Scilab Manual for Digital Image Processing by Dr Abhishek Choubey Electronics Engineering Sreenidhi Institute Of Science And Technology[1]

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Experiment: 1

Image analysis on 16 X 16 image size

Scilab code Solution 1.1 1

```
1  //Image analysis on 16*16 image size
2  //Scilab 5.4.1
3  //Windows 10
4  //Requires SIVP, IPD toolboxes
5
6  clear;
7  clc;
8
9  //Form an image of dimension 16x16 containing 16
       vertical strips
10 A=[0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
11      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
12      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
```

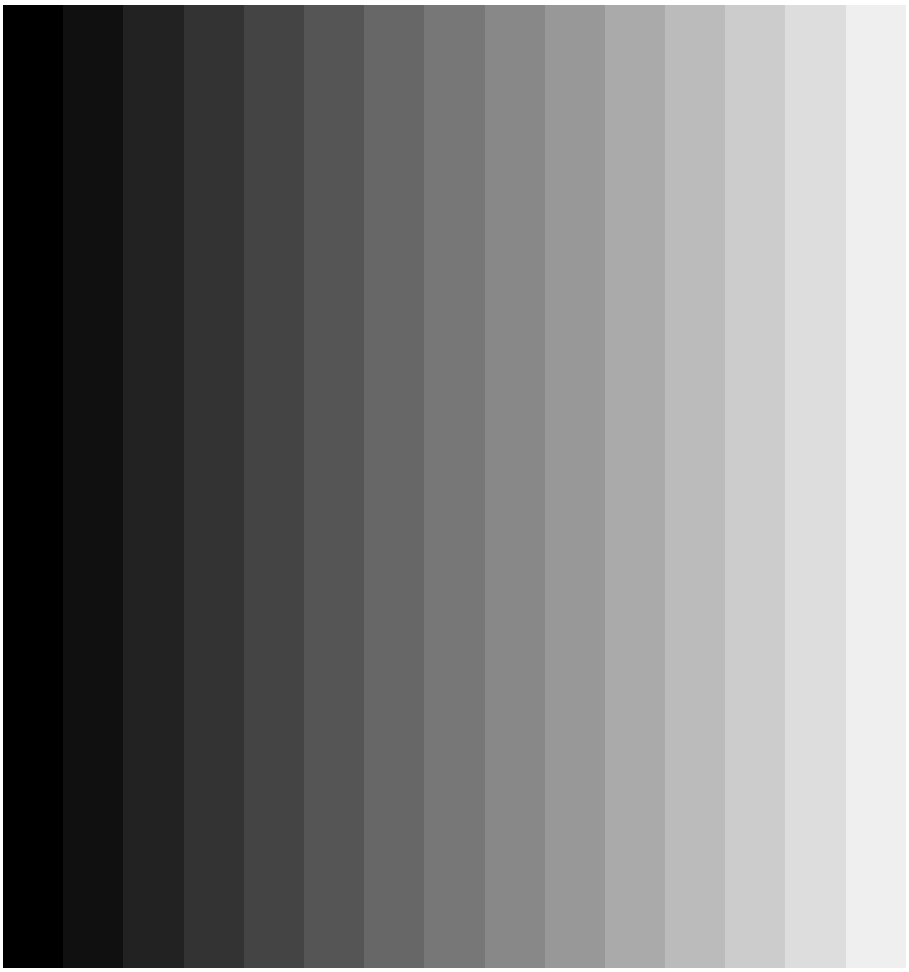

Figure 1.1: 1

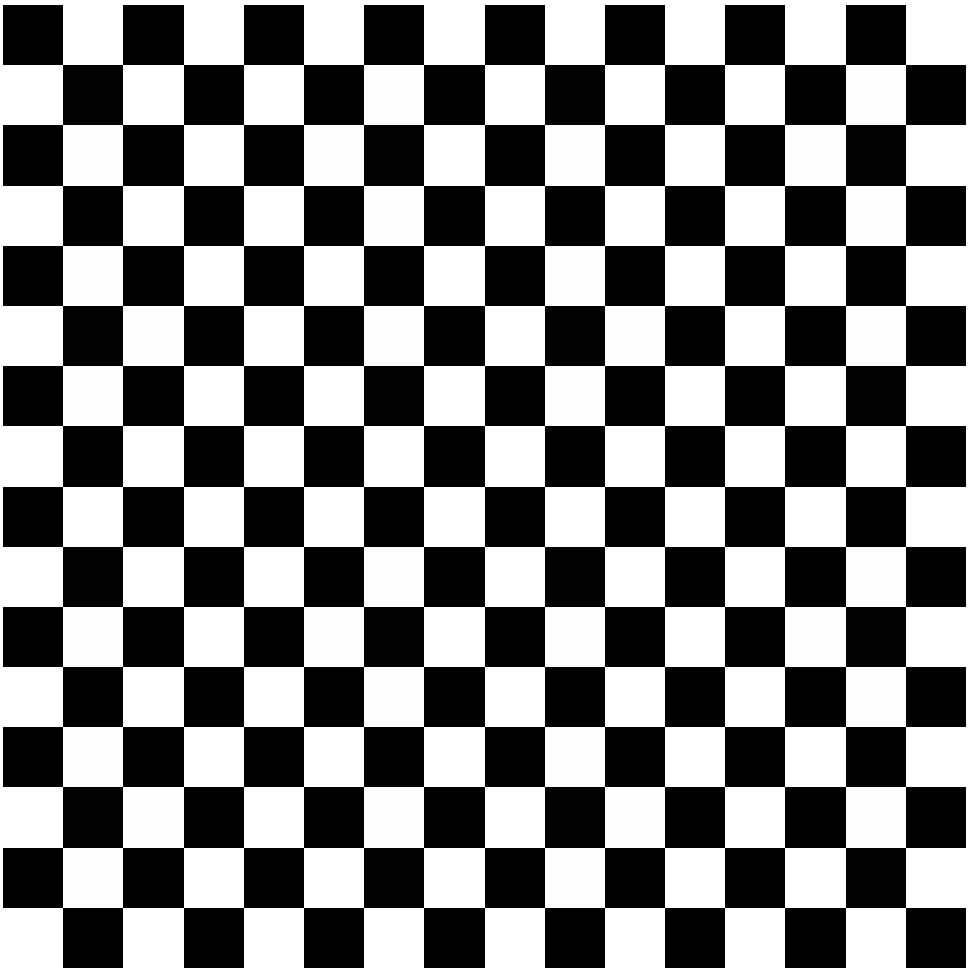

Figure 1.2: 1

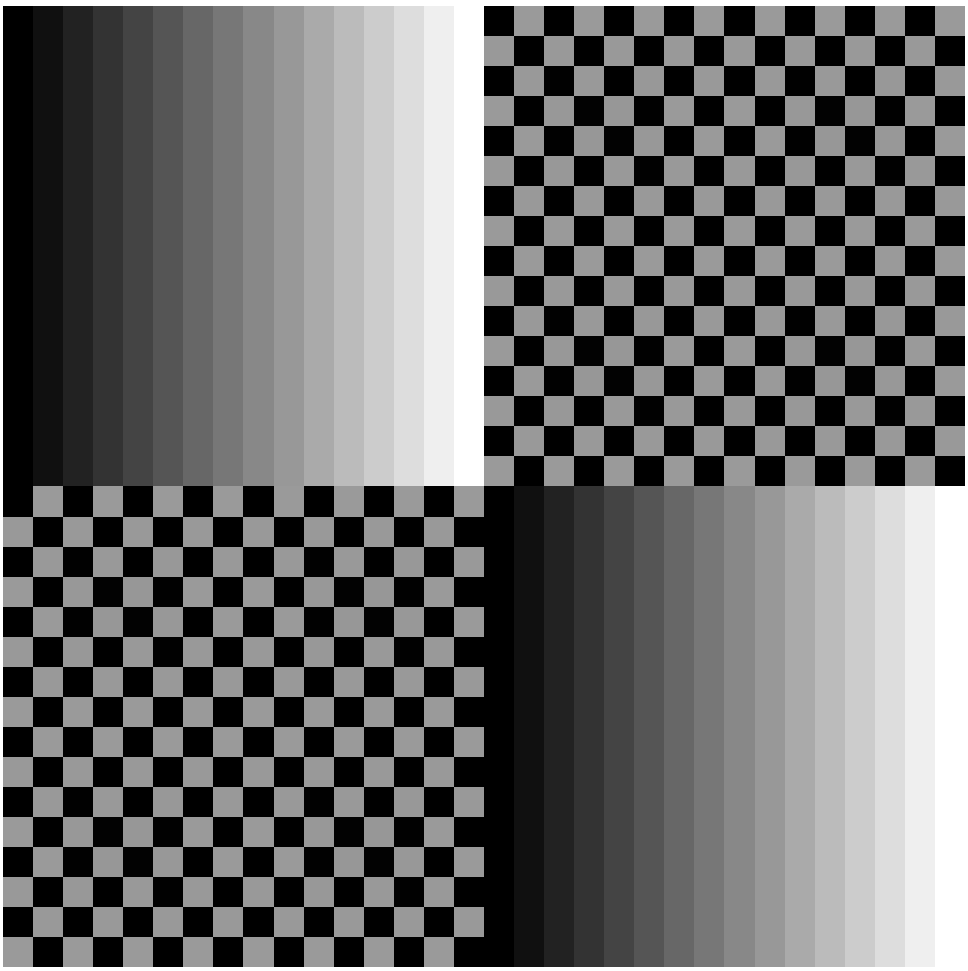

Figure 1.3: 1

```
13      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
14      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
15      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
16      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
17      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
18      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
19      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
20      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
21      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
22      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
23      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
24      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15;
25      0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15];
26 A1=mat2gray(A);
27 imwrite(A1,'VerticalStrips.jpeg');
28
29 //Form a check-board "B" of dimension 16x16
      containing 16 blocks
30 a=[0 9; 9 0];
31 b=[a a; a a];
32 c=[b b; b b];
33 B=[c c; c c];
34 B1=mat2gray(B);
35 imwrite(B1,'Check-board.jpeg');
36
37 //Form image containing top-left and bottom-right
      quarter parts A and top-right & bottom-left
      quarters B.
38 C=[ A B; B A];
39 C1=mat2gray(C);
40 imwrite(C1,'Quarter.jpeg');
```

Experiment: 2

Image analysis on 256 X 256 image size

check Appendix AP 1 for dependency:

```
Cameramanimg.jpg
```

Scilab code Solution 2.2 2

```
1 //Image analysis on 256*256 image size
2 //Scilab 5.4.1
3 //Windows 10
```

Figure 2.1: 2

Figure 2.2: 2

Figure 2.3: 2

Figure 2.4: 2

Figure 2.5: 2

Figure 2.6: 2

```
4  //Requires SIVP, IPD toolboxes
5
6  clear;
7  clc;
8
9  I=imread('cameraman.jpg');
10
11 //Break the cameraman image of dimension 256x256
       into four equal
12 //square shapes C11, C12, C21 & C22 and display all
       into a single
13 //figure of 2x2 dimensions.
14 C11=I(1:128, 1:128);
15 C12=I(1:128, 129:256);
16 C21=I(129:256, 1:128);
17 C22=I(129:256, 129:256);
18 imwrite(C11,'C11.jpeg');//Top Left
19 imwrite(C12,'C12.jpeg');//Top Right
20 imwrite(C21,'C21.jpeg');//Bottom Left
21 imwrite(C22,'C22.jpeg');//Bottom Right
22 J=[C11 C12; C21 C22];//Reconstruct original image
       from the squares
23 imwrite(J,'Single.jpeg');//Reconstructed image from
       squares
24
25 //Interchange the C11 & C22 and C12 & C21 and show
       the image
26 K=[C22 C21; C12 C11];
27 imwrite(K,'Interchange.jpeg');//Interchanged image
```

Experiment: 3

Singular Value Decomposition

Scilab code Solution 3.3 3

```
1  //Singular Value Decomposition
2  //Scilab 5.4.1
3  //Windows 10
4  //Requires SIVP, IPD toolboxes
5
6  clear;
7  clc;
8
9  A = [1,-2,3;3,2,-1];
10 [U,S,V]= svd(A);
11 A_recon = U*S*V';
12 disp(U,'U =')
13 disp(S,'S =')
14 disp(V,'V =')
15 disp(A_recon,'A matrix from svd =')
16
17 //Output
18 //
19 // U =
20 //
21 //  - 0.7071068    0.7071068
```

```
22 //     0.7071068     0.7071068
23 //
24 // S =
25 //
26 //     4.2426407     0.            0.
27 //     0.            3.1622777     0.
28 //
29 // V =
30 //
31 //     0.3333333     0.8944272   - 0.2981424
32 //     0.6666667     1.110D-16     0.7453560
33 //   - 0.6666667     0.4472136     0.5962848
34 //
35 // A matrix from svd =
36 //
37 //     1.   - 2.     3.
38 //     3.     2.   - 1.
```

Experiment: 4

Performing KL transform

Scilab code Solution 4.4 4

```
1  //Performing KL transform
2  //Scilab 5.4.1
3  //Windows 10
4  //Requires SIVP, IPD toolboxes
5
6  clear;
7  clc;
8
9  X = [3,5,6,7;5,6,3,3;4,6,7,5];
10 [m,n]= size(X);
11 A = [];
12 E = [];
13 for i =1:n
14     A = A+X(:,i);
15     E = E+X(:,i)*X(:,i)';
16 end
17 mx = A/n;                          //mean matrix
18 E = E/n;
19 C = E - mx*mx';                    //covariance matrix C =
     E[xx']-mx*mx'
20 [V,D] = spec(C);                   //eigen values and eigen
```

```
    vectors
d = diag(D);                 //diagonal elements od
    eigen values
[d,i] = gsort(d);           //sorting the elements of D
     in descending order
for j = 1:length(d)
    T(:,j)= V(:,i(j));
end
T =T'
disp(d,'Eigen Values are U = ')
disp(T,'The eigen vector matrix T =')
disp(T,'The KL tranform basis is =')

//KL transform
for i = 1:n
    Y(:,i)= T*X(:,i);
end
disp(Y,'KL transformation of the input matrix Y =')

//Reconstruction
for i = 1:n
    x(:,i)= T'*Y(:,i);
end
disp(x,'Reconstruct matrix of the given sample
    matrix X =')

//Output
//
// Eigen Values are U =
//
//    3.6278623
//    1.0409979
//    0.4561398
//
// The eigen vector matrix T =
//
//    0.7383786  - 0.5693168    0.3614907
//    0.0603190    0.5896337    0.8054152
```

```
55 //    0.6716835    0.5728966  - 0.4697135
56 //
57 // The KL tranform basis is =
58 //
59 //    0.7383786  - 0.5693168    0.3614907
60 //    0.0603190    0.5896337    0.8054152
61 //    0.6716835    0.5728966  - 0.4697135
62 //
63 // KL transformation of the input matrix Y =
64 //
65 //    0.8145143    2.444936     5.2527556
       5.2681528
66 //    6.3507865    8.6718888    7.7687219
       6.2182105
67 //    3.0006794    3.977516     2.4607962
       4.0719067
68 //
69 // Reconstruct matrix of the given sample matrix X =
70 //
71 //    3.    5.    6.    7.
72 //    5.    6.    3.    3.
73 //    4.    6.    7.    5.
74 //
```

Experiment: 5

Brightness enhancement and supression

check Appendix AP 5 for dependency:

baboon.png

Scilab code Solution 5.5 5

```
1 //Brightness enhancement and supression
2 //Scilab 5.4.1
3 //Windows 10
4 //Requires SIVP, IPD toolboxes
5
6 clear;
7 clc;
8
9 a=imread('baboon.png');
10
11 //Brightness Enhancement
```

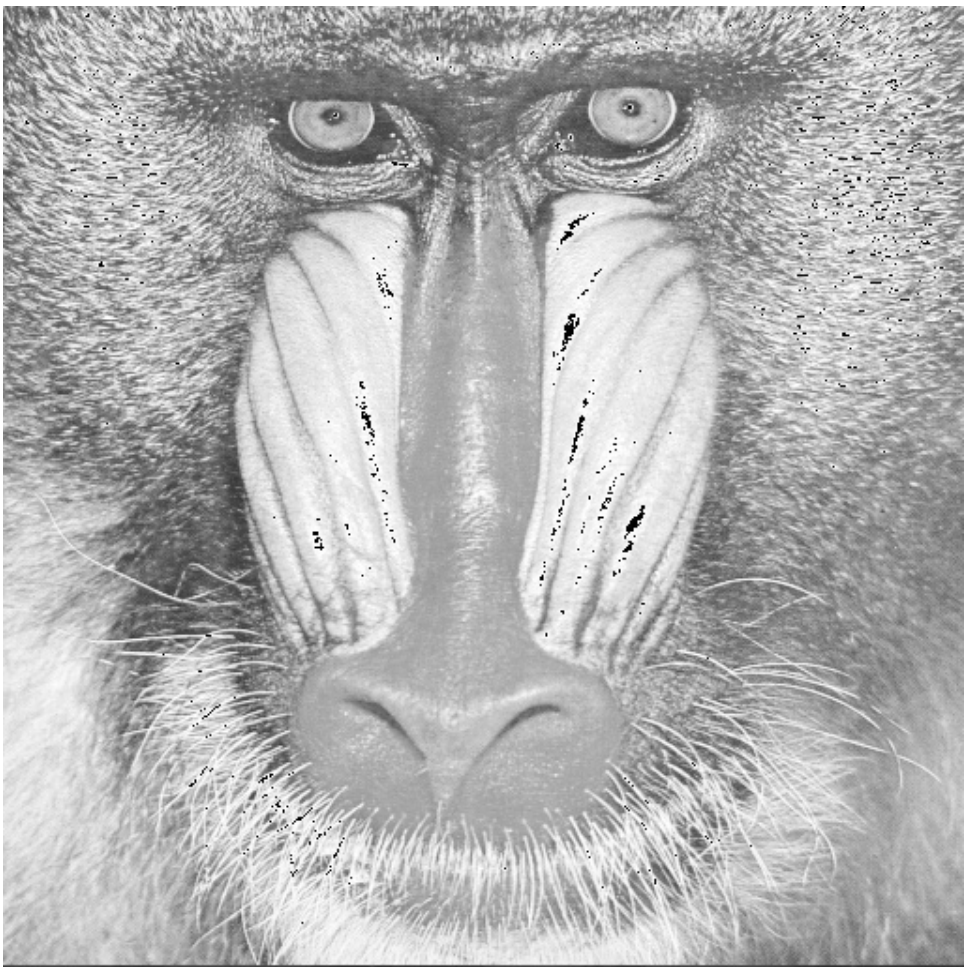

Figure 5.1: 5

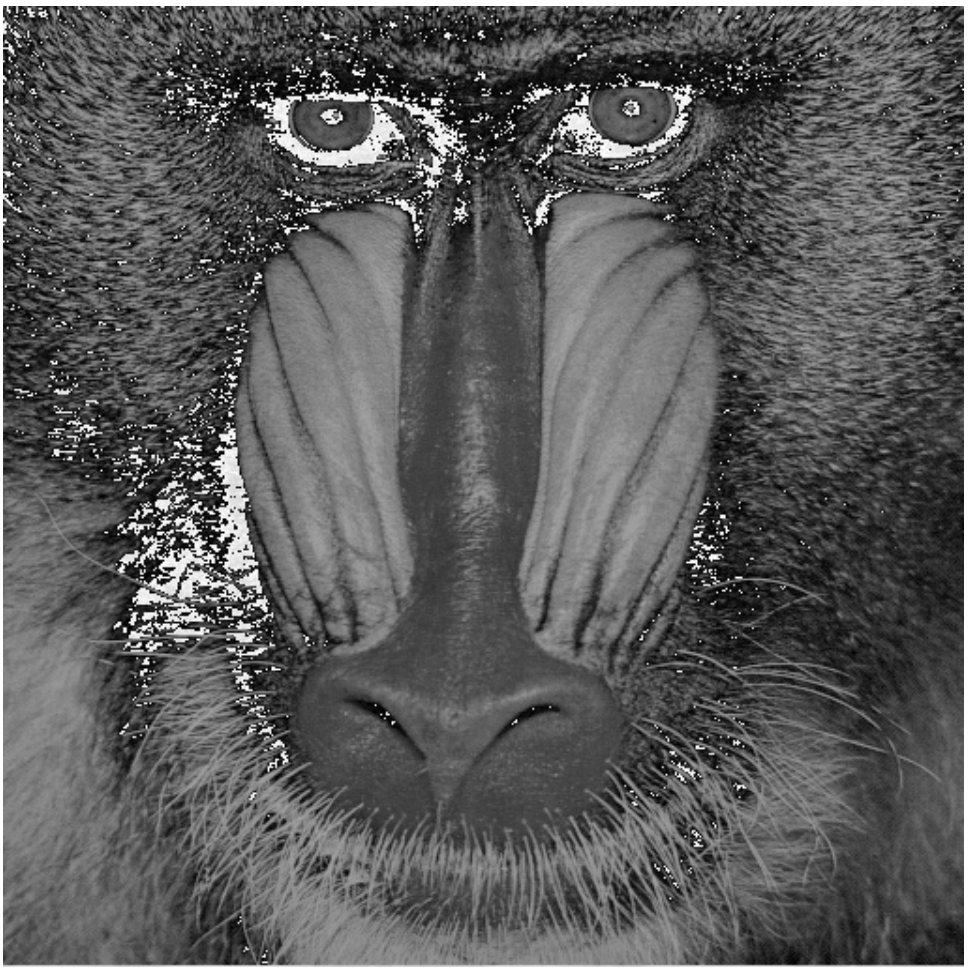

Figure 5.2: 5

```
12 a = rgb2gray(a);
13 b = double(a)+50;
14 b = uint8(b);
15 imwrite(b,'BrightnessEnhancedImage.jpeg');
16
17 a=imread('baboon.png');
18
19 //Brightness suppression
20 a = rgb2gray(a);
21 b = double(a)-50;
22 b = uint8(b);
23 imwrite(b,'BrightnessSupressedImage.jpeg');
```

Experiment: 6

Contrast Manipulation

check Appendix AP 3 for dependency:

Lenna.png

Scilab code Solution 6.6 6

```
1  //Contrast Manipulation
2  //Scilab 5.4.1
3  //Windows 10
4  //Requires SIVP, IPD toolboxes
5
6  clear;
7  clc;
8
9  a=imread('Lenna.png');
10
11 a = rgb2gray(a);
12 b = double(a)*0.5;
13 b = uint8(b)
```

Figure 6.1: 6

Figure 6.2: 6

```
14 c = double(b)*2;
15 c = uint8(c)
16
17 imwrite(b,'DecreaseinContrast.jpeg');
18 imwrite(c,'IncreaseinContrast.jpeg');
```

Experiment: 7

Color separation into R,B,G

check Appendix AP 2 for dependency:

peppers.png

Scilab code Solution 7.7 7

```
1 //Color separation into R,B,G
2 //Scilab 5.4.1
3 //Windows 10
4 //Requires SIVP, IPD toolboxes
5
6 clear;
7 clc;
8
9 a=imread('peppers.png');
10
11 a1 = a;
```

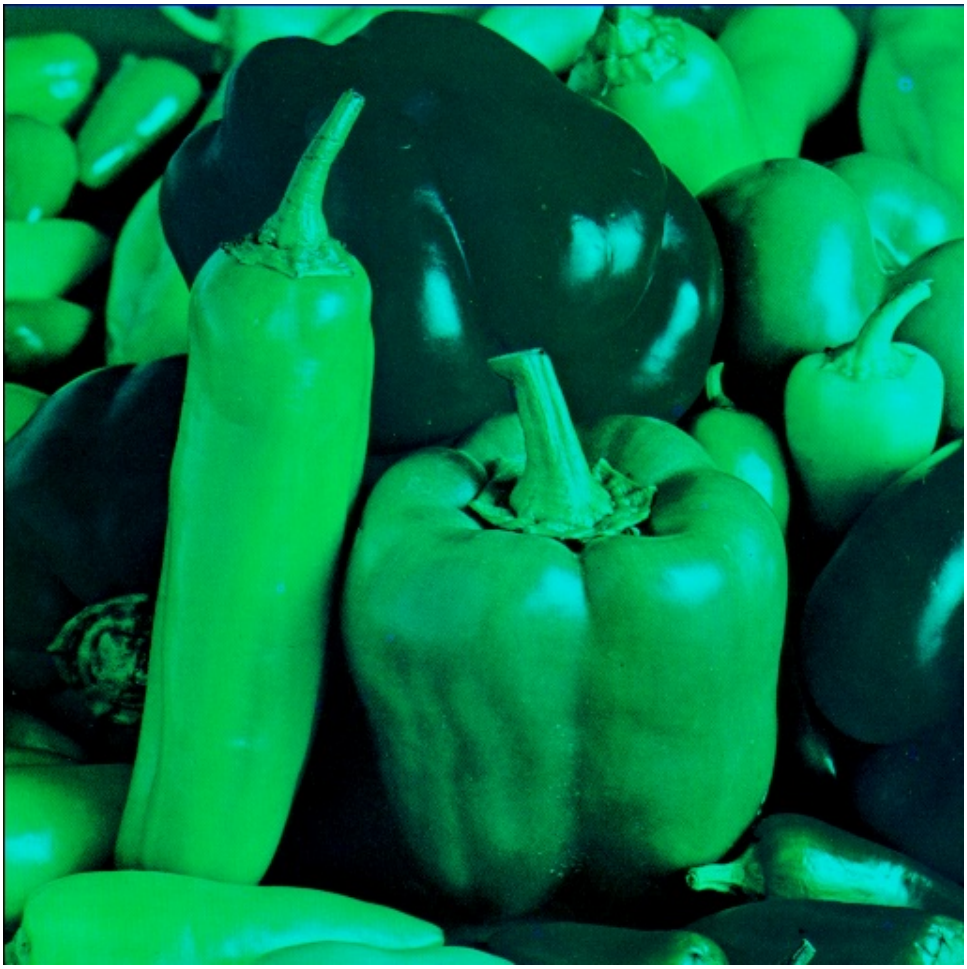

Figure 7.1: 7

Figure 7.2: 7

Figure 7.3: 7

```
12 b1 = a;
13 c1 = a;
14 a1(:,:,1)=0;
15 b1(:,:,2)=0;
16 c1(:,:,3)=0;
17
18 imwrite(a1, 'RedMissing.jpeg');
19 imwrite(b1, 'GreenMissing.jpeg');
20 imwrite(c1, 'BlueMissing.jpeg');
```

Experiment: 8

Gamma correction

check Appendix AP 4 for dependency:

ararauna.png

Scilab code Solution 8.8 8

```
1 //Gamma correction
2 //Scilab 5.4.1
3 //Windows 10
4 //Requires SIVP, IPD toolboxes
5
6 clear;
7 clc;
8
9 I=imread('ararauna.png');
10
11 gamma_Value = 0.5;
12 max_intensity = 255; //for uint8 image
13 //Look up table creation
14 LUT = max_intensity.*(([0:max_intensity]./
     max_intensity).^gamma_Value);
```

Figure 8.1: 8

```
15 LUT = floor(LUT);
16 //Mapping of input pixels into lookup table values
17 K = double(I)+1;
18 J = zeros(I);
19 [m,n,p]= size(K);
20 for i = 1:m
21  for j =1:n
22      for k = 1:p
23           J(i,j,k)= LUT(K(i,j,k));
24       end
25     end
26 end
27
28 imwrite(uint8(J), 'GammaCorrectedImage.jpeg'); //
   IPD toolbox
```

Experiment: 9

Adding various types of noises to image

check Appendix AP 3 for dependency:

Lenna.png

Scilab code Solution 9.9 9

```
1 //Add various types of noises to image
2 //Scilab 5.4.1
3 //Windows 10
4 //Requires SIVP, IPD toolboxes
5
6 clear;
7 clc;
8
9 lenna=imread('Lenna.png');
```

Figure 9.1: 9

Figure 9.2: 9

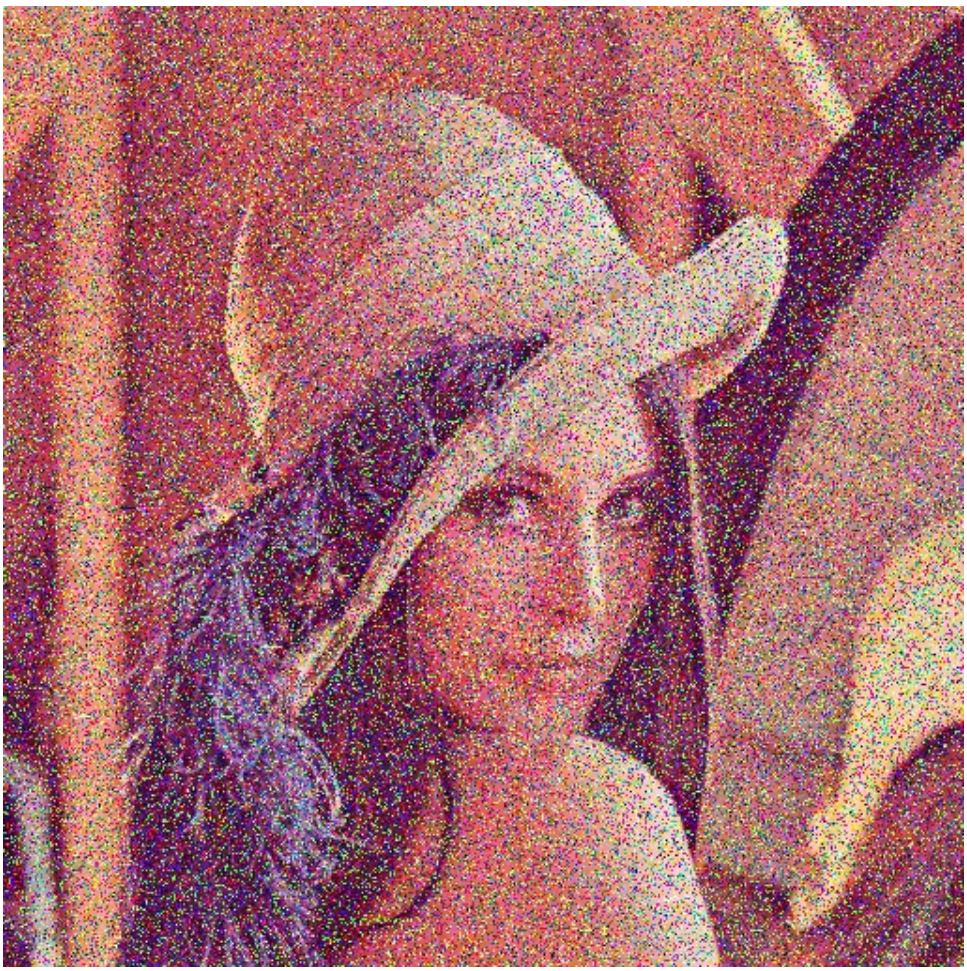

Figure 9.3: 9

```
10
11 //Gaussian
12 lenaNgaussian = imnoise(lenna,'gaussian');
13 imwrite(lenaNgaussian,'lenaNgaussian.jpeg');
14
15 //Speckle
16 lenaNspeckle = imnoise(lenna,'speckle');
17 imwrite(lenaNspeckle,'lenaNspeckle.jpeg');
18
19 //Salt & Pepper
20 d=0.25  //drop out noise
21 lenaNsalpep = imnoise(lenna,'salt & pepper',d);
22 imwrite(lenaNsalpep,'lenaNsalpep.jpeg');
```

Experiment: 10

Demonstrate the various Image Conversions

check Appendix AP 1 for dependency:

`Cameramanimg.jpg`

check Appendix AP 3 for dependency:

`Lenna.png`

check Appendix AP 4 for dependency:

`ararauna.png`

check Appendix AP 5 for dependency:

`baboon.png`

check Appendix AP 2 for dependency:

`peppers.png`

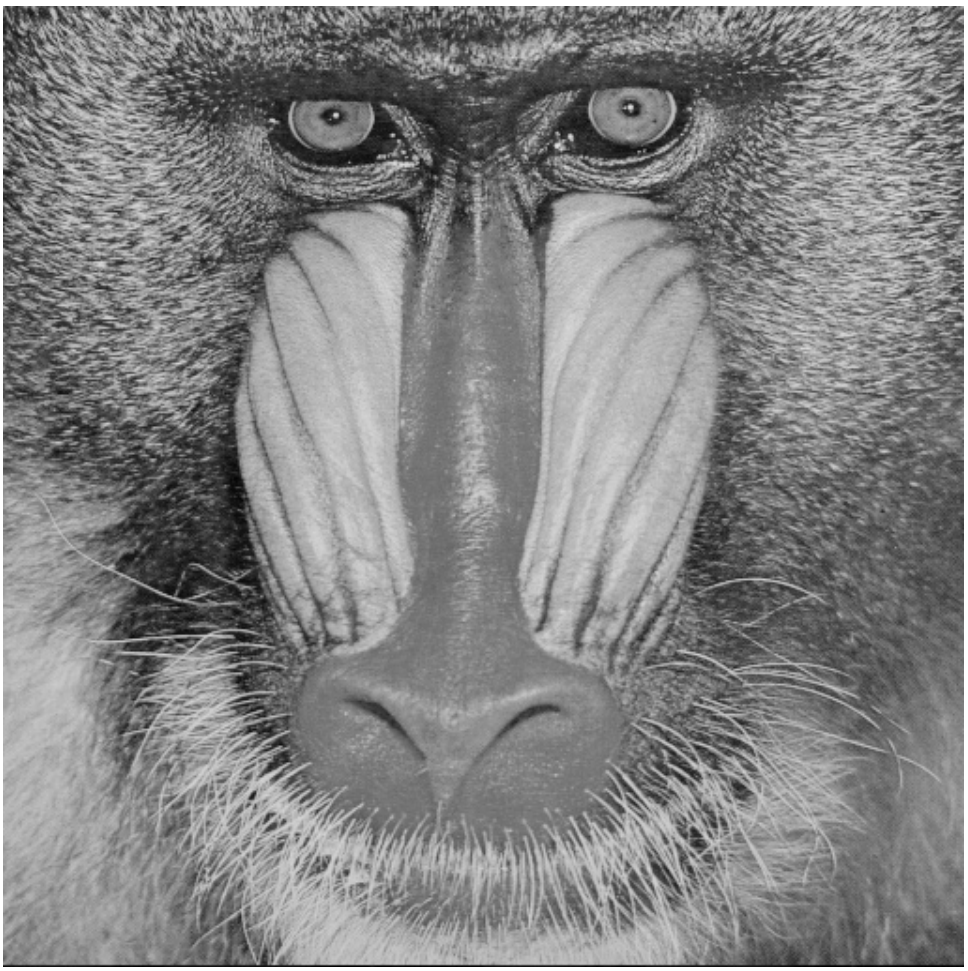

Figure 10.1: 10

Figure 10.2: 10

Figure 10.3: 10

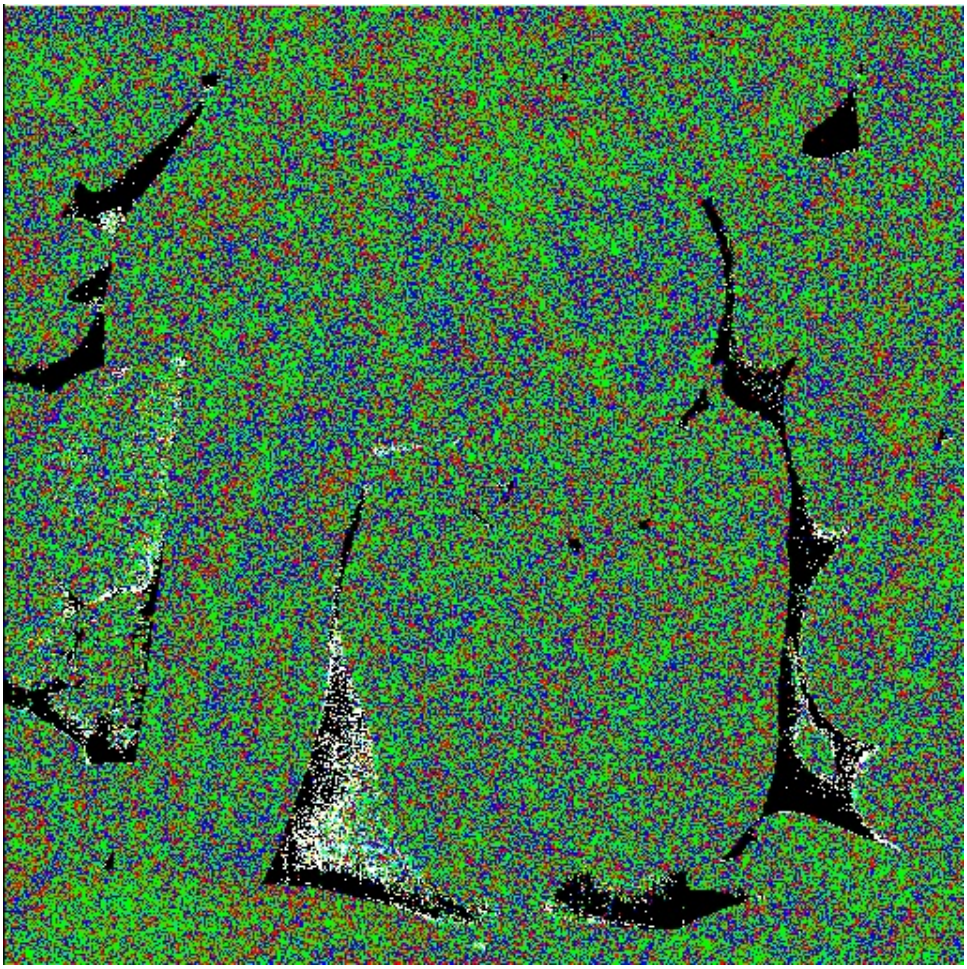

Figure 10.4: 10

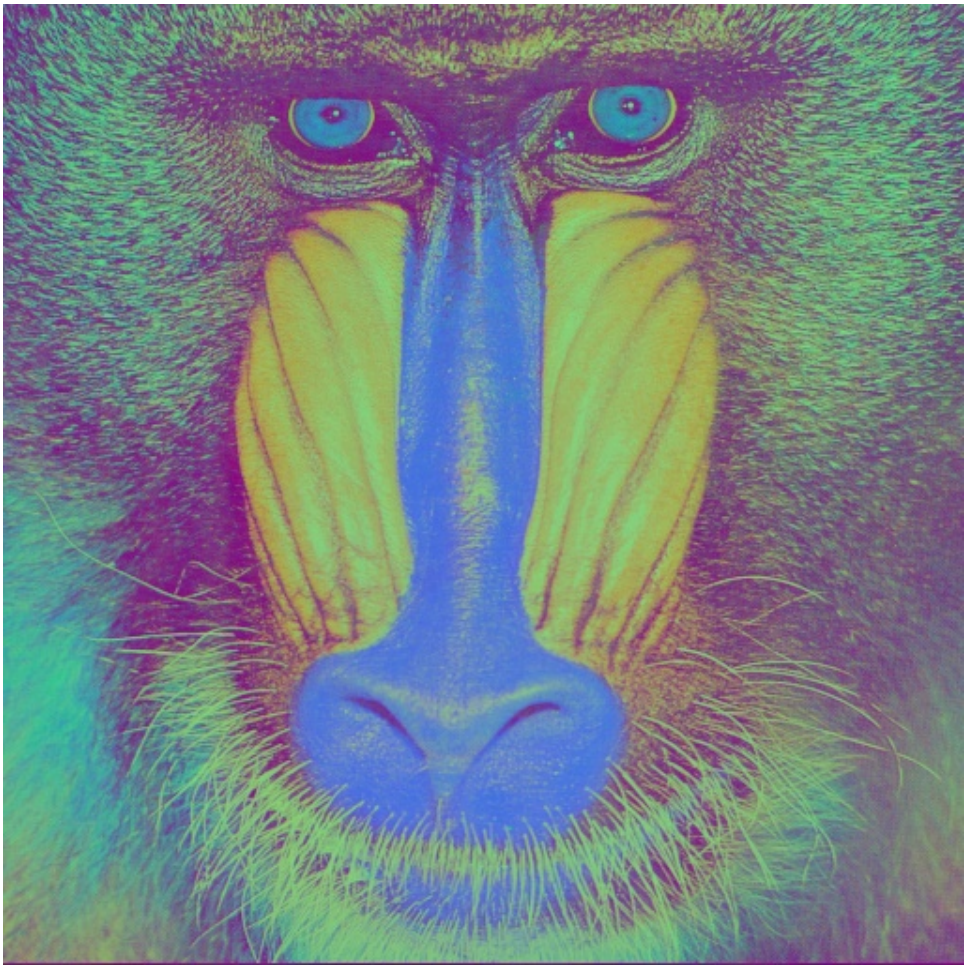

Figure 10.5: 10

Figure 10.6: 10

Scilab code Solution 10.10 10

```
1 //Demonstrate the various Image Conversions
2 //Scilab 5.4.1
3 //Windows 10
```

```
4  //Requires SIVP, IPD toolboxes
5
6  clear;
7  clc;
8
9  //RBG to Gray scale
10 baboon = imread('baboon.png');
11 babgray = rgb2gray(baboon);
12 imwrite(babgray,'babgray.jpeg');
13
14 //RBG to Binary
15 lena = imread('Lenna.png');
16 lenabw = im2bw(lena,0.5);
17 imwrite(lenabw,'lenabw.jpeg');
18
19 //RBG to HSV
20 cameraman = imread('cameraman.jpg');
21 cameramanhsv = rgb2hsv(cameraman);
22 imwrite(cameramanhsv,'cameramanhsv.jpeg');
23
24 //HSV to RGB
25 peppers = imread('peppers.png');
26 peppersrgb = hsv2rgb(peppers);
27 imwrite(peppersrgb,'peppersrgb.jpeg');
28
29 //RBG to YCbCr
30 baboon = imread('baboon.png');
31 baboonycbcr = rgb2ycbcr(baboon);
32 imwrite(baboonycbcr,'baboonycbcr.jpeg');
33
34 //YCbCr to RGB
35 ararauna = imread('ararauna.png');
36 araraunargb = ycbcr2rgb(ararauna);
37 imwrite(araraunargb,'araraunargb.jpeg');
```

Experiment: 11

Demonstrate Spatial Domain Processing

check Appendix AP 3 for dependency:

Lenna.png

Scilab code Solution 11.11 11

```
1 //Demonstrate Spatial Domain Processing
2 //Scilab 5.4.1
3 //Windows 10
4 //Requires SIVP, IPD toolboxes
5
6 clear;
7 clc;
8
9 lenna=imread('Lenna.png');
```

Figure 11.1: 11

Figure 11.2: 11

Figure 11.3: 11

```
10
11 //Sobel
12 h = fspecial('sobel');
13 lenaSobel = imfilter(lenna,h)
14 imwrite(lenaSobel,'lenaSobel.jpeg');
15
16 //Prewitt
17 h = fspecial('prewitt');
18 lenaPrewitt = imfilter(lenna,h)
19 imwrite(lenaPrewitt,'lenaPrewitt.jpeg');
20
21 //Laplacian
22 h = fspecial('laplacian');
23 lenaLaplacian = imfilter(lenna,h)
24 imwrite(lenaLaplacian,'lenaLaplacian.jpeg');
```

Experiment: 12

Motion blur of an image

check Appendix AP 4 for dependency:

ararauna.png

Scilab code Solution 12.12 12

```
1  //Motion blur of an image
2  //Scilab 5.4.1
3  //Windows 10
4  //Requires SIVP, IPD toolboxes
5
6  clear;
7  clc;
8
9  a=imread('ararauna.png');
10
11 //filter coefficients of fspecial('motion',10,25)
12 H =[0,0,0,0,0,0,0,0.0032,0.0449,0.0865,0.0072;...
13 0,0,0,0,0,0.0092,0.0509,0.0925,0.0629,0.0213,0;...
14 0,0,0,0.0152,0.0569,0.0985,0.0569,0.0152,0,0,0;...
15 0,0.0213,0.0629,0.0925,0.0509,0.0092,0,0,0,0,0;...
```

Figure 12.1: 12

```
0.0072,0.0865,0.0449,0.0032,0,0,0,0,0,0,0];
Motion_Blur = imfilter(a,H);
Motion_Blur =uint8(Motion_Blur);

imwrite(Motion_Blur,'MotionBlurredImage.jpeg')
```

Experiment: 13

Trimmed Average Filter

check Appendix AP 3 for dependency:

Lenna.png

Scilab code Solution 13.13 13

```
1 //Trimmed Average Filter
2 //Scilab 5.4.1
3 //Windows 10
4 //Requires SIVP, IPD toolboxes
5
6 clear;
7 clc;
8
9 c=imread('Lenna.png');
10 s = 1; //s denotes the number of values to be left
     in the end
11 r = 1;
12 N = 9; //3x3 window
```

Figure 13.1: 13

Figure 13.2: 13

```
13 a = double(imnoise(c,'gaussian'));
14 [m,n] = size(a);
15 b = zeros(m,n);
16 for i= 2:m-1
17     for j = 2:n-1
18         mat = [a(i,j),a(i,j-1),a(i,j+1),a(i-1,j),a(i
              +1,j),a(i-1,j-1),...
19                a(i-1,j+1),a(i-1,j+1),a(i+1,j+1)];
20         sorted_mat = gsort(mat);
21         Sum=0;
22         for k=r+s:(N-s)
23             Sum = Sum+mat(k);
24         end
25         b(i,j)= Sum/(N-r-s);
26     end
27 end
28 a = uint8(a);
29 b = uint8(b);
30 //figure
31 //imshow(c)
32 //title('Original Image')
33
34 imwrite(a,'noisyimage.jpeg')
35 imwrite(b,'TrimmedAverageFilteredImage.jpeg')
```

Experiment: 14

Determine image negative

check Appendix AP 2 for dependency:

peppers.png

Scilab code Solution 14.14 14

```
1  //Determine image negative
2  //Scilab 5.4.1
3  //Windows 10
4  //Requires SIVP, IPD toolboxes
5
6  clear;
7  clc;
8
9  a=imread('peppers.png');
10 k = 255-double(a);
11 k = uint8(k);
12 imwrite(k,'ImageNegative.jpeg')
```

Figure 14.1: 14

Experiment: 15

Image operations to perform clockwise and anti-clockwise operations

check Appendix AP 1 for dependency:

`Cameramanimg.jpg`

Scilab code Solution 15.15 15

```
1 //Image operations to perform clockwise and anti-
    clockwise operations
2 //Scilab 5.4.1
3 //Windows 10
4 //Requires SIVP, IPD toolboxes
5
6 clear;
7 clc;
8
```

Figure 15.1: 15

Figure 15.2: 15

```
A = imread('Cameramanimg.jpg');

//Rotate the Image anticlockwise by an angle of 90
   degrees
[M,N]=size(A);
for i=1:N
    for j=1:M
        B(j,i)=A(i,j);
    end
end
NM=B(N:-1:1,:);
imwrite(NM,'anticlockwise90.jpeg')

//Rotate the Image by an angle of 180 degrees
B= A(size(A,1):-1:1,size(A,1):-1:1,:);
imwrite(B,'clockwise180.jpeg')
```

Appendix

Cameramanimg

peppers

Lenna

arara-rauna

baboon