

Scilab Manual for
Digital Image Processing
by Dr B.Chandra Mohan
Electronics Engineering
Bapatla Engineering College¹

Solutions provided by
Mr R.Senthilkumar- Assistant Professor
Electronics Engineering
Institute of Road and Transport Technology

November 24, 2024

¹Funded by a grant from the National Mission on Education through ICT, <http://spoken-tutorial.org/NMEICT-Intro>. This Scilab Manual and Scilab codes written in it can be downloaded from the "Migrated Labs" section at the website <http://scilab.in>

Contents

List of Scilab Solutions	4
1 Histogram display and histogram equalization	6
2 Kernel processing on images leading to image enhancement	10
3 Display of 2D filters frequency responses and processing the images using these filters	14
4 Implementation of Airthmetic Coding for images	18
5 Basic JPEG algorithm implementation	20
6 DPCM encoding and decoding of images	25
7 Simple image watermarking algorithms using LSB substitution	30
8 Simple content based image retrieval using various distance metrics	36
9 Image segmentation algorithms using Snakes	41
10 Color images manipulations, reading and writing of color images	44
11 Color image enhancements	47
12 Color image histogram manipulation	51

13 LOG Masks implementation for gray and color images	55
14 Special effects implementation on grey and color images	57
15 Simple video reading and writing .avi formats and manipulation of video frames	62

List of Experiments

Solution 1.1	Exp1	6
Solution 2.1	Exp2	10
Solution 3.1	Exp3	14
Solution 4.1	Exp4	18
Solution 5.1	Exp5	20
Solution 6.1	Exp6	25
Solution 7.1	Exp7	30
Solution 8.1	Exp8	36
Solution 9.1	Exp9	41
Solution 10.1	Exp10	44
Solution 11.1	Exp11	47
Solution 12.1	Exp12	51
Solution 13.1	Exp13	55
Solution 14.1	Exp14	57
Solution 15.1	Exp15a	62
Solution 15.2	Exp15b	63
AP 1	Rotate Image 90 degree	66
AP 2	Histogram of Gray images	67
AP 3	Image Enhancement	67
AP 4	Inverse Zig Zag scanning of pixels	69
AP 5	Zig Zag Scanning of Pixels	70
AP 6	2D Fast Fourier Transform	70
AP 7	Inverse 2D Fast Fourier Transform	71

List of Figures

1.1	Exp1	8
1.2	Exp1	9
2.1	Exp2	12
2.2	Exp2	13
3.1	Exp3	16
3.2	Exp3	17
6.1	Exp6	28
6.2	Exp6	29
7.1	Exp7	34
7.2	Exp7	35
8.1	Exp8	39
8.2	Exp8	40
11.1	Exp11	49
11.2	Exp11	50
12.1	Exp12	53
12.2	Exp12	54
14.1	Exp14	60
14.2	Exp14	61

Experiment: 1

Histogram display and histogram equalization

Scilab code Solution 1.1 Exp1

```
1 //Program 1 Histogram display and histogram
   equalization
2 //Software version
3 //OS Windows7
4 //Scilab5.4.1
5 //Image Processing Design Toolbox 8.3.1-1
6 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
7 clc;
8 clear;
9 close;
10 //a=imread('C:\Users\senthilkumar\Desktop\
   Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
   tire.tif'); //Image Path
11 a=imread('C:\Users\senthilkumar\Desktop\
   Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
   tire.jpeg');
12 [m n]=size(a);
13 for i=1:256
```

```

14     b(i)=length(find(a==(i-1)));
15 end
16 pbb=b/(m*n);
17 pb(1)=pbb(1);
18 for i=2:256
19     pb(i)=pb(i-1)+pbb(i);
20 end
21
22 s=pb*255;
23 sb=uint8(round(s));
24 index =0;
25 for i=1:m
26     for j=1:n
27         index = double(a(i,j))+1;//convert it to
                double
28         //otherwise index = 255+1 =0
29         hea(i,j)= sb(index);//histogram equalization
30     end
31 end
32 figure ,
33 ShowImage(a,'Original Image')//IPD toolbox
34 title('Original Image')
35 figure
36 plot2d3('gnn',[1:256],b)
37 title('Histogram of the Image')
38 figure
39 ShowImage(hea,'Image after Histogram equalization')
    //IPD toolbox
40 title('Image after Histogram equalization')

```

Original Image



Figure 1.1: Exp1

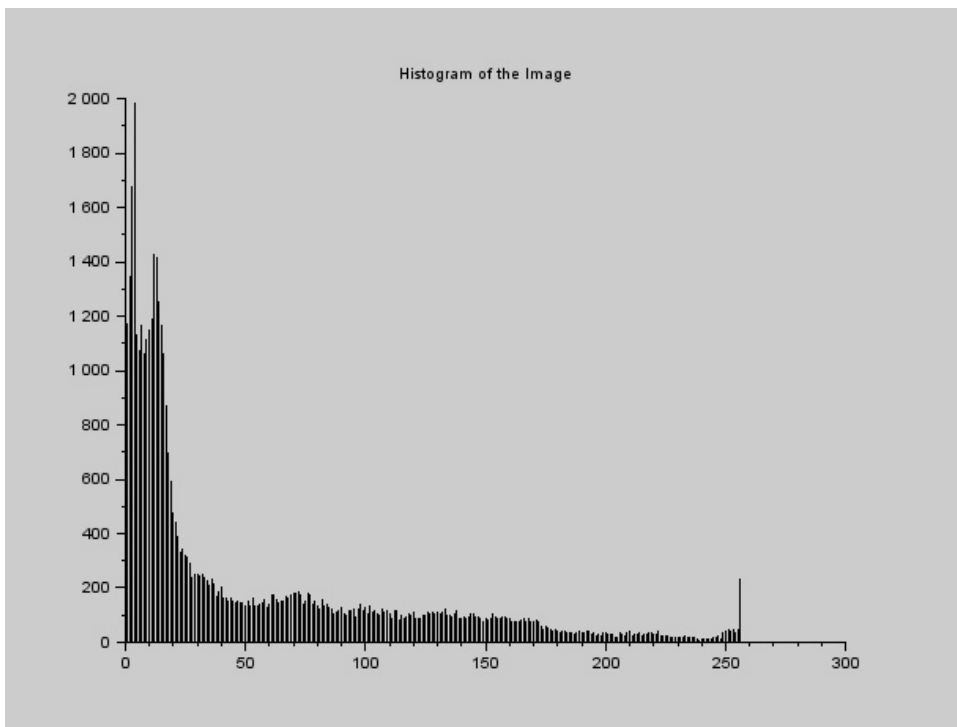


Figure 1.2: Exp1

Experiment: 2

Kernel processing on images leading to image enhancement

Scilab code Solution 2.1 Exp2

```
1 //Program 2.Kernel processing on images leading to
  image enhancement.
2 //Software version
3 //OS Windows7
4 //Scilab5.4.1
5 //Image Processing Design Toolbox 8.3.1-1
6 //Scilab Image and Video Processing toolbox
  0.5.3.1-2
7 clc
8 clear
9 close
10 a=imread('C:\Users\senthilkumar\Desktop\
  Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
  cktnoise.jpeg');//SIVP toolbox
11 ks=input('enter the size of the kernel 1 for 1 1 3
  for 3 3 ... ');//kernel size 3x3
12 [m n]=size(a);
13
14 a1=zeros(m+ks-1,n+ks-1);
```

```

15 [m1 n1]=size(a1);
16 x=floor(ks/2);
17 a1(1+x:m1-x,1+x:n1-x)=a;
18 b=[];
19 c=[];
20
21 for i=1+x:m1-x
22     for j=1+x:n1-x
23         t=a1(i-x:i+x,j-x:j+x);
24         men=sum(sum(t))/(ks*ks);
25         med=median(t(:));
26         b(i-x,j-x)=men;
27         c(i-x,j-x)=med;
28     end
29 end
30
31 figure
32 ShowImage(a,'Noised image(before enhancement)');//
    IPD toolbox
33 title('Noised image(before enhancement)');
34 figure
35 ShowImage(uint8(b),'enhancement with mean filtering'
    );//IPD toolbox
36 title('enhancement with mean filtering');
37 figure
38 ShowImage(uint8(c),'enhancement with median
    filtering');//IPD toolbox
39 title('enhancement with median filtering');
40 //RESULT
41 //enter the size of the kernel 1 for 1 1 3 for 3 3
    ...3

```

Noised image(before enhancement)

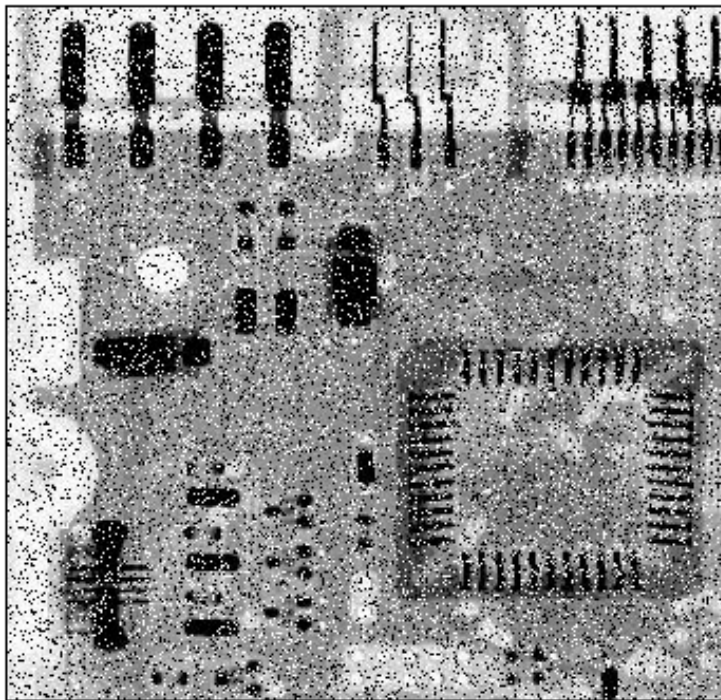


Figure 2.1: Exp2

enhancement with mean filtering

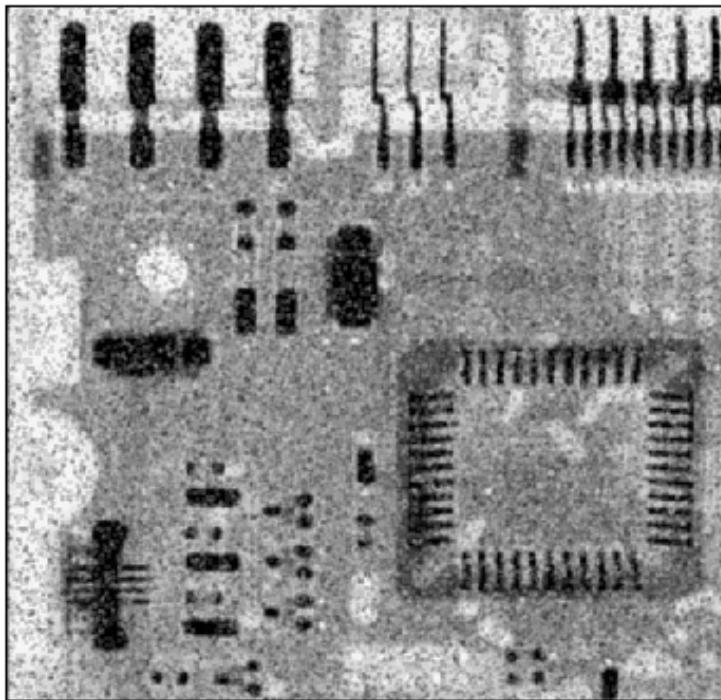


Figure 2.2: Exp2

Experiment: 3

Display of 2D filters frequency responses and processing the images using these filters

check Appendix [AP 6](#) for dependency:

```
fft2d.sce
```

check Appendix [AP 7](#) for dependency:

```
ifft2d.sce
```

Scilab code Solution 3.1 Exp3

```
1 //Program 3:Display of 2D filters frequency
  responses and processing the images using these
  filters
2 //Reference: "Digital Image Processing",Dr.S.
  Jayaraman ,S. Esakkirajan ,T. Veerakumar ,TMH,2011
3 //Note: The in-built scilab functions fft2d and
  ifft2d are not working properly
4 //It give wrong results.
5 //Use My functions for 2D-FFT and 2D-IFFT.
6 //Software version
```

```

7 //OS Windows7
8 //Scilab5.4.1
9 //Image Processing Design Toolbox 8.3.1-1
10 //Scilab Image and Video Processing toolbox
    0.5.3.1-2
11 clc;
12 close;
13 clear;
14 exec('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    fft2d.sce')
15 exec('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    ifft2d.sce')
16 im1 = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    balloonsnoisy.png'); //colour noise image
17 im = rgb2gray(im1); //gray noise image
18 fc = 100; //cut off frequency -more features choose
    high cutoff frequency
19 n = 1; //filter order =1
20 [co,ro]= size(im);
21 cx = round(co/2); //centre of the image
22 cy = round(ro/2);
23 IM = fft2d(double(im));
24 imf = fftshift(IM);
25 H = zeros(co,ro);
26 for i = 1:co
27     for j = 1:ro
28         d = (i-cx).^2+(j-cy).^2;
29         H(i,j) = 1/(1+((d/fc/fc).^(2*n))); //Low
            Pass Butterworth First Order filter
30     end
31 end
32 out_im = imf.*H;
33 out = abs(ifft2d(out_im));
34 out = uint8(out);
35 figure

```




Figure 3.1: Exp3

```
36 ShowColorImage(im1, 'Colour Noisy Image')
37 figure
38 ShowImage(im, 'Gray Noise Image')
39 figure
40 ShowImage(H, 'Low Pass Filter Frequency Response')
41 figure
42 ShowImage(out, 'Filtered Image')
```



Figure 3.2: Exp3

Experiment: 4

Implementation of Airthmetic Coding for images

Scilab code Solution 4.1 Exp4

```
1 // Program 4. Implementation of arithmetic coding
  for images
2 //Note 1: In order to run this program download
  Huffman toolbox from
3 //scilab atoms
4 //Note 2: The Huffman atom is used to encode images
  of small size only
5 //Software version
6 //OS Windows7
7 //Scilab5.4.1
8 //Image Processing Design Toolbox 8.3.1-1
9 //Scilab Image and Video Processing toolbox
  0.5.3.1-2
10 clear;
11 clc;
12 close;
13 //A=testmatrix('frk',10)+1;
14 a = imread('C:\Users\senthilkumar\Desktop\
  Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
```

```

    cameraman.jpeg');
15 A = imresize(a,[16 16]); //Only Image of small size
    is possible to call huffcode
16 B = size(A);
17 A=A(:).';
18 A = double(A);
19 [QT,QM]=huffcode(A); //Huffman Encoding
20 disp('compressed Bit sequence:');
21 disp(QT);
22 disp('Code Table:');
23 disp(QM);
24 // Now, the reverse operation
25 C = huffdeco(QT,QM); //Huffman Decoding
26 for i=1:B(1)
27     E(i,1:B(2))= C((i-1)*B(2)+1:i*B(2));
28 end
29 D = E';
30 E = imresize(D,[32,32]);
31 figure
32 ShowImage(a,'Original cameraman Image 256x256')
33 figure
34 ShowImage(E,'Reconstructed cameraman Image 256x256')
    ;

```

Experiment: 5

Basic JPEG algorithm implementation

check Appendix [AP 4](#) for dependency:

```
izigzag5.sci
```

check Appendix [AP 5](#) for dependency:

```
zigzag5.sci
```

Scilab code Solution 5.1 Exp5

```
1 // Program 5. Basic JPEG algorithm implementation
2 //Software version
3 //OS Windows7
4 //Scilab5.4.1
5 //Image Processing Design Toolbox 8.3.1-1
6 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
7 close
8 clear;
9 clc;
10 exec('C:\Users\senthilkumar\Desktop\
   Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
   zigzag_5.sci')
```

```

11 exec('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    izigzag_5.sci')
12 I = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    cameraman.jpeg'); //256x256 image
13 I = imresize(I,0.25); //reduced to 64x64 image [in
    order to reduce the computation time]
14 [m,n]=size(I); // Finding the dimensions of the image
    file.
15 I=double(I);
16 q= [16 11 10 16 24 40 51 61;
17     12 12 14 19 26 58 60 55;
18     14 13 16 24 40 57 69 56;
19     14 17 22 29 51 87 80 62;
20     18 22 37 56 68 109 103 77;
21     24 35 55 64 81 104 113 92;
22     49 64 78 87 103 121 120 101;
23     72 92 95 98 112 100 103 99];
24 N=8; // Block size for which
    DCT is Computed.
25 M=8;
26 I_Trnsfrm.block=zeros(N,M); // Initialising the DCT
    Coefficients Structure Matrix "I_Trnsfrm" with the
    required dimensions.
27 for a=1:m/N
28     for b=1:n/M
29         for k=1:N
30             for l=1:M
31                 Mean_Sum=0;
32                 //2D-Discrete Cosine Transform
33                 ///////
34                 for i=1:N
35                     for j=1:M
                        Mean_Sum = Mean_Sum+double(I
                            (N*(a-1)+i,M*(b-1)+j))*
                            cos(%pi*(k-1)*(2*i-1)/(2*
                                N))*cos(%pi*(l-1)*(2*j-1)

```

```

                                                    /(2*M));
36         end
37     end
38     //////////////////////////////////
39     if k==1
40         Mean_Sum = Mean_Sum*sqrt(1/N);
41     else
42         Mean_Sum = Mean_Sum*sqrt(2/N);
43     end
44     if l==1
45         Mean_Sum = Mean_Sum*sqrt(1/M);
46     else
47         Mean_Sum = Mean_Sum*sqrt(2/M);
48     end
49     I_Trnsfrm(a,b).block(k,l)= Mean_Sum;
50     end
51 end
52 // Normalizing the DCT Matrix and Quantizing
   the resulting values.
53 I_Trnsfrm(a,b).block=round(I_Trnsfrm(a,b).
   block./q);
54 end
55 end
56 I_zigzag.block = zeros(N,M);
57 for a= 1:m/N
58     for b = 1:n/M
59         I_zigzag(a,b).block = zigzag_5(I_Trnsfrm(a,b)
   .block);
60     end
61 end
62 I_rec_Trnsfm.block = zeros(N,M);
63 for a= 1:m/N
64     for b = 1:n/M
65         I_rec_Trnsfm(a,b).block = izigzag_5(I_zigzag
   (a,b).block);
66     end
67 end
68 // Denormalizing the Reconstructed Transform matrix

```

```

        using the same
69 // Normalization matrix.
70 for a=1:m/N
71     for b=1:n/M
72         I_rec_Trnsfm(a,b).block =(I_rec_Trnsfm(a,b).
            block).*q;
73     end
74 end
75 //Inverse 2D-DCT
76 for a=1:m/N
77     for b=1:n/M
78         for i=1:N
79             for j=1:M
80                 Mean_Sum =0;
81                 for k=1:N
82                     for l=1:M
83                         if k==1
84                             temp =double(sqrt(1/2)*
                                I_rec_Trnsfm(a,b).
                                block(k,l))*cos(%pi*(k
                                -1)*(2*i-1)/(2*N))*cos
                                (%pi*(l-1)*(2*j-1)/(2*
                                M));
85                         else
86                             temp = double(
                                I_rec_Trnsfm(a,b).
                                block(k,l))*cos(%pi*(
                                k-1)*(2*i-1)/(2*N))*
                                cos(%pi*(l-1)*(2*j-1)
                                /(2*M));
87                             end
88                             if l==1
89                                 temp = temp*sqrt(1/2);
90                             end
91                             Mean_Sum = Mean_Sum+temp;
92                         end
93                     end
94                 Mean_Sum = Mean_Sum*(2/sqrt(M*N));

```



```
95             I_rec((a-1)*N+i,(b-1)*M+j)= Mean_Sum
96                 ;
97             end
98         end
99     end
100 // Displaying the Reconstructed Image.
101 diff_image = im2double(I)*255-I_rec;
102 diff_image = diff_image/max(max(diff_image));
103 diff_image = im2uint8(diff_image);
104 I_rec = I_rec/max(max(I_rec));
105 I_rec = im2uint8(I_rec);
106 figure
107 ShowImage(I_rec,'Recovered Image');
108 figure
109 ShowImage(diff_image,'Difference Image')
110 figure
111 imhist(I_rec);
112 figure
113 imhist(diff);
```

Experiment: 6

DPCM encoding and decoding of images

Scilab code Solution 6.1 Exp6

```
1 // Program 6 DPCM encoding and decoding of images
2 //Software version
3 //OS Windows7
4 //Scilab5.4.1
5 //Image Processing Design Toolbox 8.3.1-1
6 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
7 clc
8 clear
9 //Function to find number of elements in an image
10 function [N] = numel(X)
11     //X-input image
12     //N- number of elements in image X
13     [m,n]= size(X);
14     N = m*n;
15 endfunction
16 //
```

////////////////////////////////////


```
51         inq=ret*q;
52         repre=repre+inq;
53         c(i,j)=repre;
54     end
55 end
56 figure
57 ShowImage(a,'Image Before Quantization')
58 figure
59 ShowImage(b,'Quantized Image')
60 figure
61 ShowImage(c,'Reconstructed Image From Quantized
    Image')
62 psnr = psnr_mse_maxerr(a,c);
63 disp(psnr,'PSNR in dB= ')
64 //RESULT
65 //enter the quantization value 2
66 //PSNR in dB = 51.165559
67
68 //enter the quantization value 8
69 //PSNR in dB = 40.698164
70 //
```

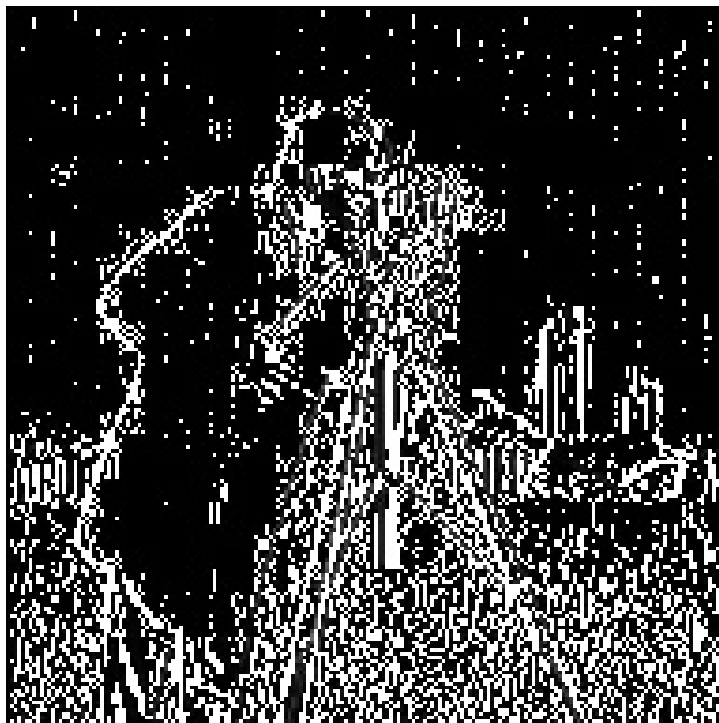


Figure 6.1: Exp6



Figure 6.2: Exp6

Experiment: 7

Simple image watermarking algorithms using LSB substitution

Scilab code Solution 7.1 Exp7

```
1 //Program 7. Simple image watermarking algorithms
   using LSB substitution
2 //Note 1: The imread function in SIVP toolbox read
   the binary image as gray
3 //scale image. During bitset it will create problems
   .
4 //The grayscale image can be converted into binary
   image using the function
5 //gray2bin()
6 //Note 2: The functions bit_set and bit_get are
   written inorder to save the
7 // scilab workspace memory during execution
8 //Software version
9 //OS Windows7
10 //Scilab5.4.1
11 //Image Processing Design Toolbox 8.3.1-1
12 //Scilab Image and Video Processing toolbox
```

0.5.3.1-2

```
13 clc
14 clear
15 close
16 //Function to find number of elements in an image
17 function [N] = numel(X)
18     //X-input image
19     //N- number of elements in image X
20     [m,n]= size(X);
21     N = m*n;
22 endfunction
23 //Function to calculate peak signal to noise ratio
24 function [psnr,mse,maxerr] = psnr_mse_maxerr(X,Xapp)
25 //PSNR_MSE_MAXERR Peak signal to noise ratio
26 //X - original Image
27 //Xapp - reconstructed image
28 //psnr - peak signal to noise ratio
29 //mse - mean square error
30 //maxerr - maximum error
31 X     = double(X);
32 Xapp = double(Xapp);
33 absD = abs(X-Xapp);
34 A     = absD.^2;
35 mse  = sum(A(:))/numel(X);
36 psnr = 10*log10(255*255/mse);
37 maxerr = round(max(absD(:)));
38 endfunction
39 //
    //////////////////////////////////////
40 function [A]= gray2bin(B)
41     [m,n] = size(B)
42     for i = 1:m
43         for j = 1:n
44             if(B(i,j)>200)
45                 A(i,j)= 1;
46             else
47                 A(i,j)=0;
```



```

48         end
49
50     end
51
52 end
53 endfunction
54 //
    //////////////////////////////////////
55 function [c]= bit_set(c,b)
56     [m,n] = size(c);
57     for i=1:m
58         for j=1:n
59             c(i,j)=bitset(c(i,j),1,b(i,j));
60         end
61     end
62 endfunction
63 //
    //////////////////////////////////////
64 function [d] = bit_get(c)
65     [m,n] = size(c);
66     for i=1:m
67         for j=1:n
68             d(i,j)=bitget(c(i,j),1);
69         end
70     end
71 endfunction
72 //
    //////////////////////////////////////
73 a = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    cameraman.jpeg'); // original image
74 b = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\wat
    .jpg'); // watermark image
75 b = gray2bin(b);

```

```
76 [m n] = size(a);
77 a = double(a);
78 c = a;
79 c = bit_set(c,b);
80 d = bit_get(c);
81
82 figure
83 ShowImage(a, 'Original image');
84 title('Original image');
85 figure
86 ShowImage(b, 'watermark image');
87 title('watermark image');
88 figure
89 ShowImage(uint8(c), 'watermarked image');
90 title('watermarked image');
91 figure
92 ShowImage(d, 'extracted watermark');
93 title('extracted watermark');
94 psnr = psnr_mse_maxerr(a,c);
95 correlation = corr2(b,d);
96 disp(correlation, 'correlation between watermark
    image and extracted watermark=')
```

watermarked image



Figure 7.1: Exp7

extracted watermark



Figure 7.2: Exp7

Experiment: 8

Simple content based image retrieval using various distance metrics

Scilab code Solution 8.1 Exp8

```
1 //Program 8: Simple content based image retrieval
   using various distance metrics.
2 //Based on Similarity matrix
3 //Using Colormaps of different images
4 //Note 1: Other methods like wavelet based
   decomposition along with Euclidean distance
5 //comparison of sub images can be used for image
   retrieval
6 //Note 2: Principal Component Analysis (PCA) inbuilt
   function is available to
7 //get eigen vectors and eigen values for image
   retrieval
8 //Software version
9 //OS Windows7
10 //Scilab5.4.1
11 //Image Processing Design Toolbox 8.3.1-1
12 //Scilab Image and Video Processing toolbox
```

0.5.3.1-2

```
13 clear;
14 clc;
15 close;
16 I1 = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    Picture1.png'); //257x257x3.
17 I1 = imresize(I1,0.5);
18 [IndexedImage_I1, ColorMap] = RGB2Ind(I1); //IPD
    toolbox
19 I = ColorMap; //66049x3
20 J1 = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    Picture2.png'); //257x257x3.
21 J1 = imresize(J1,0.5);
22 [IndexedImage_J1, ColorMap] = RGB2Ind(J1); //IPD
    toolbox
23 J = ColorMap; //66049x3
24 //Similarity Matrix Method
25 [r,c]= size(I);
26 A = [];
27 I = double(I);
28 J = double(J);
29 for i = 1:r
30     for j = 1:c
31         M1(i,j) = (I(i,2)*sin(I(i,1))-J(j,2)*sin(J(j
            ,1)))^2;
32         M2(i,j) = (I(i,2)*cos(I(i,1))-J(j,2)*cos(J(j
            ,1)))^2;
33         M3(i,j) = (I(i,3)-J(i,3))^2;
34         M(i,j)= sqrt(M1(i,j)+M2(i,j)+M3(i,j));
35         A(i,j) = 1-M(i,j)/sqrt(5);
36     end
37 end
38 I1_rec = Ind2RGB(IndexedImage_I1,A)
39 I1_rec = imresize(I1_rec,2);
40 J1_rec = Ind2RGB(IndexedImage_J1,A)
41 J1_rec = imresize(J1_rec,2);
```

```
42 figure
43 ShowColorImage(I1,'original first image');
44 figure
45 ShowColorImage(I1_rec,'Reconstructed first image');
46 figure
47 ShowColorImage(J1,'original second image');
48 figure
49 ShowColorImage(J1_rec,'Reconstructed second image');
```



Figure 8.1: Exp8



Figure 8.2: Exp8

Experiment: 9

Image segmentation algorithms using Snakes

Scilab code Solution 9.1 Exp9

```
1 // Program 9.Image segmentation algorithms using
   snakes.
2 //Note: Incomplete.
3 //So many functions are not avilable in Scilab
4 //Image segmentation algorithms using snakes is
   impossible with current
5 //version of scilab and scilab image processing
   atoms.
6 //I tried my best
7 //Software version
8 //OS Windows7
9 //Scilab5.4.1
10 //Image Processing Design Toolbox 8.3.1-1
11 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
12 close;
13 clear;
14 clc;
15 J = imread('C:\Users\senthilkumar\Desktop\
```

```

        Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
        binary_image.jpg');
16 J = rgb2gray(J);
17 J = imresize(J,[256,256]);
18 J = double(J);
19 [h,w] = size(J);
20 for i = 1:h
21     for j= 1:w
22         if(J(i,j)>200)
23             J(i,j)= 1;
24         else
25             J(i,j) =0;
26         end
27     end
28 end
29 I = imfilter(J,fspecial('gaussian',[17 17],3));
30 figure
31 ShowImage(I,'Snakes')
32 N=500; // number of snake points
33 alpha=1;
34 tstep=1;
35 N_iter=500;
36 f=50;
37 global EDGE_SOBEL;
38 gradient = EdgeFilter(I,EDGE_SOBEL);
39 [m,n] = size(gradient);
40 Ix = gradient(:,:);
41 Iy = gradient(:,:);
42 S = -f*(Ix.*Ix + Iy.*Iy);
43 gradient = EdgeFilter(S,EDGE_SOBEL);
44 Sx = gradient(:,:);
45 Sy = gradient(:,:);
46 eps = 2.2204e-016;
47 Smag = sqrt(Sx.^2 + Sy.^2)+eps;
48 Sx(:) = Sx./Smag;
49 Sy(:) = Sy./Smag;
50 D=[-tstep*alpha*ones(N,1) (1+2*tstep*alpha)*ones(N
    ,1) -tstep*alpha*ones(N,1)];

```

```
51 D(2,3)=D(2,3)-tstep*alpha;
52 D($-1,1)=D($-1,1)-tstep*alpha;
53 theta = linspace(0,2*%pi,N);
54 theta = theta(:);
55 x = w/2 + 10 + (h/3)*cos(theta);
56 y = h/2 - 10 + (h/4)*sin(theta);
57 plot(x,y, 'r');
```

Experiment: 10

Color images manipulations, reading and writing of color images

Scilab code Solution 10.1 Exp10

```
1 //Program 10.Color images manipulations , reading and
   writing of color images
2 //Software version
3 //OS Windows7
4 //Scilab5.4.1
5 //Image Processing Design Toolbox 8.3.1-1
6 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
7 clc
8 clear
9 close
10 //Showing RGB components of a color RGB image.
11 //Splitting the color image (RGB Image) into three
   planes
12 a=imread('C:\Users\senthilkumar\Desktop\
   Chandra_Mohan_LAB\DIP_Scilab_Programs\peppers.
   png'); //this image is 348x512x3 size
```

```

13  figure
14  ar=a(:,:,1);
15  ShowImage(ar, 'RED Matrix')
16  figure
17  ag=a(:,:,2);
18  ShowImage(ag, 'GREEN Matrix')
19  figure
20  ab=a(:,:,3);
21  ShowImage(ab, 'BLUE Matrix')
22  //Reconstruction of original color image from three
    RGB planes
23
24  RGB = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\DIP_Scilab_Programs\peppers.
    png'); //SIVP toolbox
25  RGB_128 = RGB/2;
26  RGB_128 = round(RGB_128)
27  [X,map] = RGB2Ind(RGB_128);
28  figure
29  ShowImage(X, 'Indexed Image',map)
30  //Limiting no of colours to 8 without dithering
31  figure
32  RGB_8 = RGB/7;
33  RGB_8 = round(RGB_8)
34  [X1,map1]=RGB2Ind(RGB);
35  ShowImage(X1, 'Without Dither',map1)
36
37  figure
38  ShowColorImage(RGB, 'RGB Color Image')
39  YIQ = rgb2ntsc(RGB);
40  figure
41  ShowColorImage(YIQ, 'NTSC image YIQ')
42  RGB = ntsc2rgb(YIQ);
43  YCC = rgb2ycbcr(RGB);
44  figure
45  ShowColorImage(YCC, 'equivalent HSV image YCbCr')
46  RGB = ycbcr2rgb(YCC);
47  HSV = rgb2hsv(RGB);

```

```
48 figure
49 ShowColorImage(HSV, 'equivalent HSV image')
50 RGB = hsv2rgb(HSV);
```

Experiment: 11

Color image enhancements

check Appendix [AP 3](#) for dependency:

```
imgenh11.sci
```

Scilab code Solution 11.1 Exp11

```
1 //Program 11. Color image enhancements
2 //Software version
3 //OS Windows7
4 //Scilab5.4.1
5 //Image Processing Design Toolbox 8.3.1-1
6 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
7 clc
8 clear
9 close
10 a=imread('C:\Users\senthilkumar\Desktop\
   Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
   balloonsnoisy.png');
11 ks=input('enter the size of the kernel 1 for 1 1 3
   for 3 3 ... ');
12 exec('C:\Users\senthilkumar\Desktop\
   Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
   imgenh_11.sci')
```



```
13 for i=1:3
14     b(:,:,i)=imgenh11(a(:,:,i),ks);
15 end
16
17 figure
18 ShowColorImage(a,'Noised image(before enhancement)')
19     ;
19 title('Noised image(before enhancement)');
20 figure
21 ShowColorImage(uint8(b),'enhancement with mean
22     filtering');
22 title('enhancement with mean filtering');
23 //RESULT
24 //enter the size of the kernel 1 for 1 1 3 for 3 3
25     ...3
26
26 //NOTE: since the image is large [480 640] it will
27     take some time to
27 //show the result
```

Noised image(before enhancement)

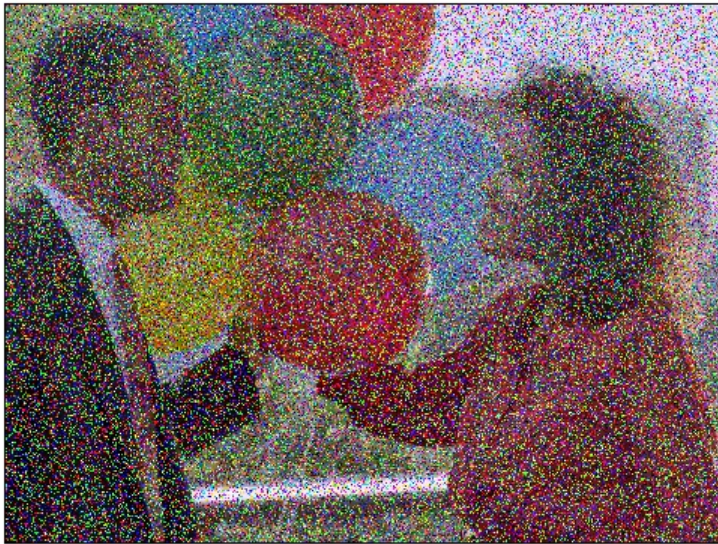


Figure 11.1: Exp11

enhancement with mean filtering



Figure 11.2: Exp11

Experiment: 12

Color image histogram manipulation

check Appendix [AP 2](#) for dependency:

```
histbw12.sci
```

Scilab code Solution 12.1 Exp12

```
1 //Program 12 Color image histogram manipulation
2 //Software version
3 //OS Windows7
4 //Scilab5.4.1
5 //Image Processing Design Toolbox 8.3.1-1
6 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
7 clc
8 close
9 a=imread('C:\Users\senthilkumar\Desktop\
   Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
   peppers.png');
10 a1=uint8(a);
11 exec('C:\Users\senthilkumar\Desktop\
   Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
   histbw_12.sci')
```

```
12 for i=1:3
13     b(:,:,i)=histbw12(a1(:,:,i));
14 end
15 figure
16 ShowColorImage(a,'original color image');
17 title('original color image');
18 figure
19 ShowColorImage(b,'histogram equalization of color
    image');
20 title('histogram equalization of color image');
21 rgbhist_12(a);
22 //exec('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    rgbhist_12.sci')
```

original color image



Figure 12.1: Exp12

histogram equalization of color image



Figure 12.2: Exp12

Experiment: 13

LOG Masks implementation for gray and color images

Scilab code Solution 13.1 Exp13

```
1 //Program 13. LOG Masks implementation for gray and
  color images
2 //Software version
3 //OS Windows7
4 //Scilab5.4.1
5 //Image Processing Design Toolbox 8.3.1-1
6 //Scilab Image and Video Processing toolbox
  0.5.3.1-2
7 clc
8 clear
9 close
10 a=imread('C:\Users\senthilkumar\Desktop\
  Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
  cameraman.jpeg');
11 a=double(a);
12 logmask=[0 1 1 2 2 2 1 1 0;1 2 4 5 5 5 4 2 1;1 4 5 3
  0 3 5 4 1;2 5 3 -12 -24 -12 3 5 2;2 5 0 -24 -40
  -24 0 5 2;
13 2 5 3 -12 -24 -12 3 5 2;1 4 5 3 0 3 5 4 1;1
```



```

                2 4 5 5 5 4 2 1;0 1 1 2 2 2 1 1 0];
14 [m n]=size(a);
15 [m1 n1]=size(logmask);
16 b=zeros(m+m1-1,n+n1-1);
17 m2=floor(m1/2);
18 n2=floor(n1/2);
19 b(m2+1:m+m2,n2+1:n+n2)=a;
20 for i=m2+1:m+m2
21     for j=n2+1:n+n2
22         c=b(i-m2:i+m2,j-n2:j+n2);
23         d=sum(sum(c.*logmask));
24         if d>150
25             e(i-m2,j-n2)=0;
26         else
27             e(i-m2,j-n2)=1;
28         end
29     end
30 end
31 end
32 title('Cameraman image after LOG masked')
33 imshow(e)//SIVP toolbox

```

Experiment: 14

Special effects implementation on grey and color images

check Appendix [AP 1](#) for dependency:

```
rot90f.sci
```

Scilab code Solution 14.1 Exp14

```
1 //Program 14. Special effects implementation on gray
   and color images
2 //Note: The functions like entropfilt().m are not
   available in scilab
3 //But similar effects can be produced in scilab
   using other methods.
4 //Software version
5 //OS Windows7
6 //Scilab5.4.1
7 //Image Processing Design Toolbox 8.3.1-1
8 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
9 clc;
10 clear;
11 close;
```

```

12 exec('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    rot90_f.sci')
13 img1 = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    mandrill.jpeg'); //colour image
14 img2 = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    twozebras.jpg'); //colour image
15 img3 = imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    cameraman.jpeg'); //gray image
16 filter1 = fspecial('sobel');
17 img1_filter = imfilter(img1,filter1);
18 img2_filter = imfilter(img2,filter1);
19 ShowColorImage(img1, 'original image 1');
20 figure
21 ShowColorImage(img1_filter, 'Special effect in
    Mandrill Image')
22 figure
23 ShowColorImage(img2, 'original image 2');
24 figure
25 ShowColorImage(img2_filter, 'Special effect in
    twozebras Image')
26 img3_negative = 255-double(img3); //image negative
27 img3_rotate = rot90f(img3,3);
28 //Image contrast adjustment
29 [m,n] = size(img3);
30 for i = 1:m
31     for j = 1:n
32         if img3(i,j)>70 then
33             img3_adjust(i,j) = img3(i,j)+(255-img3(i
                ,j));
34         else
35             img3_adjust(i,j) = img3(i,j);
36         end
37     end
38 end

```

```
39 end
40 figure
41 ShowImage(img3, 'Cameraman original Image');
42 figure
43 ShowImage(img3_negative, 'Cameraman Negative Image')
44 figure
45 ShowImage(img3_rotate, '270 degree rotation of
    cameraman image')
46 figure
47 ShowImage(img3_adjust, 'Cameraman Image Contrast
    Adjustment')
```

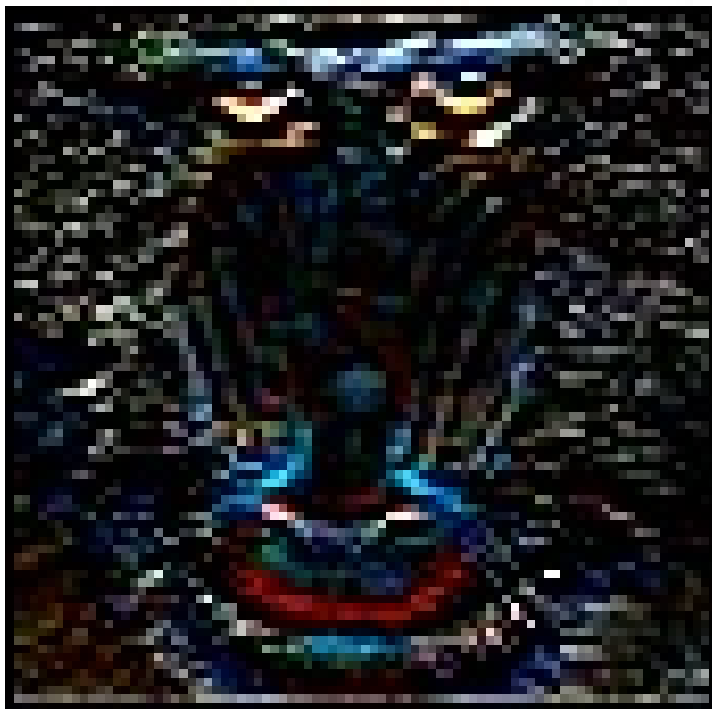


Figure 14.1: Exp14

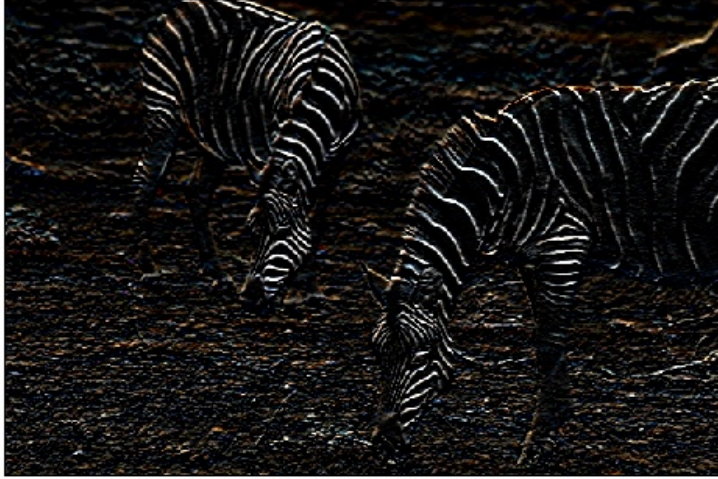


Figure 14.2: Exp14

Experiment: 15

Simple video reading and writing .avi formats and manipulation of video frames

Scilab code Solution 15.1 Exp15a

```
1 //Program 15. Simple video reading and writing .avi
   formats and manipulation of video frames.
2 //Note 1: Install xvid codec for read and write
   video files from
3 //http://www.xvid.org/Downloads.15.0.html
4 //Note 2: very large can not be read by scilab
5 //Note 3: shuttle.avi is a large file more 100
   frames. use shuttlenew.avi file
6 //for video processing applications
7 //Using SIVP Atom
8 //Software version
9 //OS Windows7
10 //Scilab5.4.1
11 //Image Processing Design Toolbox 8.3.1-1
12 //Scilab Image and Video Processing toolbox
   0.5.3.1-2
13 clear;
```

```

14 clc;
15 close;
16 //n = aviopen('SCI+\'/contrib/sivp/images/video.avi');
17 n = aviopen('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\red
    -car-video.avi');
18 im = avireadframe(n); //get a frame
19 imshow(im);
20 avilistopened()
21 aviclose(n);

```

Scilab code Solution 15.2 Exp15b

```

1 //Program 15. Simple video reading and writing .avi
  formats and manipulation of video frames.
2 //Note 1: Install xvid codec for read and write
  video files from
3 //http://www.xvid.org/Downloads.15.0.html
4 //Note 2: very large can not be read by scilab
5 //Note 3: shuttle.avi is a large file more 100
  frames. use red-car-video.avi file
6 //for video processing applications
7 //Using Image Processing Design Atom (IPD)
8 //Software version
9 //OS Windows7
10 //Scilab5.4.1
11 //Image Processing Design Toolbox 8.3.1-1
12 //Scilab Image and Video Processing toolbox
  0.5.3.1-2
13 clear;
14 clc;
15 close;
16 VideoPath = 'C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\red
    -car-video.avi';

```



```
17
18 VideoInfo = GetVideoStruct('C:\Users\senthilkumar\
    Desktop\Chandra_Mohan_LAB\
    Digital_Image_ProcessingLab\red-car-video.avi');
19
20 VideoFilePointer = OpenVideoFile('C:\Users\
    senthilkumar\Desktop\Chandra_Mohan_LAB\
    Digital_Image_ProcessingLab\red-car-video.avi');
21
22 figure();
23
24 for n = 1 : VideoInfo.NumberOfFrames
25
26     RGB = ReadImage(VideoFilePointer);
27
28     ShowColorImage(RGB, VideoPath);
29
30 end;
31
32 CloseVideoFile(VideoFilePointer);
```

Appendix

```
Scilab code AP11 function [B] = rot90f(A,k)
2 [%nargout,%nargin] = argn(0)
3 //ROT90 Rotate matrix 90 degrees.
4 // ROT90(A) is the 90 degree counterclockwise
  rotation of matrix A.
5 // ROT90(A,K) is the K*90 degree rotation of A, K
  = +-1,+-2,...
6 [m,n] = size(A);
7 if %nargin==1 then
8   k = 1;
9 else
10  k = k-fix(k/4).*4;
11  if(k<0) then
12    k = k+4;
13  end
14 end
15 if k == 1
16     A = A.';
17     B = A(n:-1:1,:);
18 elseif k == 2
19     B = A(m:-1:1,n:-1:1);
20 elseif k == 3
21     B = A(m:-1:1,:);
22     B = B.';
23 else
24     B = A;
25 end
```

26 **endfunction**

Rotate Image 90 degree

```
Scilab code AP 12 function [hea,b]=histbw12(a)
2 //a=imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab
    \tire.jpeg')
3 //a- original image
4 //b- histogram
5 //hea- histogram equalized image
6 [m n]=size(a);
7 for i=1:256
8     b(i)=length(find(a==(i-1)));
9 end
10 pbb=b/(m*n);
11 pb(1)=pbb(1);
12 for i=2:256
13     pb(i)=pb(i-1)+pbb(i);
14 end
15
16 s=pb*255;
17 sb=uint8(round(s));
18 index =0;
19 for i=1:m
20     for j=1:n
21         index = double(a(i,j))+1;//convert it to
                double
22         //otherwise index = 255+1 =0
23         hea(i,j)= sb(index);//histogram
                equalization
24     end
25 end
26 endfunction
27 //note:
28 //First run this function
29 //type the following commands in scilab console
    window
```

```

30 //a=imread('C:\Users\senthilkumar\Desktop\
    Chandra_Mohan_LAB\Digital_Image_ProcessingLab\
    tire.jpeg')
31 //[hea,b] = histbw_12(a);
32 //figure,
33 //ShowImage(a,'Original Image')//IPD toolbox
34 //title('Original Image')
35 //figure
36 //plot2d3('gnn',[1:256],b)
37 //title('Histogram of the Image')
38 //figure
39 //ShowImage(hea,'Image after Histogram equalization
    ')//IPD toolbox
40 //title('Image after Histogram equalization')

```

Histogram of Gray images

```

Scilab code AP 13 function [out] = imgenh11(a,ks)
2     [m n]=size(a);
3     a1=zeros(m+ks-1,n+ks-1);
4     [m1 n1]=size(a1);
5     x=floor(ks/2);
6     a1(1+x:m1-x,1+x:n1-x)=a;
7     out=[];
8
9     for i=1+x:m1-x
10        for j=1+x:n1-x
11            t=a1(i-x:i+x,j-x:j+x);
12            med=median(t(:));
13            out(i-x,j-x)=med;
14        end
15    end
16 endfunction

```

Image Enhancement

```

Scilab code AP 14 function [result] = izigzag5(data)
2 //inverse ZigZag scanning of input data

```

```

3  N= sqrt(size(data,1));
4  z = 1;
5  count = 0;
6  row = 1;
7  col = 0;
8  for (x = 2:2*N),
9      if (x <= N+1),
10         y = x + 1;
11         if(modulo(x,2) == 0)
12             col = col + 1;
13         else
14             row = row + 1;
15         end
16     else
17         y = N+1;
18         if (modulo(x,2) == 0)
19             row = row - 1;
20             col = col + 2;
21         else
22             row = row + 2;
23             col = col - 1;
24         end
25     end
26
27     while((row < y)&(col < y)&(row > 0)&(col > 0))
28         result(row,col) = data(z);
29         z = z + 1;
30
31         if(modulo(x,2) == 0)
32             row = row - 1;
33             col = col + 1;
34         else
35             row = row + 1;
36             col = col - 1;
37         end
38     end
39 end
40 endfunction

```

```
Scilab code AP 15 function [result] = zigzag5(data)
2 // ZigZag scanning of input data
3 N= size(data,1);
4 z = 1;
5 count = 0;
6 row = 1;
7 col = 0;
8
9 for (x = 2:2*N),
10     if (x <= N+1)
11         y = x + 1;
12         if(modulo(x,2) == 0)
13             col = col + 1;
14         else
15             row = row + 1;
16         end
17     else
18         y = N+1;
19         if(modulo(x,2) == 0)
20             row = row - 1;
21             col = col + 2;
22         else
23             row = row + 2;
24             col = col - 1;
25         end
26     end
27
28     while((row < y)&(col < y)&(row > 0)&(col > 0))
29         result(z) = data(row,col);
30         z = z + 1;
31         if(modulo(x,2) == 0)
32             row = row - 1;
33             col = col + 1;
34         else
35             row = row + 1;
```

```

36         col = col - 1;
37     end
38 end
39 end
40 endfunction

```

Zig Zag Scanning of Pixels

```

Scilab code AP 16 function [a2] = fft2d(a)
2 //a = any real or complex 2D matrix
3 //a2 = 2D-DFT of 2D matrix 'a'
4 m=size(a,1)
5 n=size(a,2)
6 // fourier transform along the rows
7 for i=1:n
8 a1(:,i)=exp(-2*i*pi*(0:m-1)'.*(0:m-1)/m)*a(:,i)
9 end
10 // fourier transform along the columns
11 for j=1:m
12 a2temp=exp(-2*i*pi*(0:n-1)'.*(0:n-1)/n)*(a1(j,:))
13 a2(j,:)=a2temp.'
14 end
15 for i = 1:m
16     for j = 1:n
17         if((abs(real(a2(i,j)))<0.0001)&(abs(imag(a2(
18             i,j)))<0.0001))
19             a2(i,j)=0;
20         elseif(abs(real(a2(i,j)))<0.0001)
21             a2(i,j)= 0+i*imag(a2(i,j));
22         elseif(abs(imag(a2(i,j)))<0.0001)
23             a2(i,j)= real(a2(i,j))+0;
24         end
25     end
26 end

```

2D Fast Fourier Transform

```

Scilab code AP 17 function [a] =ifft2d(a2)
2 //a2 = 2D-DFT of any real or complex 2D matrix
3 //a = 2D-IDFT of a2
4 m=size(a2,1)
5 n=size(a2,2)
6 //Inverse Fourier transform along the rows
7 for i=1:n
8 a1(:,i)=exp(2*%i*%pi*(0:m-1)'.*(0:m-1)/m)*a2(:,i)
9 end
10 //Inverse fourier transform along the columns
11 for j=1:m
12 atemp=exp(2*%i*%pi*(0:n-1)'.*(0:n-1)/n)*(a1(j,:)).'
13 a(j,:)=atemp.'
14 end
15 a = a/(m*n)
16 a = real(a)
17 endfunction

```

Inverse 2D Fast Fourier Transform
