

Scilab Manual for
Digital Image Processing
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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;
```

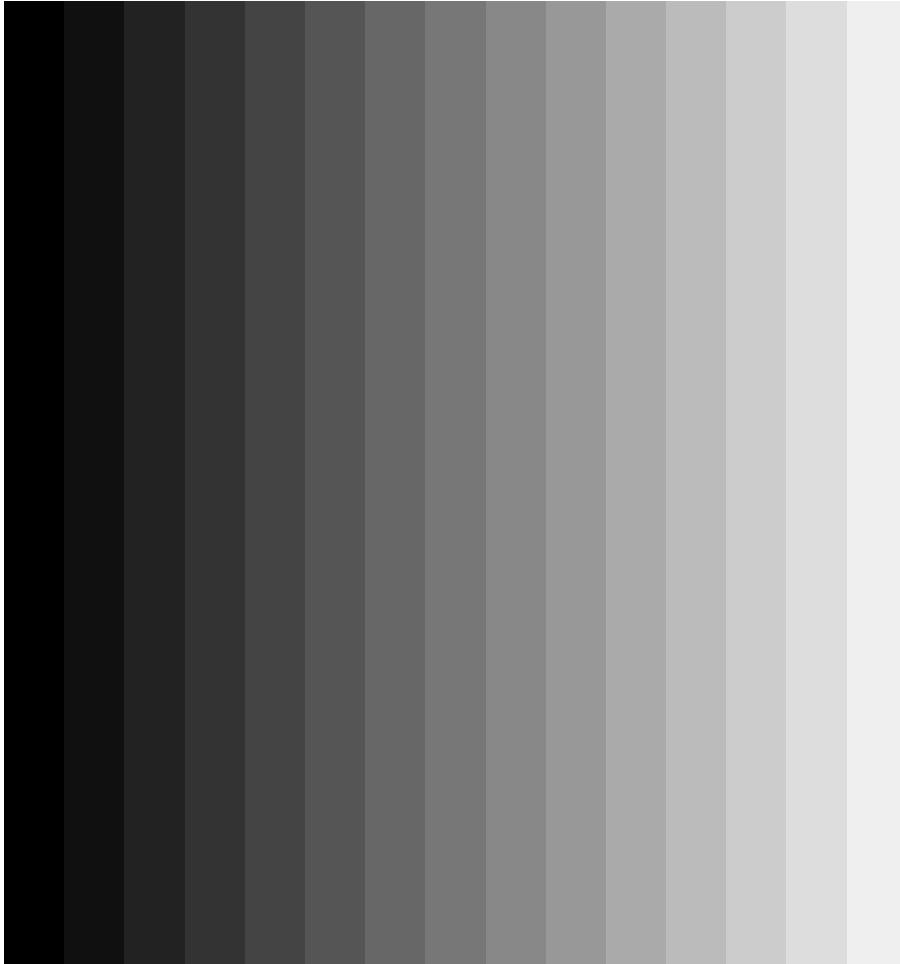


Figure 1.1: 1

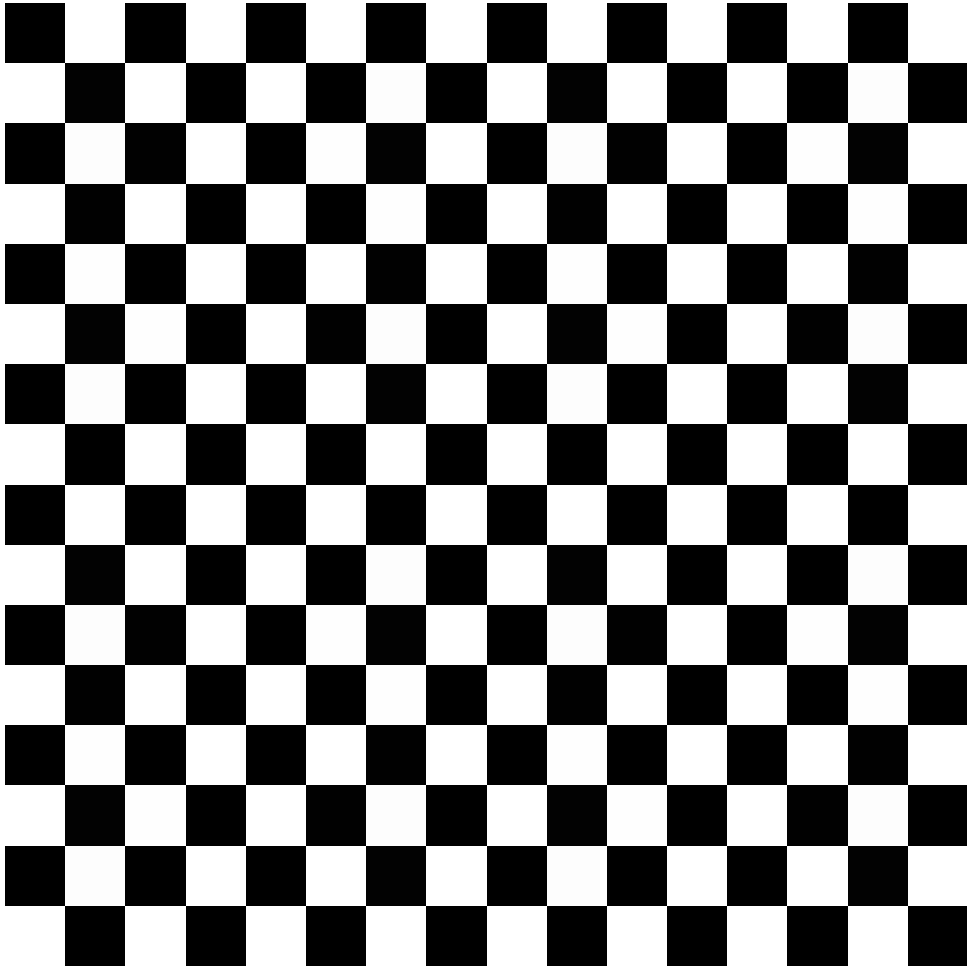


Figure 1.2: 1

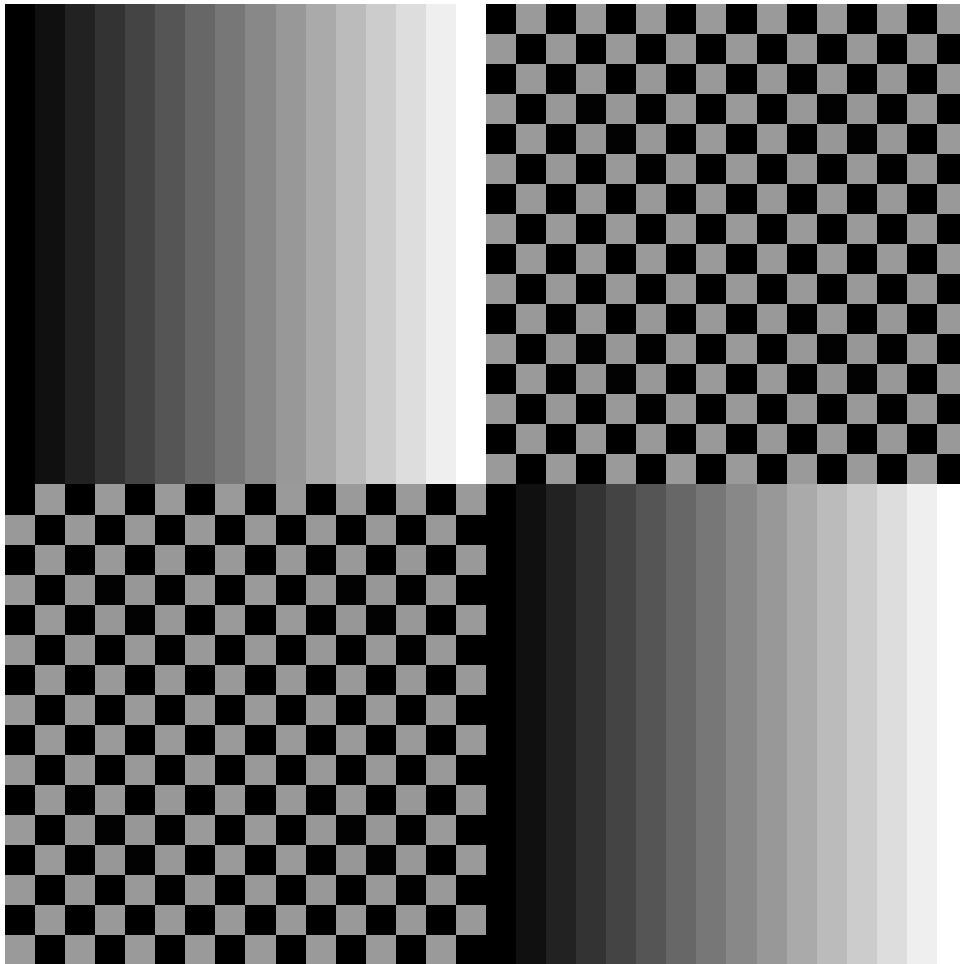


Figure 1.3: 1

```

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
21 d = diag(D);           //diagonal elements od
    eigen values
22 [d,i] = gsort(d);     //sorting the elements of D
    in descending order
23 for j = 1:length(d)
24     T(:,j)= V(:,i(j));
25 end
26 T =T'
27 disp(d,'Eigen Values are U = ')
28 disp(T,'The eigen vector matrix T =')
29 disp(T,'The KL transform basis is =')
30
31 //KL transform
32 for i = 1:n
33     Y(:,i)= T*X(:,i);
34 end
35 disp(Y,'KL transformation of the input matrix Y =')
36
37 //Reconstruction
38 for i = 1:n
39     x(:,i)= T'*Y(:,i);
40 end
41 disp(x,'Reconstruct matrix of the given sample
    matrix X =')
42
43 //Output
44 //
45 // Eigen Values are U =
46 //
47 //     3.6278623
48 //     1.0409979
49 //     0.4561398
50 //
51 // The eigen vector matrix T =
52 //
53 //     0.7383786   - 0.5693168     0.3614907
54 //     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
```

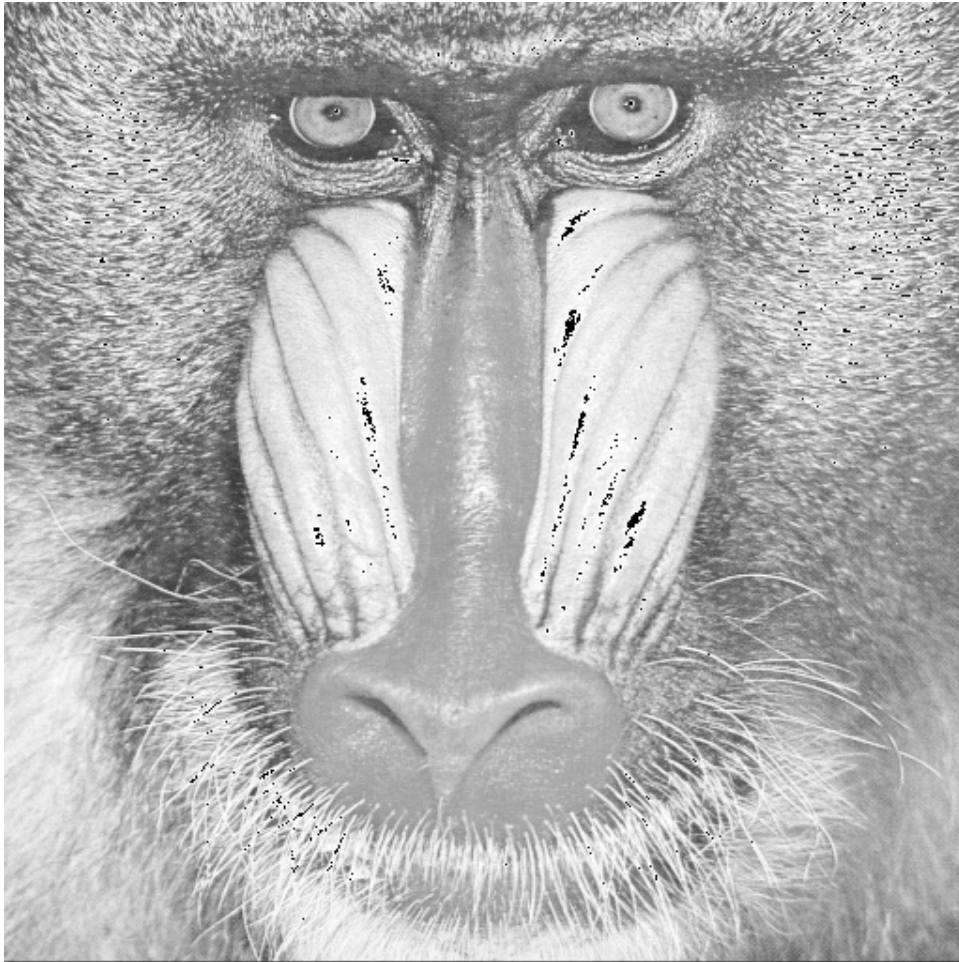


Figure 5.1: 5

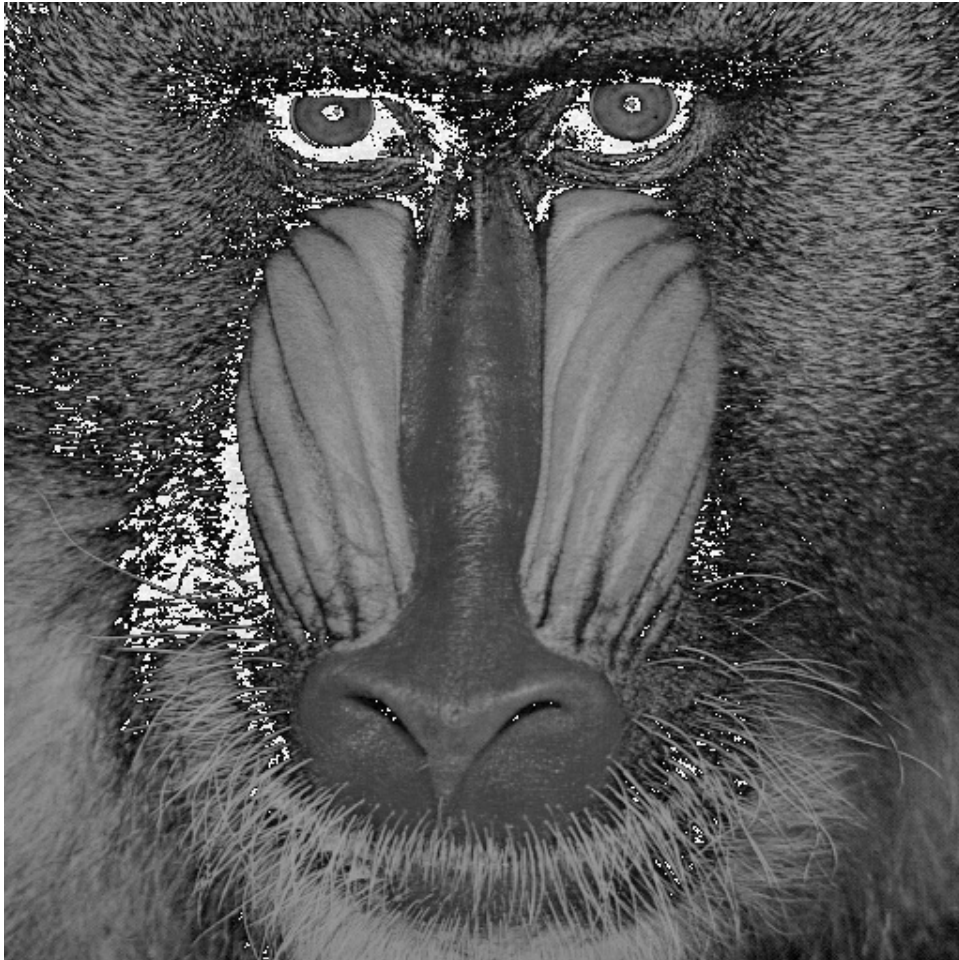


Figure 5.2: 5

```
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;
```

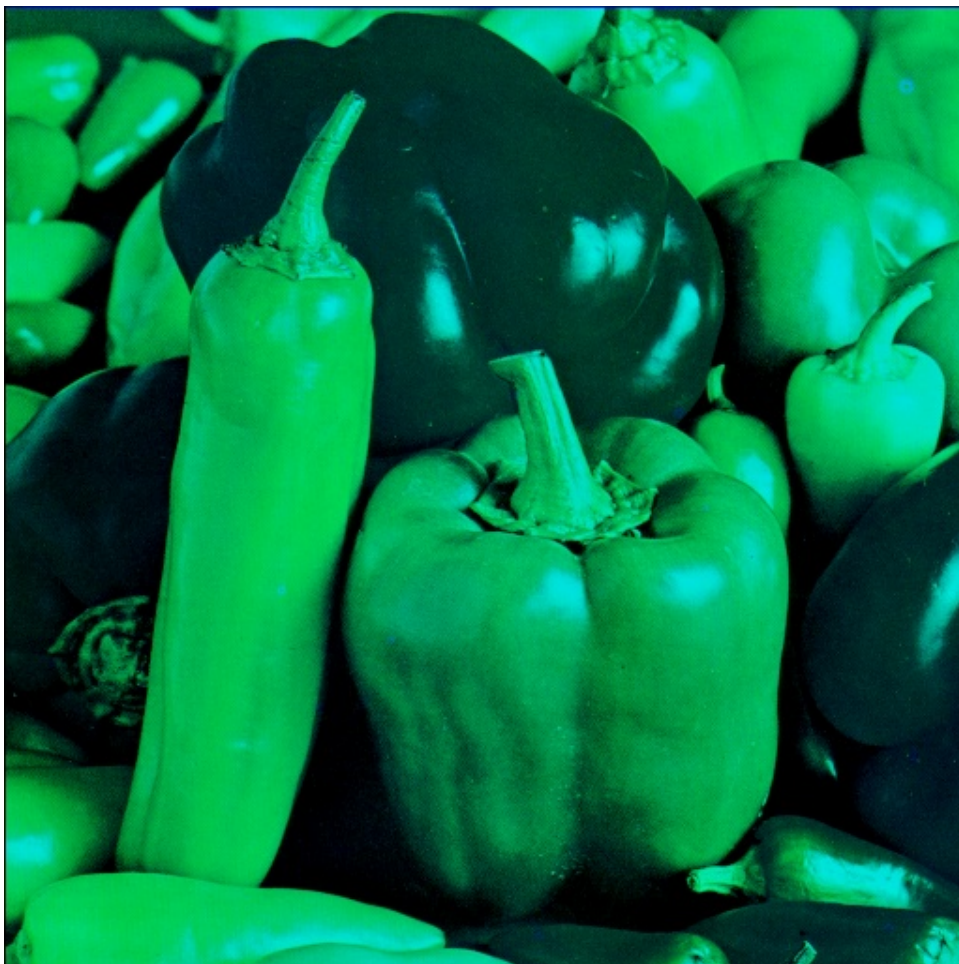


Figure 7.1: 7



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

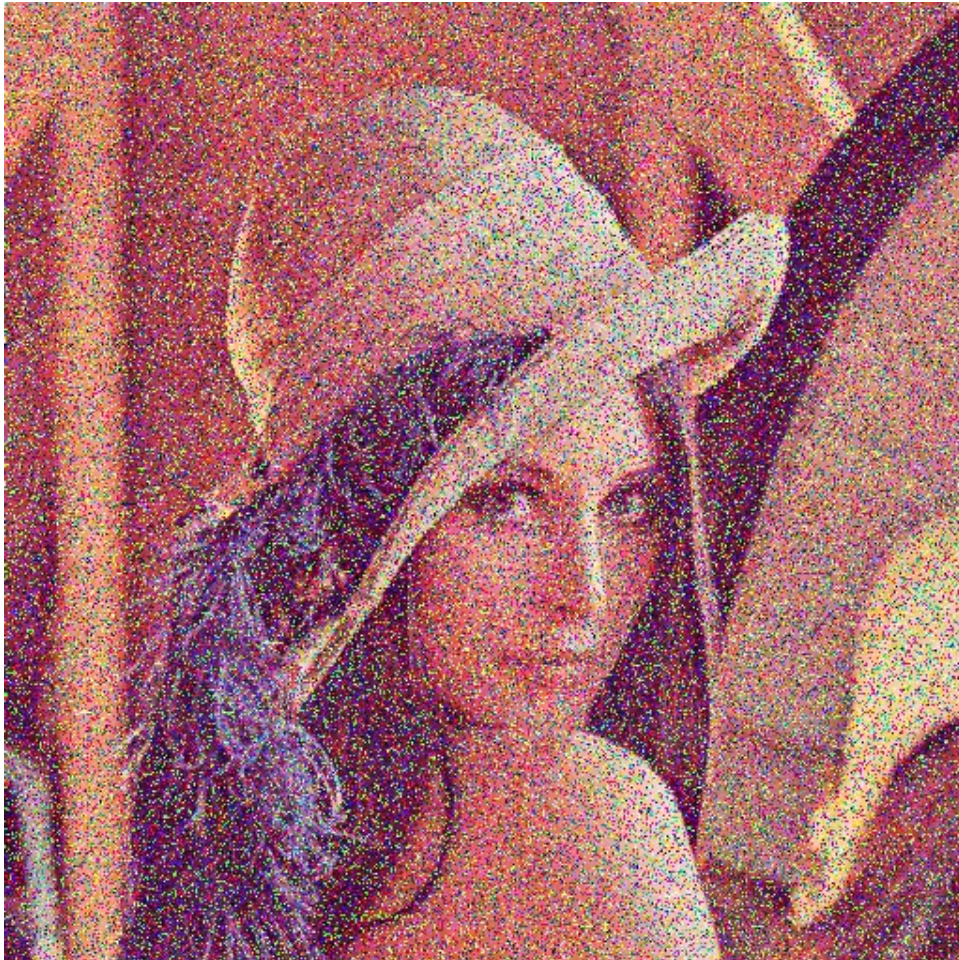


Figure 9.3: 9

```
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`

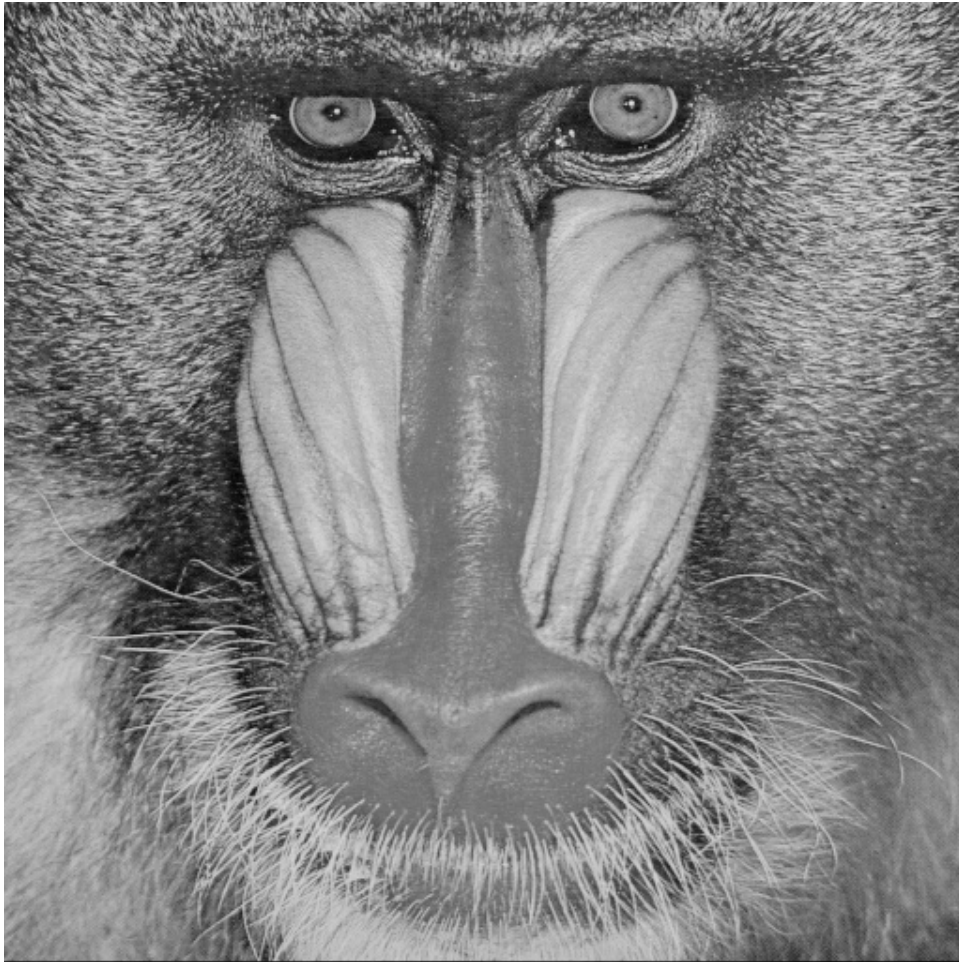


Figure 10.1: 10



Figure 10.2: 10



Figure 10.3: 10

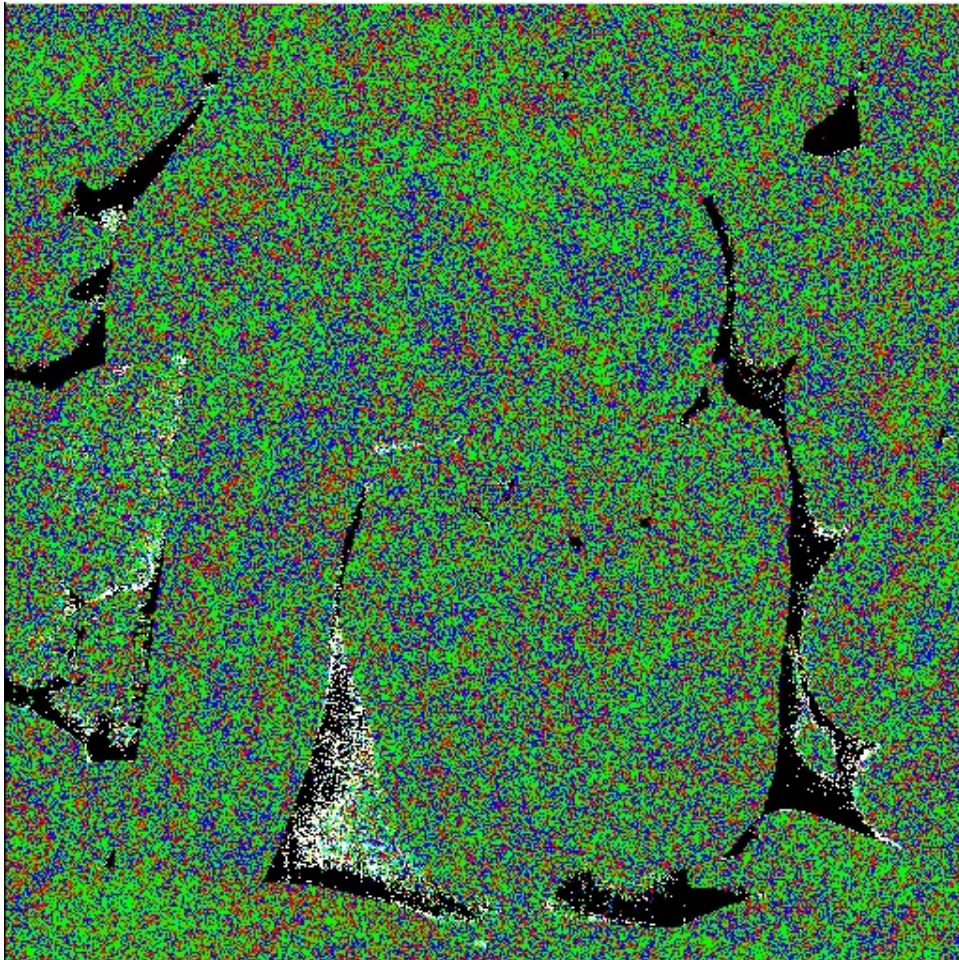


Figure 10.4: 10

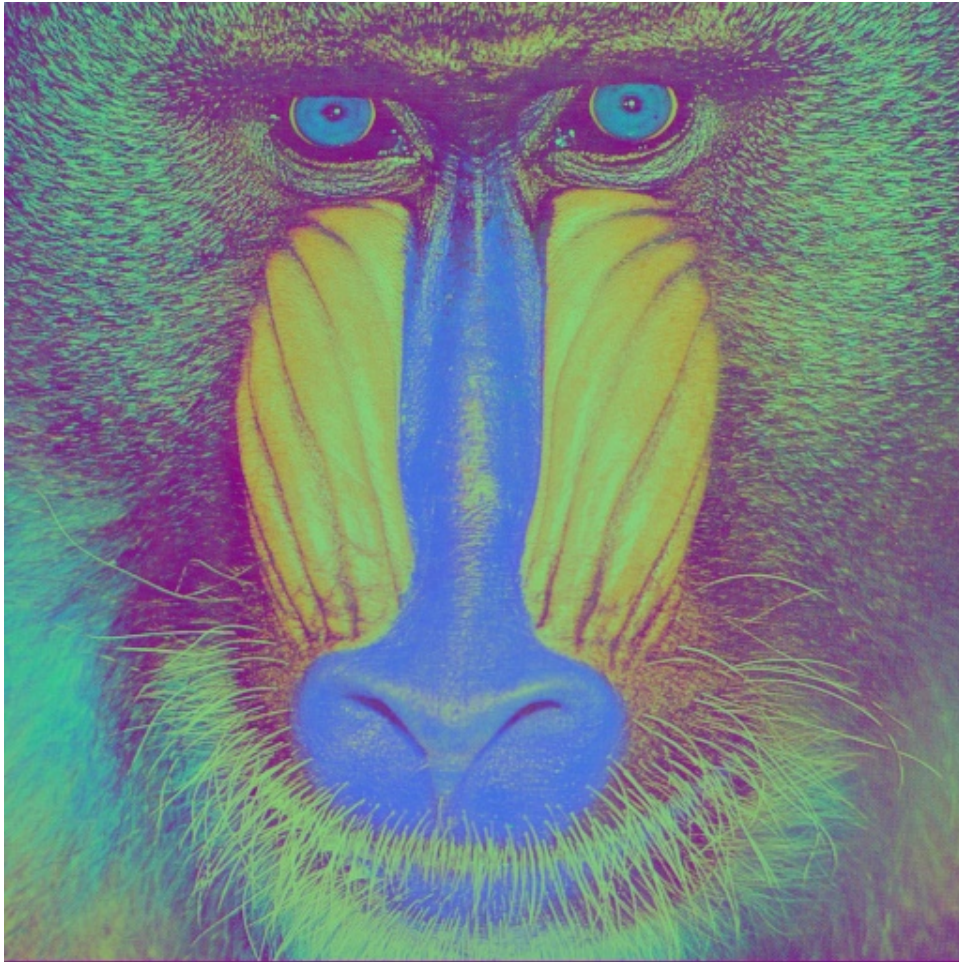


Figure 10.5: 10



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

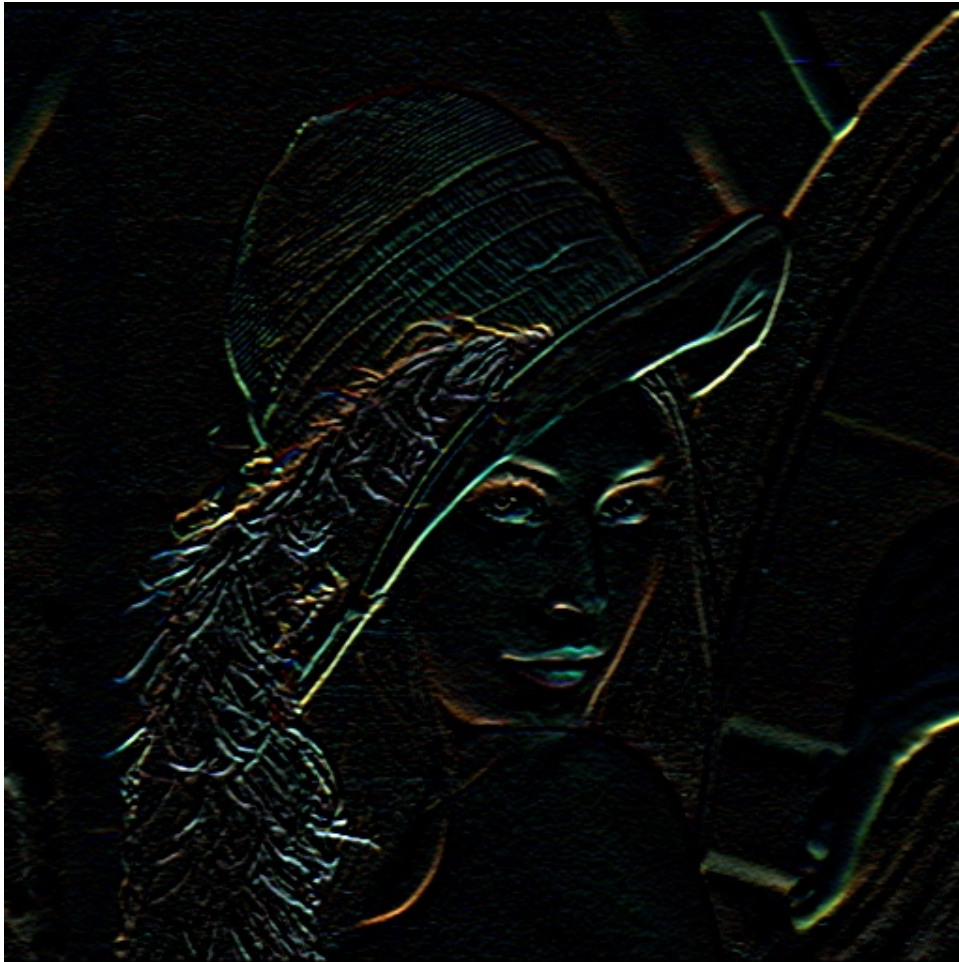


Figure 11.2: 11



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 =[0,0,0,0,0,0,0,0,0.0032,0.0449,0.0865,0.0072;...
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;...
```



Figure 12.1: 12

```
16 [0.0072,0.0865,0.0449,0.0032,0,0,0,0,0,0,0];
17 Motion_Blur = imfilter(a,H);
18 Motion_Blur =uint8(Motion_Blur);
19
20 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

```
9 A = imread('Cameramanimg.jpg');
10
11 //Rotate the Image anticlockwise by an angle of 90
    degrees
12 [M,N]=size(A);
13 for i=1:N
14     for j=1:M
15         B(j,i)=A(i,j);
16     end
17 end
18 NM=B(N:-1:1,:);
19 imwrite(NM,'anticlockwise90.jpeg')
20
21 //Rotate the Image by an angle of 180 degrees
22 B= A(size(A,1):-1:1,size(A,1):-1:1,:);
23 imwrite(B,'clockwise180.jpeg')
```

Appendix



Cameramaning



pers

pep-



Lenna



rauna

ara-



boon

ba-