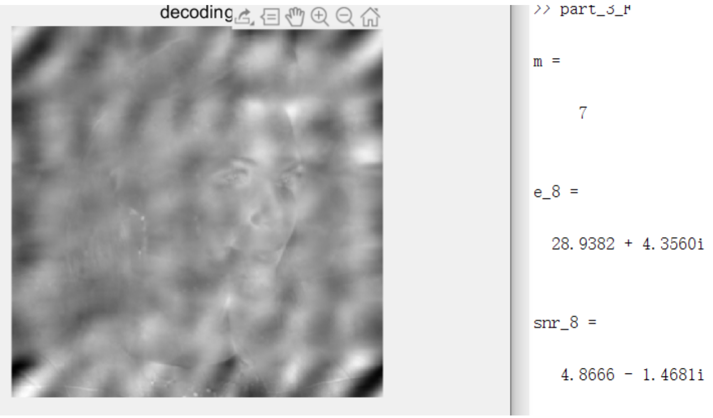
3.1 case 1



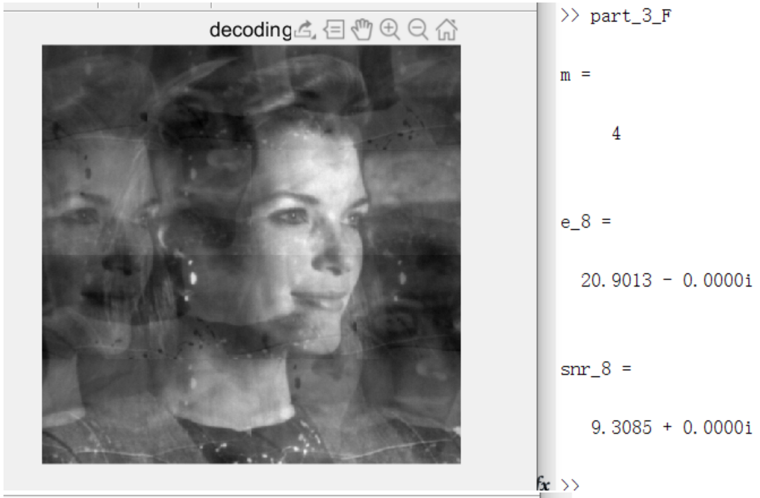
```
img=imread('Fig1.3.jpg');
[Imgm,Imgn]=size(img);
img_f = double(imcrop(img, [0,0,floor(Imgn/8)*8,floor(Imgm/8)*8]));

m = 8

img_fft=fft2(img_f);
[fftm, fftn] = size(img_fft);
list=reshape(img_fft,1,fftm * fftn);
list = abs(list);
t=list(m);
a = ones(m,m);
for i=1:m
    for j=1:m
        if(abs(img_fft(i,j))<t)
            a(i,j)=0;
        end
    end
end
fun = @(block_struct) a.* block_struct.data;
img_tc=blockproc(img_fft,[m m],fun);

% fun = @(block_struct) img_tr' * block_struct.data * img_tr;
img_tcd=ifft2(img_tc);
imshow(real(img_tcd),[]);title('decoding');
e_8 = e_RMS(img_f, img_tcd)
snr_8 = snr_ms(img_f, img_tcd)
```



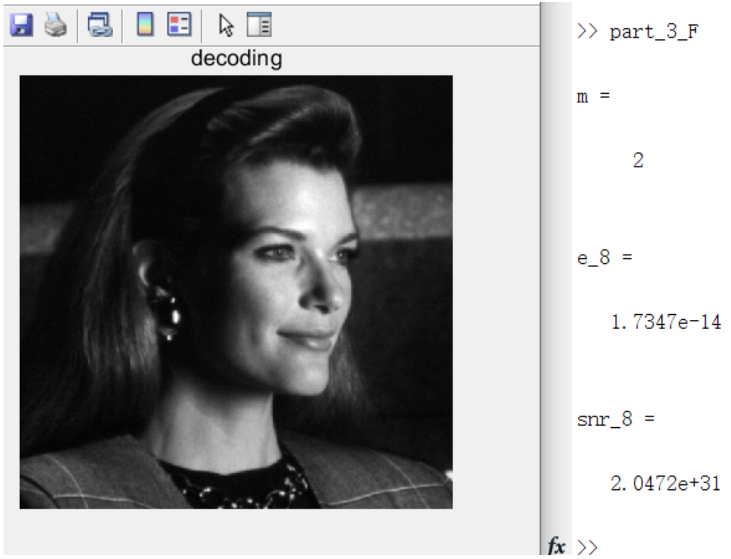
```
m =

     8


e_8 =

   1.0124e-08 - 4.1412e-08i


snr_8 =

  -2.9536e+18 + 1.5359e+18i
```



```
>> part_3_F

m =

     7


e_8 =

  28.9382 + 4.3560i


snr_8 =

   4.8666 - 1.4681i
```

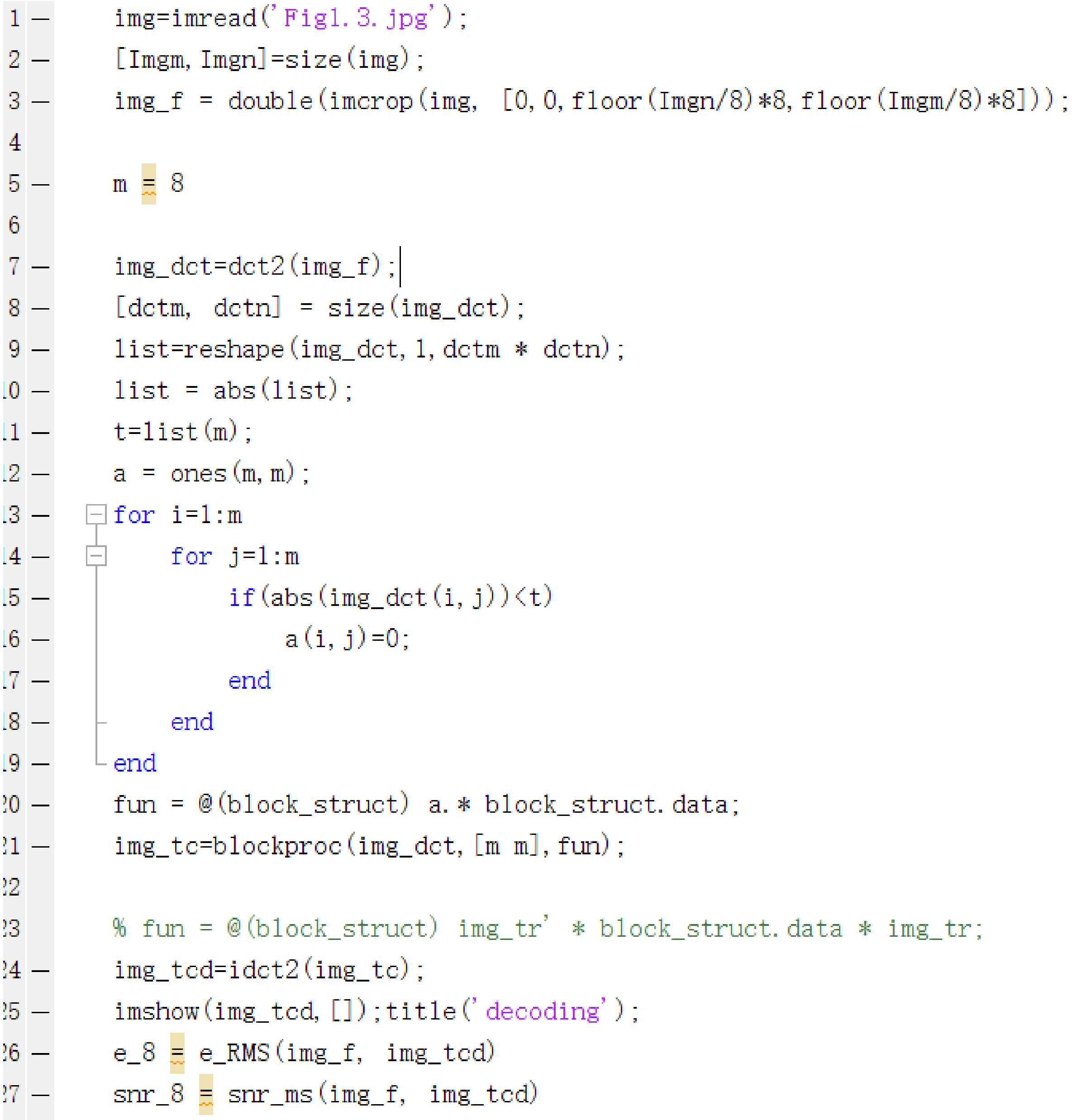


```
>> part_3_F

m =

     4


e_8 =

  20.9013 - 0.0000i


snr_8 =

   9.3085 + 0.0000i

fx >>
```

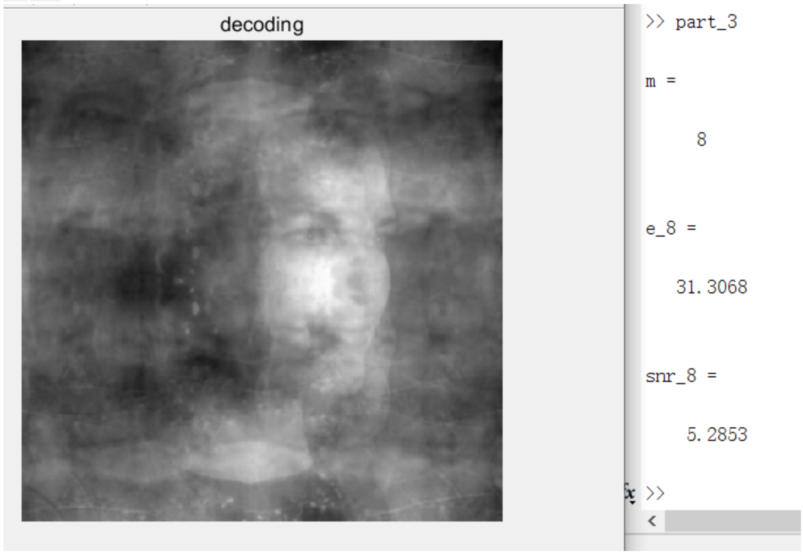


```
>> part_3_F

m =

     2


e_8 =

   1.7347e-14


snr_8 =

   2.0472e+31

fx >>
```

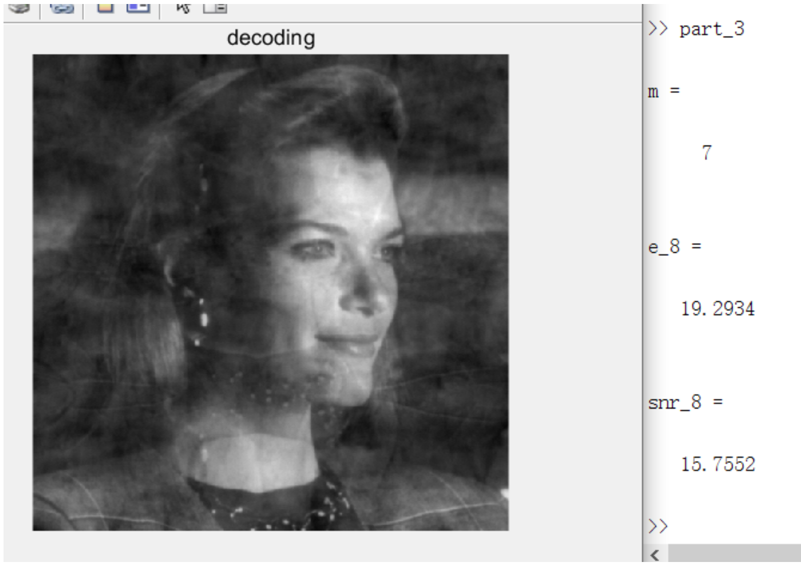
3.2 case 2



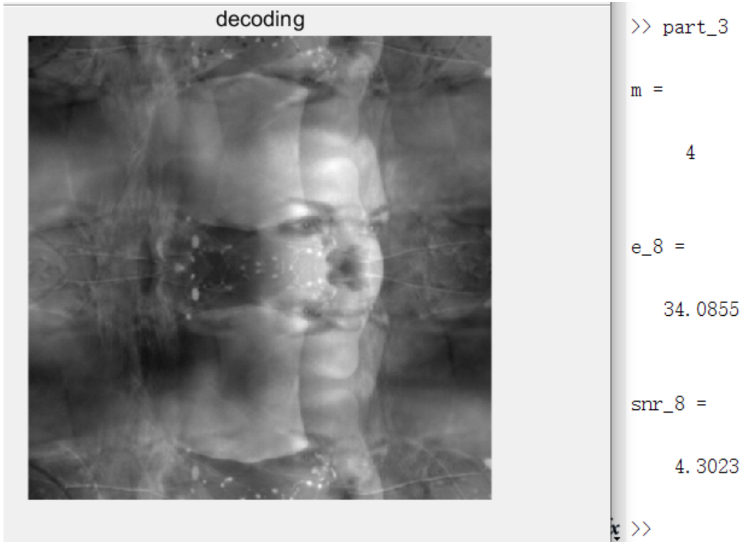
```
img=imread('Fig1.3.jpg');
[Imgm, Imgn]=size(img);
img_f = double(imcrop(img,  [0,0,floor(Imgn/8)*8,floor(Imgm/8)*8]));

m = 8

img_dct=dct2(img_f);
[dctm,  dctn] = size(img_dct);
list=reshape(img_dct,1,dctm * dctn);
list = abs(list);
t=list(m);
a = ones(m,m);
for i=1:m
    for j=1:m
        if(abs(img_dct(i,j))<t)
            a(i,j)=0;
        end
    end
end
fun = @(block_struct) a.* block_struct.data;
img_tc=blockproc(img_dct,[m m],fun);

% fun = @(block_struct) img_tr' * block_struct.data * img_tr;
img_tcd=idct2(img_tc);
imshow(img_tcd,[]);title('decoding');
e_8 = e_RMS(img_f,  img_tcd)
snr_8 = snr_ms(img_f,  img_tcd)
```



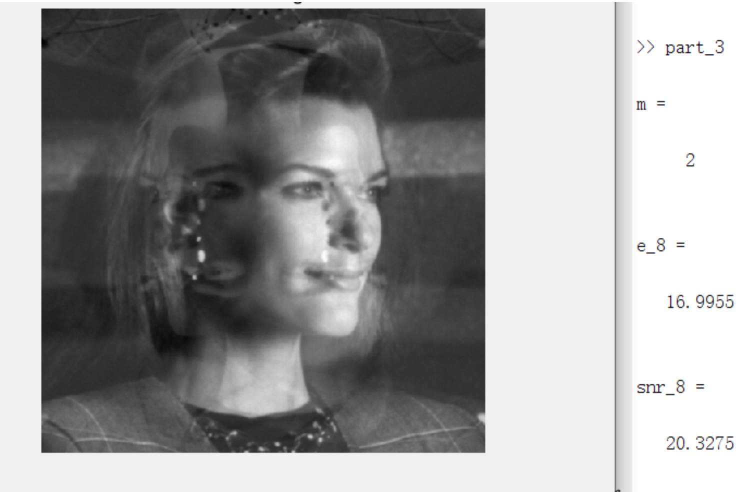
```
>> part_3

m =

     8


e_8 =

   31.3068


snr_8 =

    5.2853

>>
```



```
>> part_3

m =

     7


e_8 =

   19.2934


snr_8 =

   15.7552

>>
```



```
>> part_3

m =

     4


e_8 =

   34.0855


snr_8 =

    4.3023

>>
```



```
>> part_3

m =

     2


e_8 =

   16.9955


snr_8 =

   20.3275
```