Scilab Manual for Image Processing and Computer Vision Laboratory

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Experiment: 1

Basic Statistical Analysis of Images

check Appendix AP 12 for dependency:

```
cameraman.png
```

Scilab code Solution 1.1 Example 1

```
1 // This scilab code is to calculate basic image
    statistics
2 //such as sum, average, standard deviation, min and
    max
3
4 //The scilab environment for this is : Scilab 5.5.2
5
6 //Toolbox used: SIVP 0.5.3.2
7
8 //OS used :Windows 10 64 bit
9 //
10 //Reference book name : Digital Image Processing
11 //book author: Rafael C. Gonzalez and Richard E.
    Woods
12
```

```
13 clc //to clear command window.
14 clear all //to kill previously defined variables.
15 xdel(winsid())//to close all currently open figure(s
   ).
16
17 //This code uses camaraman.tif file for processing
18
19 img = imread('cameraman.tif'); // Reads the
   cameraman image
20 imshow(img); // Show original image.
21 if(size(img,3)>1) then
22     Gray_img= rgb2gray(img); //Converts color image
       to grayscale
23 else
24     Gray_img=img;              // if image is 2D image
25 end
26 imshow(Gray_img);             // Show gray scale image
   .
27 imgsum=sum(Gray_img);         // Calculates sum of
   image pixels
28 imgmean=mean2(Gray_img);      // Calculates mean /
   average of image pixels
29 imgstd=std2(Gray_img);        // Calculates standard
   deviation of image
30 imgmin=min(Gray_img);         // Calculates minimum of
    image pixels
31 imgmax=max(Gray_img);         // Calculates maximum of
    image pixels.
32 disp("Size of Image =");
33 disp(size(Gray_img));         // Displays size of
   image
34 disp("Sum = ");
35 disp(imgsum);                 // Displays Sum of image
    pixels
36 disp("Mean = ");
37 disp(imgmean);                // DIsplays mean /
   average of image pixels
38 disp("Standard Deviation = ");
```

```
39 disp(imgstd);                    // Displays standard
      deviation of image pixels
40 disp("Minimum of Image = ");
41 disp(imgmin);                    // Displays minimum of
      image
42 disp("Maximum of Image =");
43 disp(imgmax);                    // Displays maximum of
      image
44
45 ////////// OUTPUT //////////
46 //
47 //Size of Image =
48 //
49 //    256.    256.
50 //
51 // Sum =
52 //
53 //  120
54 //
55 // Mean =
56 //
57 //    118.72449
58 //
59 // Standard Deviation =
60 //
61 //    62.341715
62 //
63 // Minimum of Image =
64 //
65 //  7
66 //
67 // Maximum of Image =
68 //
69 //  253
```

Experiment: 2

Different Filtering Operations on Images

check Appendix AP 12 for dependency:

```
cameraman.png
```

Scilab code Solution 2.1 Example 1

```
1 // This scilab code is to calculate basic image
     statistics
2 //such as sum, average, standard deviation, min and
     max
3
4 //The scilab environment for this is : Scilab 5.5.2
5
6 //Toolbox used: SIVP 0.5.3.2
7
8 //OS used : Windows 10 64 bit
9 //
10 //Reference book name : Digital Image Processing
11 //book author: Rafael C. Gonzalez and Richard E.
     Woods
12
```

```
13 clc //to clear command window.
14 clear all //to kill previously defined variables.
15 xdel(winsid())//to close all currently open figure(s
   ).
16
17 //This code uses camaraman.tif file for processing
18 //SCI + '/contrib/SIVP_0.5.3.2/images/lena.png'
19 img = imread('cameraman.png'); // Reads the
   cameraman image
20 //title("Original Image");
21 imshow(img);                  // Show original
   image.
22 if(size(img,3)>1) then
23     Gray_img= rgb2gray(img);    //Converts color
       image to grayscale
24 else
25     Gray_img=img;               // if image is 2D
       image
26 end
27
28
29 filter = fspecial('sobel');    // Creates 2D
   special filter 'sobel'
30 imf = imfilter(Gray_img, filter); // Apply filter on
    2D image
31 //pause;
32 //title("Filtered Image");
33 figure, imshow(imf);                  // Show
   Resultant Image
```

Figure 2.1: Example 1

Experiment: 3

Morphological Operations on Images

check Appendix AP 11 for dependency:

Fig0419.png

Scilab code Solution 3.1 Basic Morphological Operations on Image

```
1
2 // This scilab code is to perform basic
     morphological operation on image
3 //such as erosion and dilation, opening and closing
     an image
4
5 //The scilab environment for this is : Scilab 5.5.2
6
7 //Toolbox used: Image Processing Desing (IPD)
     Toolbox ver. 8.3.3
8 //                SIVP 0.5.3.2
9
10 //OS used : Windows 10 64 bit
11 //
12 //Reference book name : Digital Image Processing
```

```
13 //book author: Rafael C. Gonzalez and Richard E.
     Woods
14
15 clc //to clear command window.
16 clear all //to kill previously defined variables.
17 xdel(winsid())//to close all currently open figure(s
     ).
18
19 //This code uses camaraman.tif file for processing
20 //SCI + '/contrib/SIVP_0.5.3.2/images/lena.png'
21 img = imread('Fig0419.png');  // Reads the text
     image (Image from References)
22 //title("Original Image");
23 imshow(img);                          // Show original
     image.
24 if(size(img,3)>1) then
25     Gray_img= rgb2gray(img);     //Converts color
       image to grayscale
26 else
27     Gray_img=img;                 // if image is 2D
       image
28 end
29 SE=CreateStructureElement('square',3); // create
     structuring element 3x3 square matrix
30
31 Eimg=ErodeImage(Gray_img,SE); // erosion of the
     image
32 pause;                               // type 'resume'
     command on command prompt
33 imshow(Eimg);                       // show Resultant
     image
34 //se=[1 1 1;1 1 1;1 1 1];
35 Dimg=DilateImage(Gray_img,SE);  // dilation of the
     image
36 pause;                               // type 'resume'
     command on command prompt
37 imshow(Dimg);                        // Show Resultant
     Image
```

```
38
39 Oimg=OpenImage(Gray_img,SE);   // opening operation
      on the image
40 pause;                          // type 'resume'
      command on command prompt
41 imshow(Oimg);                   // Show Resultant
      Image
42
43
44 Cimg=CloseImage(Gray_img,SE);  // closing operation
      on the image
45 pause;                          // type 'resume'
      command on command prompt
46 imshow(Cimg);                   // Show Resultant
      Image
```

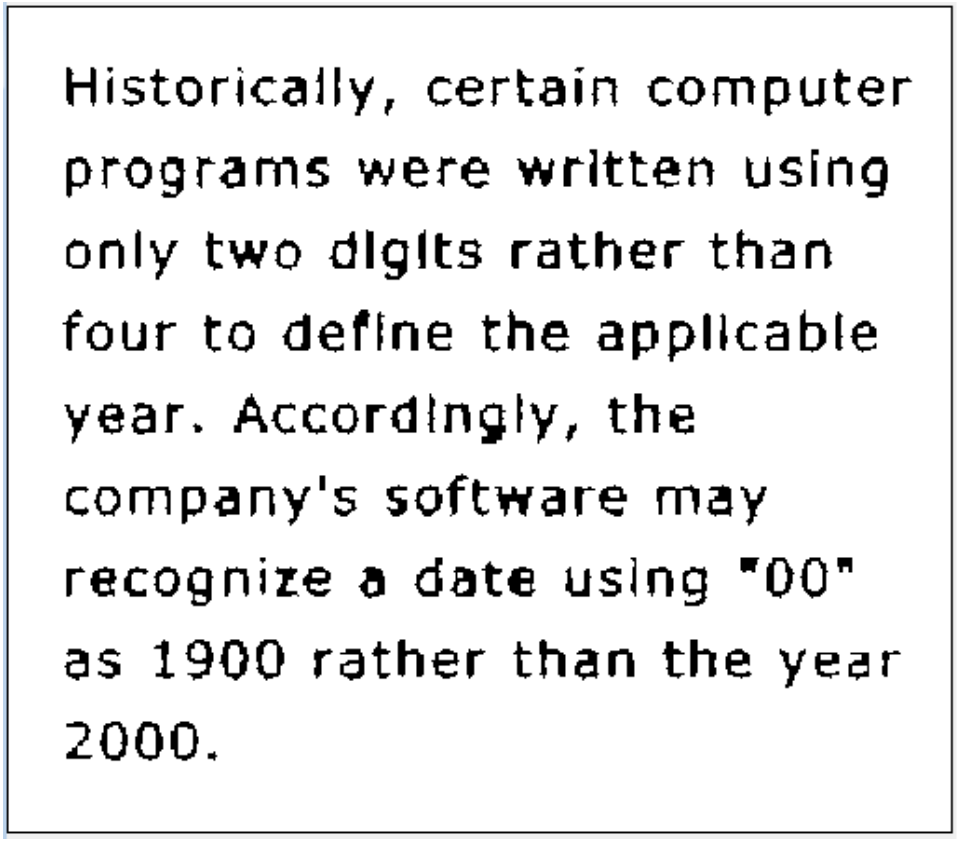


Figure 3.1: Basic Morphological Operations on Image

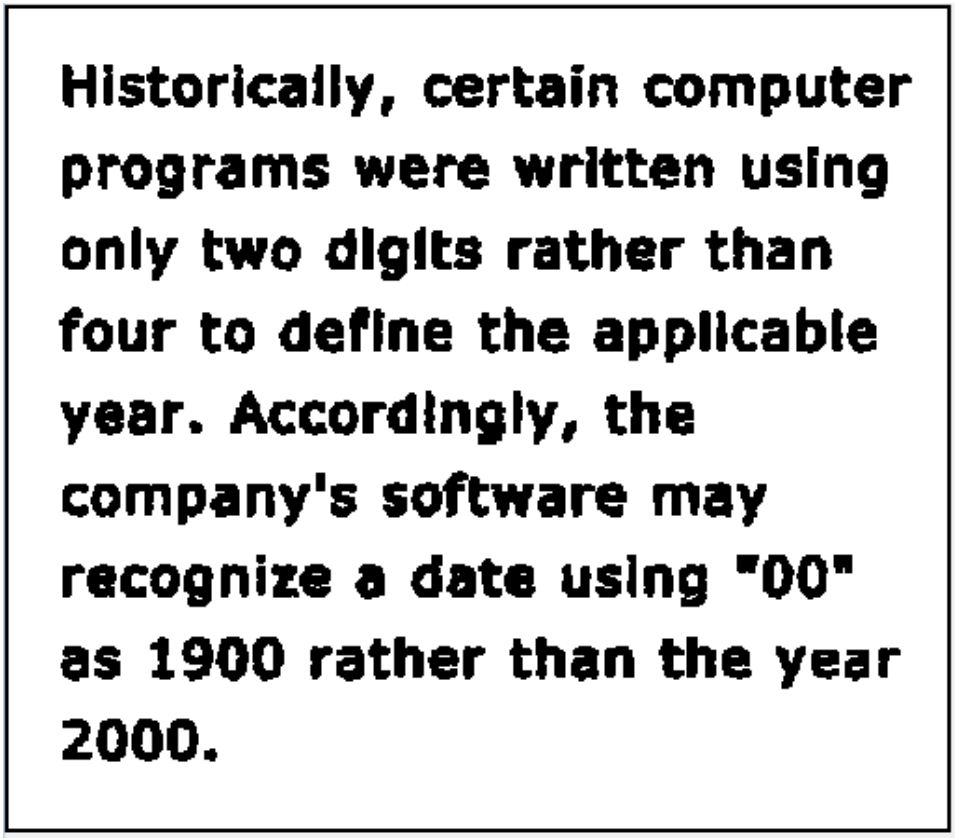


Figure 3.2: Basic Morphological Operations on Image

Experiment: 4

Basic Image Segmentation

check Appendix AP 10 for dependency:

harewood.jpg

Scilab code Solution 4.1 Example 1

```
1
2 // This scilab code is used to perform image
     segmentation using Otsu Thresholding method
3
4 //The scilab environment for this is : Scilab 6.0.1
5
6 //Toolbox used: Image Processing and Computer Vision
      Toolbox ver. 1.1
7
8
9 //OS used : Windows 10 64 bit
10 //
11 //Reference book name : Digital Image Processing
12 //book author: Rafael C. Gonzalez and Richard E.
     Woods
13
14 //clc //to clear command window.
```

```
15 //clear all //to kill previously defined variables.
16 //xdel(winsid())//to close all currently open figure
      (s).
17
18 //This code uses harewood.jpg image file for
      processing
19 //clc;
20 //clear all;
21 //I=imread('nutsBolts.jpg');
22 I=imread('harewood.jpg');                    // Reads
       input image
23 //I=rgb2gray(I);
24
25 Ihist=imhist(I);                             //
      Calculate histogram
26 Ihist=Ihist';                                //
      Transpose the histogram output
27 s=length(I);                                 //
      Calculates Total number of pixels
28 t=0:255;                                     // set
      counter t as 0 to 255
29 sumA=0.0;                                    //
      Initialize the sum variable
30 for t=1:256                                  //
      Calculate sum of pixels in histogram output
31     sumA = sumA+ t*Ihist(t);
32 end
33 sumB = 0;                                    //
      Initialize another variable as summation
34 wB = 0;                                      //
      Initialize weight background variable
35 wF = 0;                                      //
      Initialize weight foreground variable
36 varMax = 0;                                  //
      Initialize maximum value for threshold
37 threshold = 0;                               //
      Initialize threshold to zero
38
```

```
39
40 // This for block calucates threshold using Otsu
      Thresholding method
41 for t=1:256
42     wB = wB + Ihist(t);                  // Weight
         Background
43     if (wB == 0)
44         continue;
45     end
46     wF = s - wB;                      // Weight Foreground
47     if (wF == 0)
48         break;
49     end
50     sumB = sumB + (t * Ihist(t));
51     mB = sumB / wB;                // Mean Background
52     mF = (sumA - sumB) / wF;     // Mean Foreground
53     // Calculate Between Class Variance
54     varBetween = wB * wF * (mB - mF) * (mB - mF);
55     // Check if new maximum found
56     if (varBetween > varMax)
57        varMax = varBetween;
58        threshold = t;
59     end
60 end
61 //n=(threshold - max(I))/ (max(I)-min(I));
62 R=im2bw(I,threshold/256);                          //
      Binarize image with given threshold
63 imshow(R);                                         //
      Show resultant binarized image
64 //
```

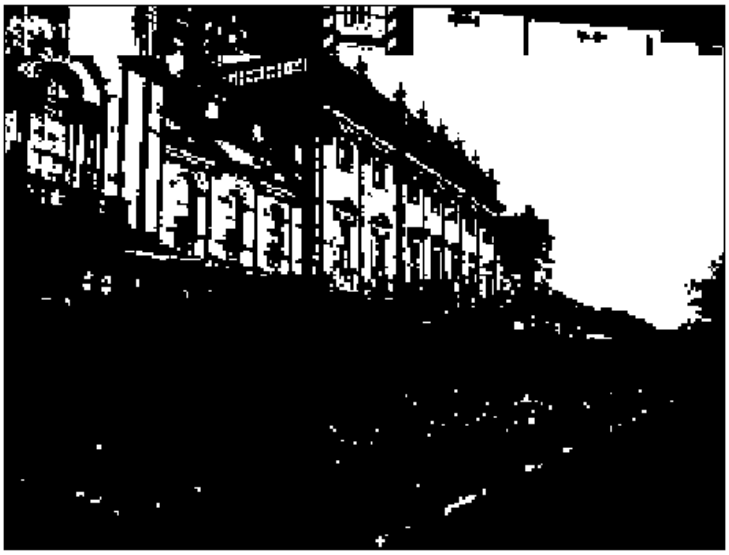


Figure 4.1: Example 1

Experiment: 5

Image Enhancement for Performance

check Appendix AP 8 for dependency:

`lenna1.png`

Scilab code Solution 5.1 Example 1

```
1
2 // This scilab code is to perform image enhancement
     by adjusting the intensity values in the image
3 //which also called as histogram equalization.
4
5 //The scilab environment for this is : Scilab 6.0.1
6
7 //Toolbox used: Image Processing and Computer Vision
      Toolbox ver. 1.1
8
9
10 //OS used : Windows 10 64 bit
11 //
12 //Reference book name : Digital Image Processing
```

```
13 //book author: Rafael C. Gonzalez and Richard E.
      Woods
14
15 clc //to clear command window.
16 clear all //to kill previously defined variables.
17 xdel(winsid())//to close all currently open figure(s
      ).
18
19 //This code uses lenna.png image file for processing
20
21
22 img=imread('lenna.png');                    // Reads
       original lenna (color) image
23 grayImg=rgb2gray(img);                      //
      Converts color image to gray scale image
24 histequalImg=imhistequal(grayImg);          //
      Perform image enhancement using intensity
      adjustment i.e. histogram equalization
25 imshow(img);                                //
      Displays original lenna image
26 figure;imshow(grayImg);                     //
      Display resultant gray scale image
27 figure;imshow(histequalImg);                //
      Displyas resultant histogram equalized image
```

Figure 5.1: Example 1

Figure 5.2: Example 1

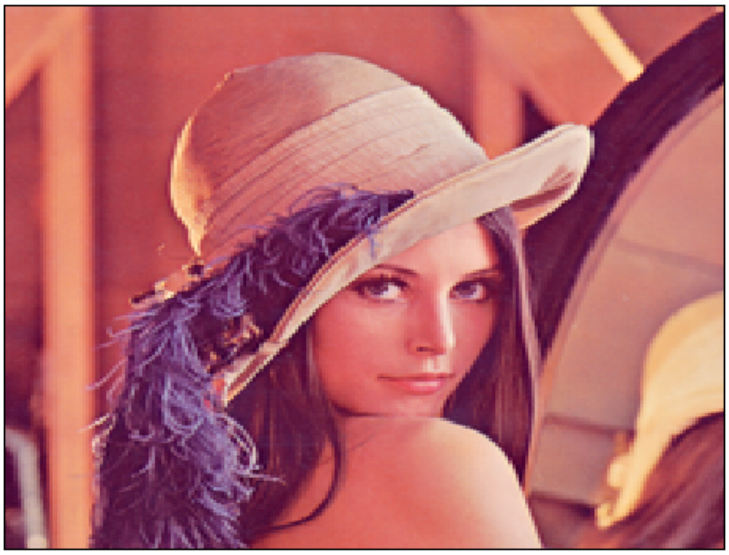


Figure 5.3: Example 1

Experiment: 6

Hough Transform Implementation on Images

check Appendix AP 9 for dependency:

pic26.png

Scilab code Solution 6.1 Example 1

```
1
2 // This scilab code is used to perform Hough
     Transform operation on the image
3 //to extract the features from image.
4
5 //The scilab environment for this is : Scilab 6.0.1
6
7 //Toolbox used: Image Processing and Computer Vision
      Toolbox ver. 1.1
8
9
10 //OS used : Windows 10 64 bit
11 //
12 //Reference book name : Digital Image Processing
```

```
13 //book author: Rafael C. Gonzalez and Richard E.
     Woods
14
15 //clc //to clear command window.
16 //clear all //to kill previously defined variables.
17 //xdel(winsid())//to close all currently open figure
     (s).
18
19 //This code uses an circle image pic26.png file for
     processing
20
21 S = imread('pic26.png');                    // Read
     input image using imread function
22 [houghmat, dist, theta] = imhough(S);       // Apply
     hough transformation
23                                             // This
                                                  returns
                                                  hough
                                                  matrix
                                                  houghmat
24                                             //
                                                  distance
                                                   from
                                                  center
                                                   to
                                                  the
                                                  point
25                                             // and
                                                  angle
                                                   of
                                                  point
                                                   to
                                                  the
```

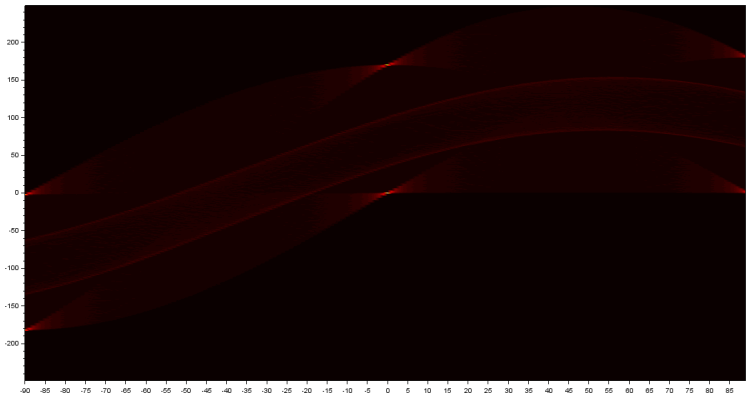


Figure 6.1: Example 1

center

```
26
27 f=scf();                                          //
     Assign current graphics window handle to f
28 f.color_map=hotcolormap(64);                      //
     Change colormap for current graphics window
29 Sgrayplot(theta,dist,houghmat',strf="021"); // Plots
     smooth 2D surface
```

Experiment: 7

SIFT Implementation for Images

check Appendix AP 8 for dependency:

`lenna1.png`

Scilab code Solution 7.1 Example 1

```
1
2 // This scilab code is to perform SIFT Transfom on
     the image
3 //to extract the features from image.
4
5 //The scilab environment for this is : Scilab 6.0.1
6
7 //Toolbox used: Image Processing and Computer Vision
      Toolbox ver. 1.1
8
9
10 //OS used : Windows 10 64 bit
11 //
12 //Reference book name : Digital Image Processing
```

```
13 //book author: Rafael C. Gonzalez and Richard E.
      Woods
14
15 //clc //to clear command window.
16 //clear all //to kill previously defined variables.
17 //xdel(winsid())//to close all currently open figure
      (s).
18
19 //This code uses lenna.png image file for processing
20
21
22 img=imread('lenna1.png');                    // Reads
       original lenna (color) image
23 SIFTfeatures=imdetect_SIFT(img);             //
      Extract features from image using SIFT algorithm
24 imshow(img);                                 //
      Displays original lenna image
25 plotfeature(SIFTfeatures);                   // Plot
      the features extracted on displayed image
```

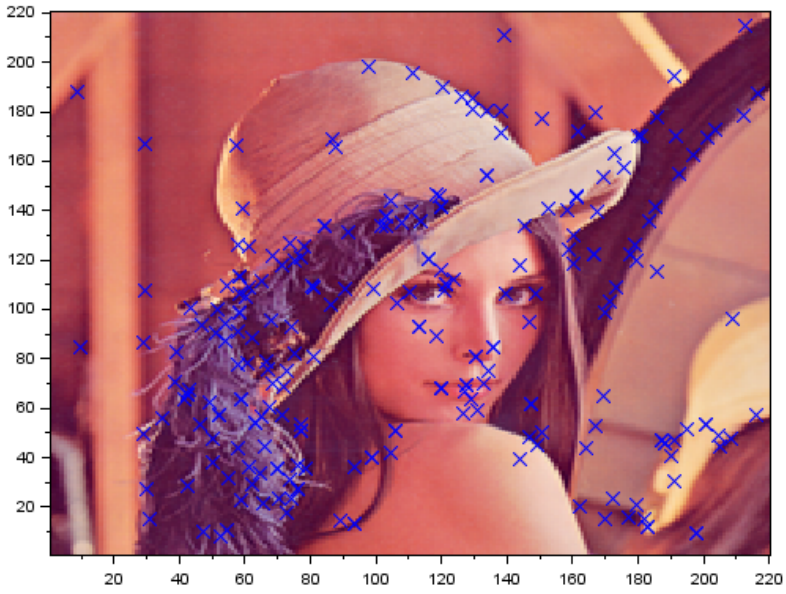


Figure 7.1: Example 1

Experiment: 8

Different Distance Measures implementations

Scilab code Solution 8.1 Example 1

```
1
2 // This scilab code is used to calculate distance
     measure between different vectors
3 //such as euclidean distance, checkerboard distance
     and mahalanobis distance
4
5 //The scilab environment for this is : Scilab 6.0.1
6
7 //OS used : Windows 10 64 bit
8 //
9 //Reference book name : Digital Image Processing
10 //book author: Rafael C. Gonzalez and Richard E.
     Woods
11
12 //clc //to clear command window.
13 clear all //to kill previously defined variables.
14 //xdel(winsid())//to close all currently open figure
     (s).
15
```

```
16 //A  = rand(1, 100);                                    //
      Create a vector of random values
17 //B = rand(1, 100);                                     //
      Creates another vector of random values
18
19 A = [5.76 43 34;6.7 32 5;3 3 5;34 12 6];     //
      Create a vector A
20 B = [1.55 5 32;4.5 9 8;2 4 3;3.2 6 7];
                                    // Create a vector B
21
22 // Euclidean Distance
23 D  = sqrt(sum((A - B) .^ 2))                    //
      Calculates euclidean distance between A and B
24 Da  = sqrt(sum((A - A) .^ 2))                    //
      Calculates euclidean distance between A itself
25 Db  = sqrt(sum((B - B) .^ 2))                    //
      Calculates euclidean distance between B itself
26
27
28 // Checkerboard Distance
29 Dc1 = sum(sum((A-B).^2,2))                            //
      Calculates Checkerboard distance between A and B
30 Dc2 = sum(sum((A-A).^2,2))                            //
      Calculates Checkerboard distance between A and B
31 Dc3 = sum(sum((B-B).^2,2))                            //
      Calculates Checkerboard distance between A itself
32
33
34 // Mahalanobis Distance
35 A = [5.76 43 34;6.7 32 5;3 3 5;34 12 6];     //
      Create a vector A
36 B = [1.55 5 32];                                    //
      Create a vector B
37 cv = cov(A);                                        //
      Calculate covariance matrix of A
38 mu = mean(A,1);                                     //
      Calucated mean value of A
39 Dm = (B-mu)*inv(cv)*(B-mu)';                         //
```

```
    Calculates Mahalanobis distance between A and B
//out=[D Da Db Dc1 Dc2 Dc3 Dm]
disp([D Da Db Dc1 Dc2 Dc3 Dm]);                    //
    Displays output on Scilab console

////////////////////////////// OUTPUT
    ////////////////////////////////////////////////

//54.774119    0.    0.    3000.2041    0.    0.
    11.17056
```

Experiment: 9

Basic Shape Analysis Implementation

check Appendix AP 7 for dependency:

`shapes.jpg`

Scilab code Solution 9.1 Example 1

```
1
2 // This scilab code is used to perform different
     edge detection methods on images
3 //which can be used in shape analysis.
4
5 //The scilab environment for this is : Scilab 6.0.1
6
7 //Toolbox used: Image Processing and Computer Vision
      Toolbox ver. 1.1
8
9
10 //OS used : Windows 10 64 bit
11 //
12 //Reference book name : Digital Image Processing
```

```
13 //book author: Rafael C. Gonzalez and Richard E.
     Woods
14
15 //clc //to clear command window.
16 //clear all //to kill previously defined variables.
17 //xdel(winsid())//to close all currently open figure
     (s).
18
19 //This code uses shapes.jpg image file for
     processing
20
21
22 img = imread('shapes.jpg');
     // Reads input image shapes.jpg
23 img = rgb2gray(img);
     // Converts input image to gray scale
24 clf
     // Clears figure handle
25 imshow(img);
     // Show gray scale image (Result file
     exp_9_1_result_1.png)
26
27 e = edge(img);
     // This performs edge detection operation with
     sobel, thresh = 0.5
28 figure(2);
     // Opens new figure
29 imshow(e)
     // Show result image (Result file
     exp_9_1_result_2.png)
30
31 e = edge(img, 'prewitt'); // thresh = 0.5
     // Applied prewitt edge detection method
32 figure(3);
33 imshow(e)
     // Show result image (Result file
     exp_9_1_result_3.png)
34
```

```
35 e = edge(img, 'canny', [0.06  0.2]);
      // Applies canny edge detection method
36 figure(4);
37 imshow(e)
      // Show result image (Result file
      exp_9_1_result_4.png)
38
39 e = edge(img, 'fftderiv', 0.4);
      // Applies FFT gradient method; 0.4 threshold
40 figure(5);
41 imshow(e)
      // Show result image (Result file
      exp_9_1_result_5.png)
```

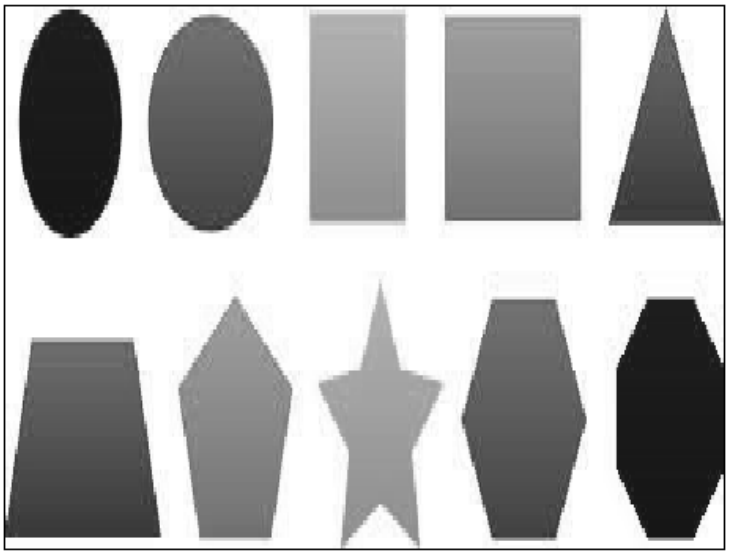


Figure 9.1: Example 1

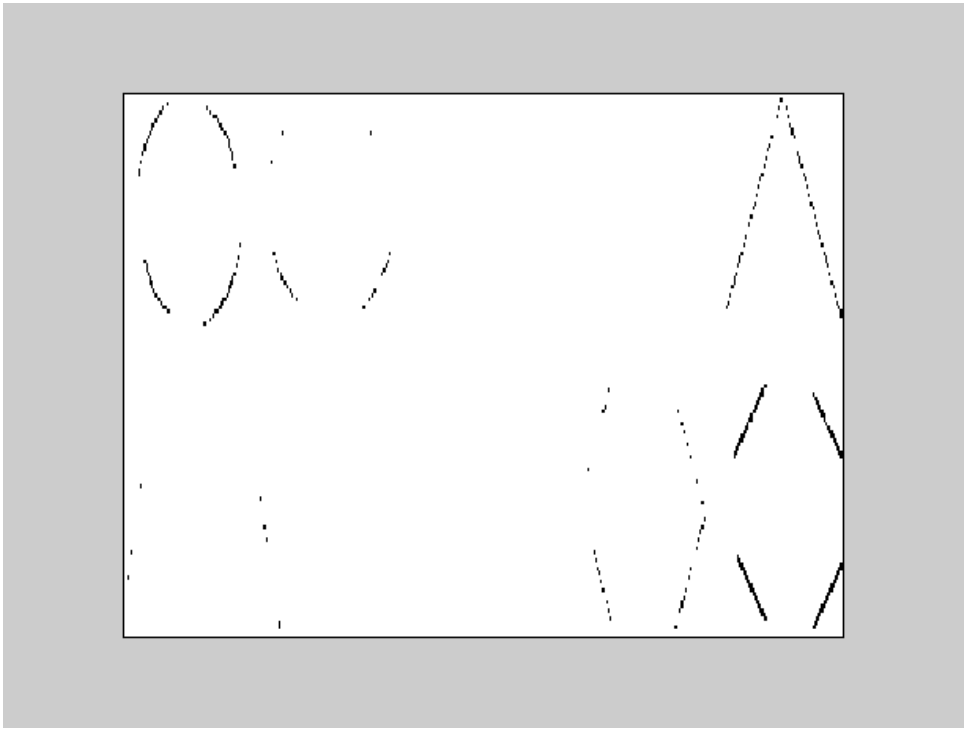


Figure 9.2: Example 1

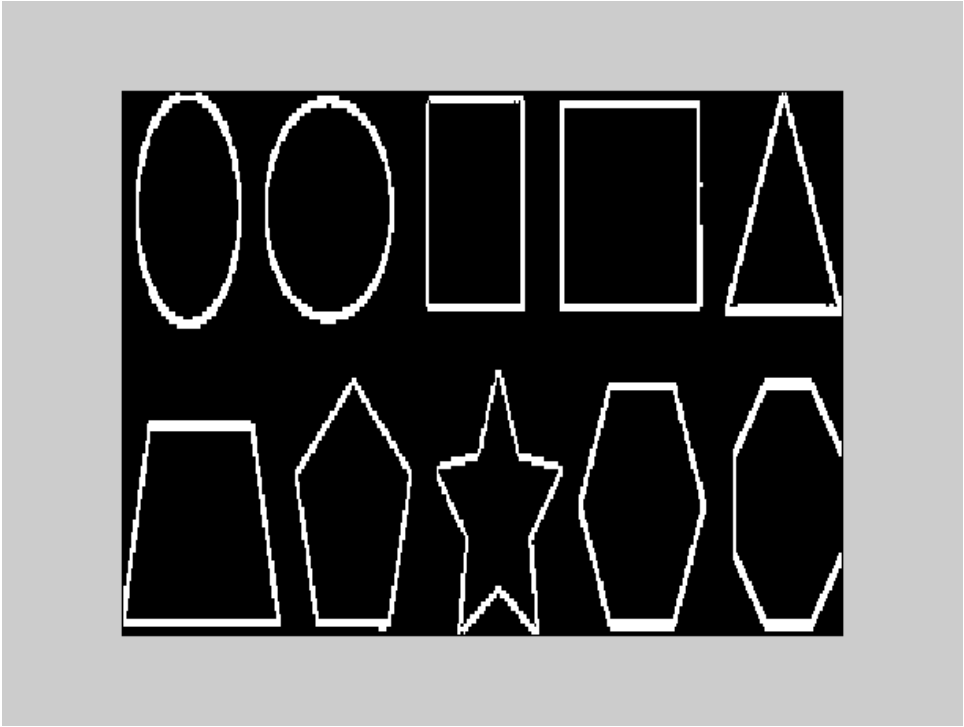


Figure 9.3: Example 1

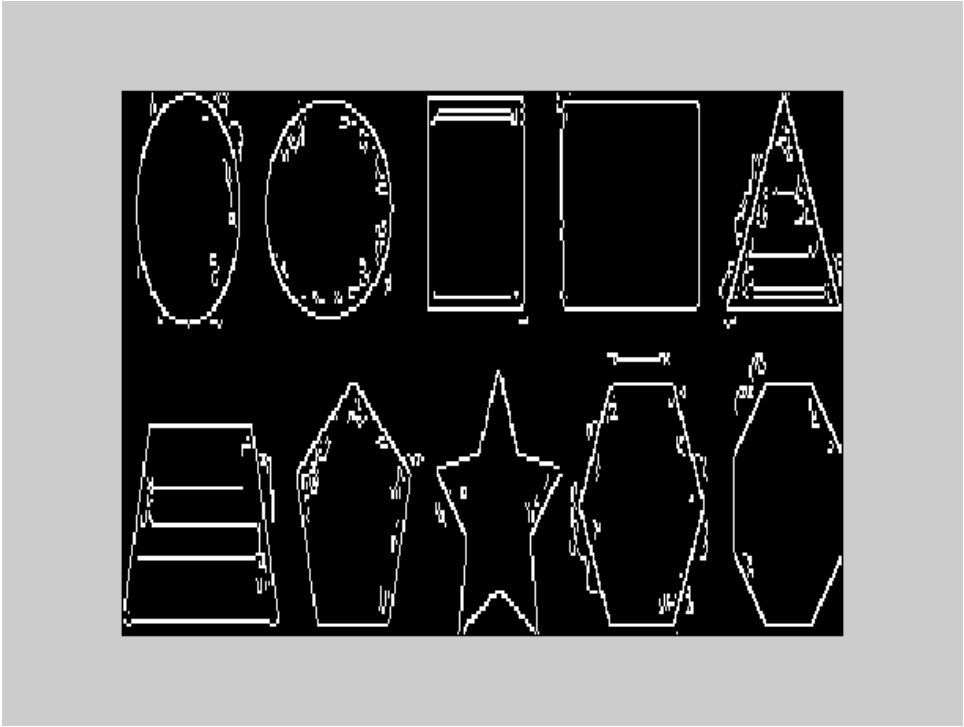


Figure 9.4: Example 1

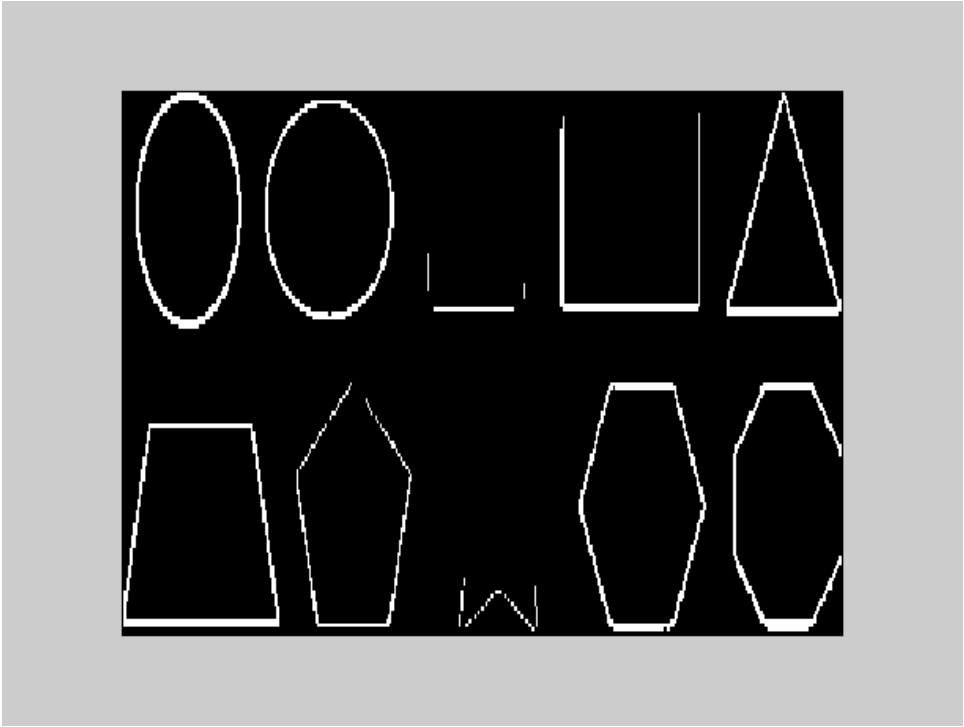


Figure 9.5: Example 1

Experiment: 10

Feature Extraction from Images

check Appendix AP 7 for dependency:

`shapes.jpg`

Scilab code Solution 10.1 Example 1

```
1
2 // This scilab code is used to extract features from
      images
3 //using FAST algorithm (this algorithm is best
     suitable for corner detection)
4
5 //The scilab environment for this is : Scilab 6.0.1
6
7 //Toolbox used: Image Processing and Computer Vision
      Toolbox ver. 1.1
8
9
10 //OS used : Windows 10 64 bit
11 //
12 //Reference book name : Digital Image Processing
13 //book author: Rafael C. Gonzalez and Richard E.
     Woods
```

```
14 // Rosten. Machine Learning for High-speed Corner
      Detection, 2006.
15
16 //clc //to clear command window.
17 //clear all //to kill previously defined variables.
18 //xdel(winsid())//to close all currently open figure
      (s).
19
20 //This code uses shapes.jpg image file for
      processing
21
22
23 //S = imcreatechecker(8,8,[1 0.5]);
24 S=imread('shapes.jpg');
                                        // Reads an input
     image
25 fobj = imdetect_FAST(S);
                                       // Extract
     features from image using FAST algorithm
26 imshow(S);
                                                        //
     Displays original image
27 plotfeature(fobj);
                                              // Plots the
     extracted features on the image shown in figure
```

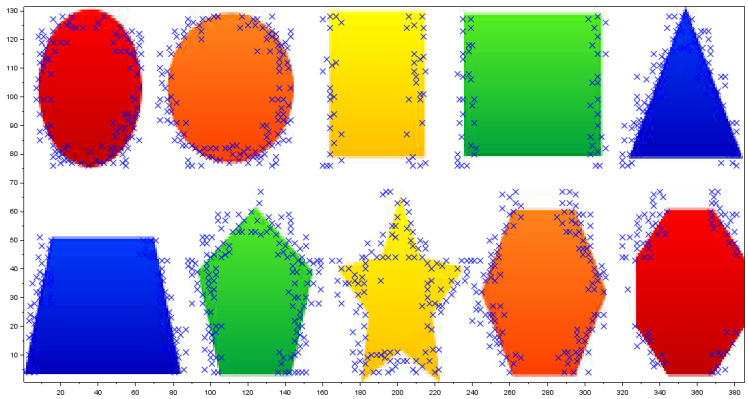


Figure 10.1: Example 1

Experiment: 11

Basics of OCR

check Appendix AP 4 for dependency:

`number.png`

check Appendix AP 5 for dependency:

`region.png`

check Appendix AP 6 for dependency:

`text.png`

Scilab code Solution 11.1 Example 1

```
1
2 // This scilab code is used to perform basic
     operation such as binarization of images
3 //that contains text with random value of threshold
4
5 //The scilab environment for this is : Scilab 6.0.1
6
7 //Toolbox used: Image Processing and Computer Vision
     Toolbox ver. 1.1
8
```

```
9
10 //OS used : Windows 10 64 bit
11 //
12 //Reference book name : Digital Image Processing
13 //book author: Rafael C. Gonzalez and Richard E.
      Woods
14
15 //clc //to clear command window.
16 clear all //to kill previously defined variables.
17 //xdel(winsid())//to close all currently open figure
      (s).
18
19 //This code uses text.png, region.png and number.png
       image files for processing
20
21 img = imread('text.png');                  // Reads
      input image
22 threshold=0.93;                            // set a
      random threshold value
23 imagen =~im2bw(img,threshold);               // Convert
       input image to binarized image with given
      threshold
24                                             // and also
                                                  negate
                                                  the
                                                  output
25 imshow(imagen);                             // Shows the
       resultant image (exp_11_1_result_1.png)
26
27 img = imread('number.png');                   // Reads
      input image
28 threshold=0.93;                            // set a
      random threshold value
29 imagen =~im2bw(img,threshold);               // Convert
       input image to binarized image with given
      threshold
30                                             // and also
                                                  negate
```

```
                                                    the
                                                    output
31 imshow(imagen);                                 // Shows the
    resultant image (exp_11_1_result_2.png)
32
33 img = imread('region.png');                       // Reads
   input image
34 threshold=0.93;                                  // set a
   random threshold value
35 imagen =~im2bw(img,threshold);                    // Convert
    input image to binarized image with given
   threshold
36                                                  // and also
                                                    negate
                                                    the
                                                    output
37 imshow(imagen);                                 // Shows the
    resultant image (exp_11_1_result_3.png)
```

Figure 11.1: Example 1

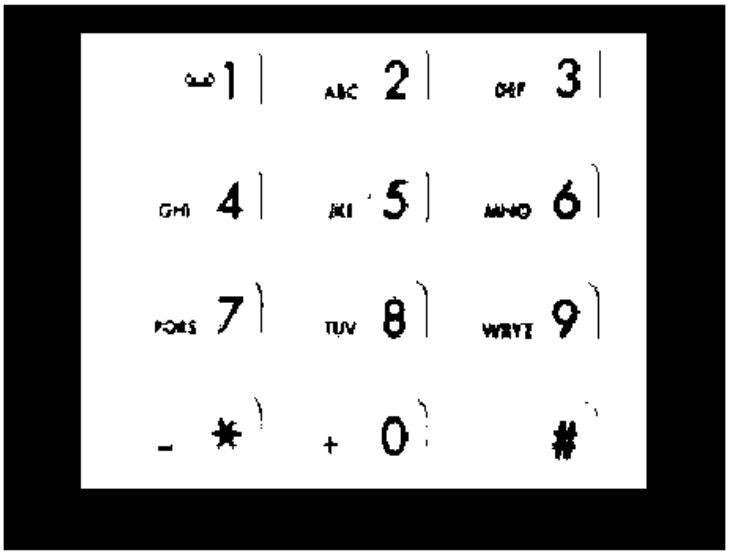


Figure 11.2: Example 1

Figure 11.3: Example 1

Experiment: 12

Face Detection Algorithm Implementation

check Appendix AP 1 for dependency:

`group.png`

check Appendix AP 2 for dependency:

`kalpana.jpg`

check Appendix AP 3 for dependency:

`random.jpg`

Scilab code Solution 12.1 Example 1

```
1
2 // This scilab code is used to detect the human face
      in the image
3
4 //The scilab environment for this is : Scilab 5.5.2
5
6 //Toolbox used: SIVP 0.5.3.2
7
```

```
8
9  //OS used : Windows 7 32 bit
10 //
11 //Reference book name : Digital Image Processing
12 //book author: Rafael C. Gonzalez and Richard E.
       Woods
13
14 //clc //to clear command window.
15 //clear all //to kill previously defined variables.
16 //xdel(winsid())//to close all currently open figure
       (s).
17
18 //This code uses different images having human faces
        for processing
19 // Images used:
20 //    kalpana.jpg
21 //    random.jpg
22 //    group.png
23
24 img = imread('kalpana.jpg');
                                // Reads input image
25
26 faces = detectfaces(img);
       // Uses function in the toolbox to detect faces
27 [m,n] = size(faces);
       // Calculates number of faces in image
28
29 for i=1:m,
       // This block draws rectangles for each face
       images detected
30      img = rectangle(img, faces(i,:), [0,255,0]);
31 end;
32
33 imshow(img);
       // Shows resultant images with the rectangle
       around face images
34
35 pause;
```

```
    // Pause till user enters resume command at
    command window
36  img = imread('random.jpg');
    // Reads input image
37
38  faces = detectfaces(img);
    // Uses function in the toolbox to detect faces
39  [m,n] = size(faces);
    // Calculates number of faces in image
40
41  for i=1:m,
    // This block draws rectangles for each face
    images detected
42      img = rectangle(img, faces(i,:), [0,255,0]);
43  end;
44
45  imshow(img);
    // Shows resultant images with the rectangle
    around face images
46  pause;
    // Pause till user enters resume command at
    command window
47  img = imread('group.png');
    // Reads input image
48
49  faces = detectfaces(img);
    // Uses function in the toolbox to detect faces
50  [m,n] = size(faces);
    // Calculates number of faces in image
51
52  for i=1:m,
    // This block draws rectangles for each face
    images detected
53      img = rectangle(img, faces(i,:), [0,255,0]);
54  end;
55
56  imshow(img);
    // Shows resultant images with the rectangle
```

Figure 12.1: Example 1

around face images

Figure 12.2: Example 1

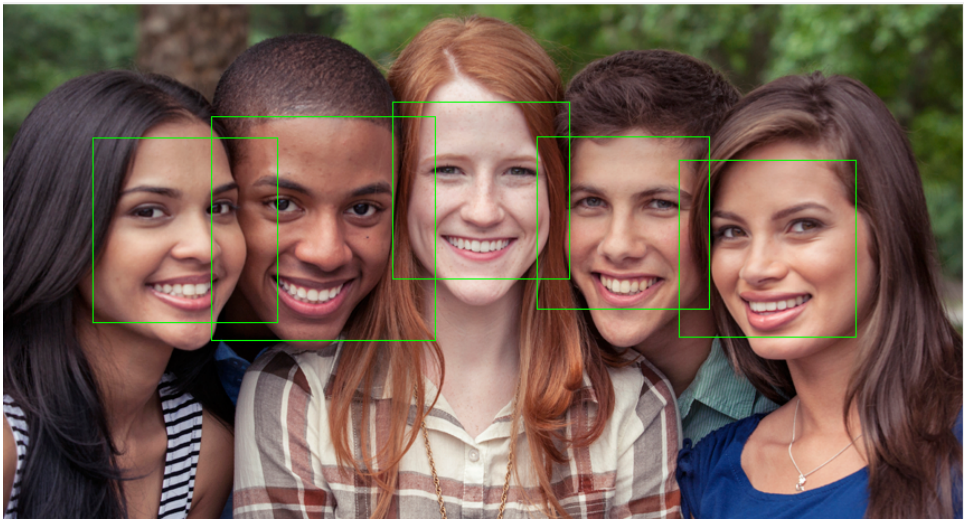


Figure 12.3: Example 1

Appendix

groupimage

kalpanachawla

randomimage

numberimage

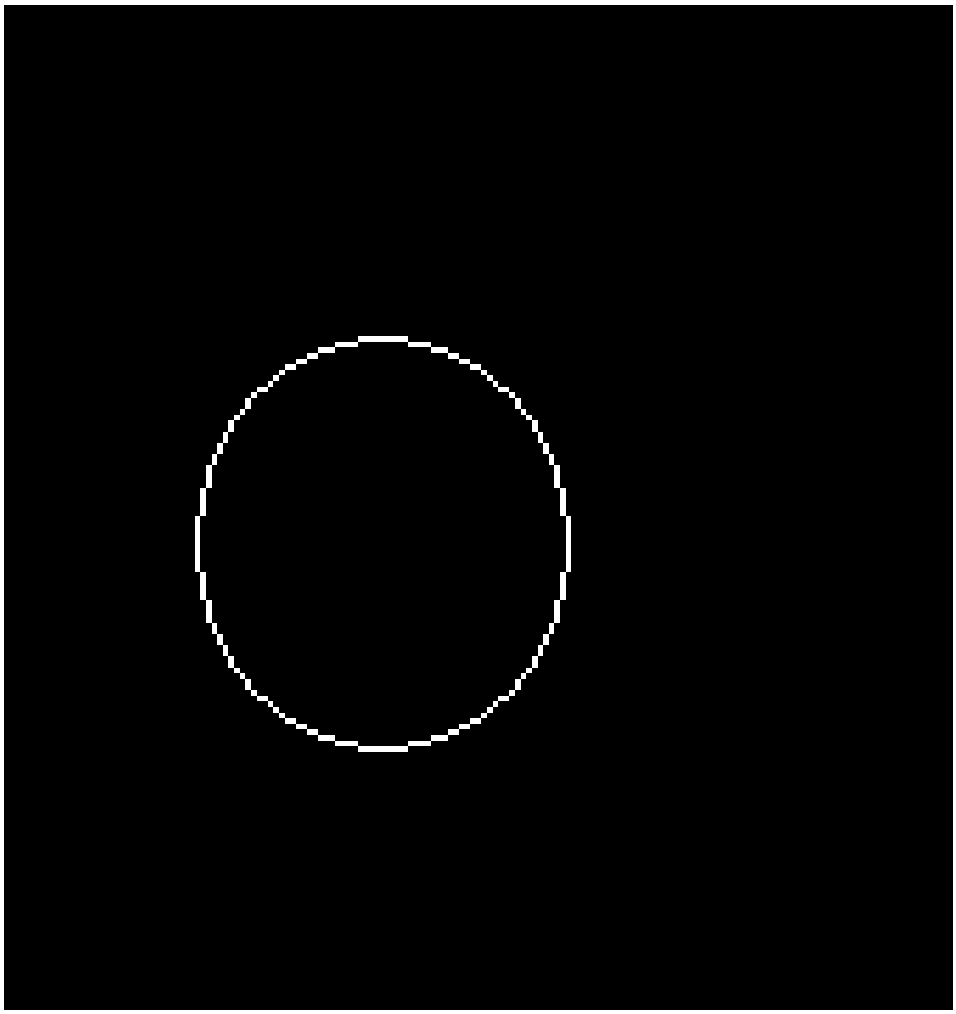
regionimage

YES, it's true M Ivan WINKLER! R
guaranteed chances to win a shar
Lump-Sum, TAX-FREE CASH. Plu
Australian Lotto Multi-Millionaire,
granted you WIN-PLUS PRIORITY.

textimage

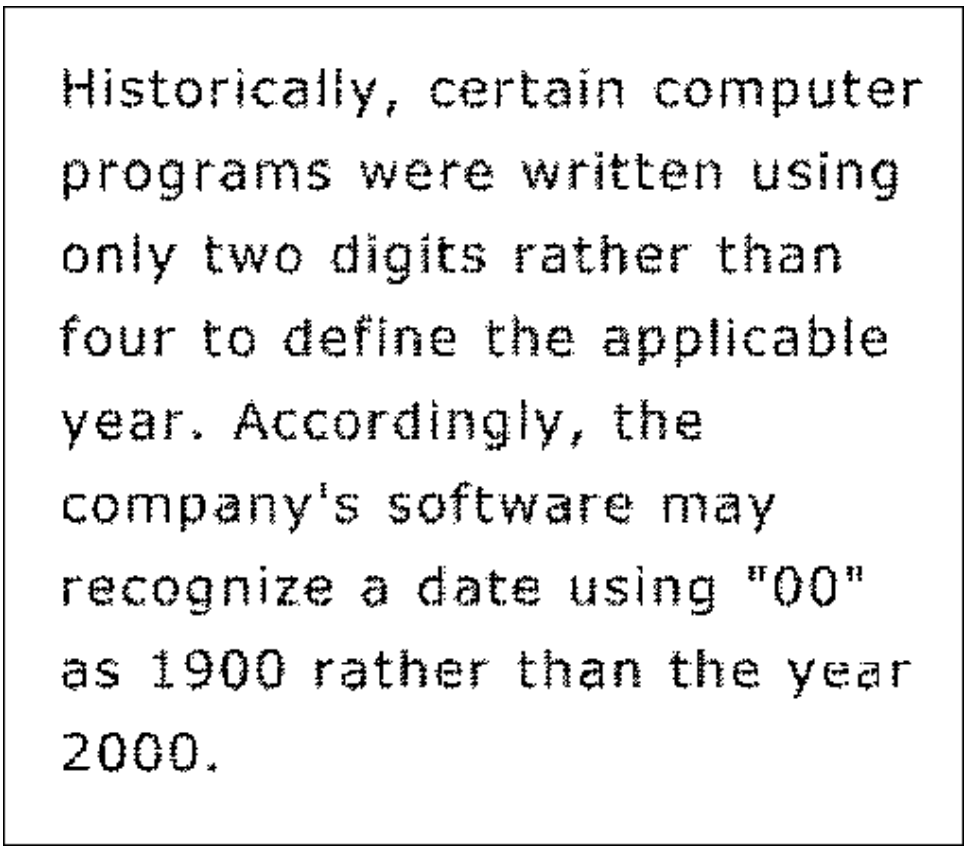
shape

lennaimage



circleimage

harewood


Historically, certain computer programs were written using only two digits rather than four to define the applicable year. Accordingly, the company's software may recognize a date using "00" as 1900 rather than the year 2000.

Text

Image

inputimage