Lab 2: JPEG Compression

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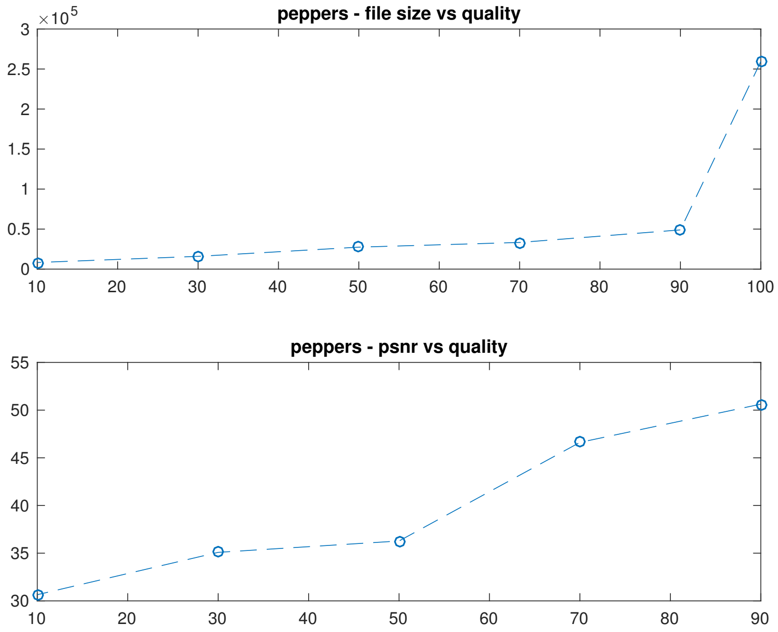
Abstract

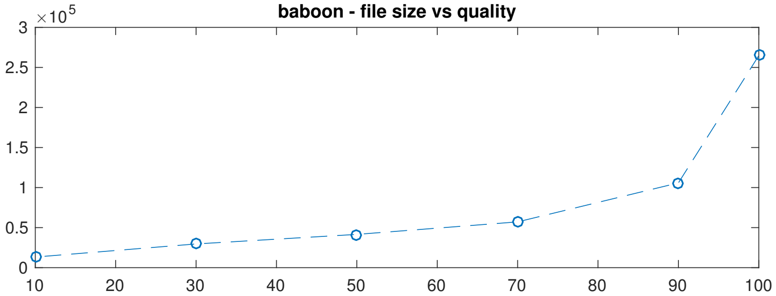
Contents

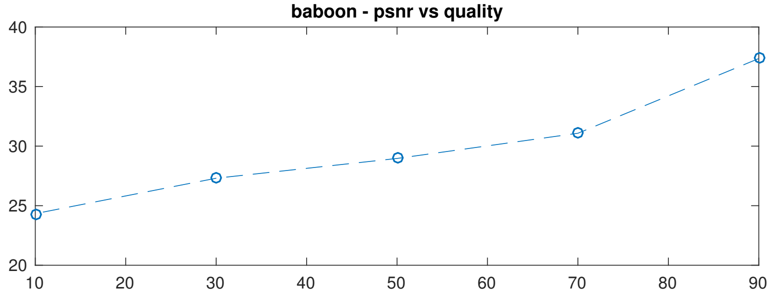
1 JPEG Quality Factor

```
pep=imread('peppers.tif');
bab=imread('baboon.tif');

imwrite(pep, 'pep90.jpg','Quality',90)
imwrite(pep, 'pep70.jpg','Quality',70)
imwrite(pep, 'pep50.jpg','Quality',50)
imwrite(pep, 'pep30.jpg','Quality',30)
imwrite(pep, 'pep10.jpg','Quality',10)

imwrite(bab, 'bab90.jpg','Quality',90)
imwrite(bab, 'bab70.jpg','Quality',70)
imwrite(bab, 'bab50.jpg','Quality',50)
imwrite(bab, 'bab30.jpg','Quality',30)
imwrite(bab, 'bab10.jpg','Quality',10)

pep_psnr=zeros(1,6);
pep_size=zeros(1,6);

temp=imfinfo('peppers.tif');
pep_size(1)=temp.FileSize;
pep_psnr(1)= psnr(pep, pep);

temp=imfinfo('pep90.jpg');
pep_size(2)=temp.FileSize;
pep_psnr(2)= psnr(imread('pep90.jpg'), pep);

temp=imfinfo('pep70.jpg');
pep_size(3)=temp.FileSize;
pep_psnr(3)= psnr(imread('pep70.jpg'), pep);

temp=imfinfo('pep50.jpg');
pep_size(4)=temp.FileSize;
pep_psnr(4)= psnr(imread('pep50.jpg'), pep);

temp=imfinfo('pep30.jpg');
pep_size(5)=temp.FileSize;
pep_psnr(5)= psnr(imread('pep30.jpg'), pep);

temp=imfinfo('pep10.jpg');
pep_size(6)=temp.FileSize;
pep_psnr(6)= psnr(imread('pep10.jpg'), pep);

figure
subplot(2,1,1)
plot(100*[1 .9 .7 .5 .3 .1],pep_size,'--o')
hold on
title('peppers␣-␣file␣size␣vs␣quality')
subplot(2,1,2)
plot(100*[1 .9 .7 .5 .3 .1],pep_psnr,'--o')
hold on
title('peppers␣-␣psnr␣vs␣quality')

bab_psnr=zeros(1,6);
bab_size=zeros(1,6);

temp=imfinfo('baboon.tif');
bab_size(1)=temp.FileSize;
```

```
bab_psnr(1)= psnr(bab, bab);

temp=imfinfo('bab90.jpg');
bab_size(2)=temp.FileSize;
bab_psnr(2)= psnr(imread('bab90.jpg'), bab);

temp=imfinfo('bab70.jpg');
bab_size(3)=temp.FileSize;
bab_psnr(3)= psnr(imread('bab70.jpg'), bab);

temp=imfinfo('bab50.jpg');
bab_size(4)=temp.FileSize;
bab_psnr(4)= psnr(imread('bab50.jpg'), bab);

temp=imfinfo('bab30.jpg');
bab_size(5)=temp.FileSize;
bab_psnr(5)= psnr(imread('bab30.jpg'), bab);

temp=imfinfo('bab10.jpg');
bab_size(6)=temp.FileSize;
bab_psnr(6)= psnr(imread('bab10.jpg'), bab);

figure
subplot(2,1,1)
plot(100*[1 .9 .7 .5 .3 .1],bab_size,'--o')
hold on
title('baboon␣-␣file␣size␣vs␣quality')
subplot(2,1,2)
plot(100*[1 .9 .7 .5 .3 .1],bab_psnr,'--o')
hold on
title('baboon␣-␣psnr␣vs␣quality')
```







2 Writing JPEG compression in matlab

myJpgEncode.m

```
function [result] = myJpgEncode( pep,Q )
%myJpgEncode implement my own jpeg algorithm
%   using the notes
A=zeros(size(pep));
stor=[];
for i=1:512/8
    for j=1:512/8
        tempA=dct2(pep(8*(i-1)+1:i*8,8*(j-1)+1:j*8));
        pep_quan=round(tempA./Q).*Q;
        stor=[stor;ZigzagMtx2Vector(pep_quan)];
    end
end
result=JPEG_entropy_encode(512,512,8,Q,stor,'./',1);
end
```

myJpgDecode.m

```
function [pep] = myJpgDecode()
%myJpgEncode implement my own jpeg algorithm
%   using the notes
[rowN,colN,dct_block_size,iQ,iZZDCTQIm]=JPEG_entropy_decode('
    ./');
pep=zeros(512);
ndx=1;
for i=1:512/8
    for j=1:512/8
        pep(8*(i-1)+1:i*8,8*(j-1)+1:j*8)=idct2(
            Vector2ZigzagMtx(iZZDCTQIm(ndx,:)));
        ndx=ndx+1;
    end
end
end
```

3 Evaluating Quantization Tables

```
Q=[16 11 10 16 24 40 51 61;...
    12 12 14 19 26 58 60 55;...
    14 13 16 24 40 57 69 56;...
    14 17 22 29 51 87 80 62;...
    18 22 37 56 68 109 103 77;...
    24 35 55 64 81 104 113 92;...
    49 64 78 87 103 121 120 101;...
    72 92 95 98 112 100 103 99];

tempQ=zeros(8);
for i=1:512/8
     for j=1:512/8
          tempQ=tempQ+abs(dct2(pep(8*(i-1)+1:i*8,8*(j-1)+1:j*8)));
     end
end
DCTs=tempQ/4096;
nrm1=max(max(DCTs))./DCTs;
Q2=double(uint8(nrm1.^.65));

stor=[];
for i=1:512/8
     for j=1:512/8
          tempA=dct2(pep(8*(i-1)+1:i*8,8*(j-1)+1:j*8));
          stor=[stor;ZigzagMtx2Vector(tempA)];
     end
end
vrnce=Vector2ZigzagMtx(var(stor));
nrm2=max(max(vrnce))./vrnce;
Q3=double(uint8(log(nrm2).^2))+1;

A=myJpgEncode( pep,Q );
jpg1=uint8(myJpgDecode());
psnr(pep,jpg1)

B=myJpgEncode( pep,Q2 );
jpg2=uint8(myJpgDecode());
psnr(pep,jpg2)

C=myJpgEncode( pep,Q3 );
jpg3=uint8(myJpgDecode());
psnr(pep,jpg3)

figure
imshow([pep,jpg1;jpg2,jpg3])
```

Q-Table	Compressed Size(kB)	PSNR(dB)
Standard	44.7	36.27
Mean	33.1	36.33
Variance	23.7	34.40

Table 1: Comparison of Different JPEG Quantization Tables Used

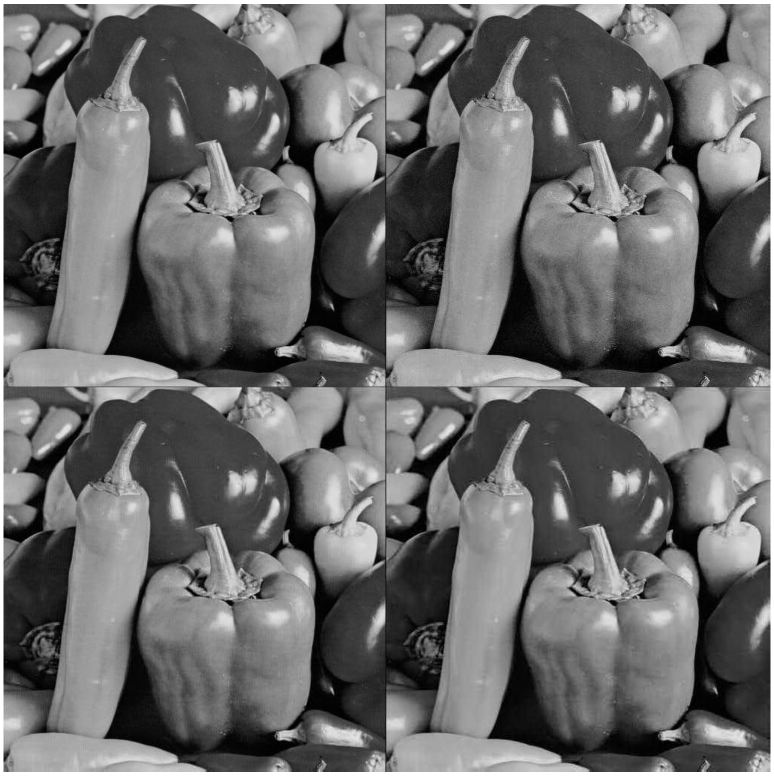


Figure 1: Resultant image after no JPEG compression(top-left), compression using the JPEG standard quantization table(top-right), compression using a quantization table based on the mean magnitude of the DCT coefficients(bottom-left), and compression using a quantization table derived from the DCT coefficients' variences(bottom-right).