University of Technology
الجامعة التكنولوجية

Computer Science Department
قسم علوم الحاسوب

Image Processing 2 (Practical)
معالجة صور 2 (عملي)

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Image histogram

Input (Load an image)

output (a text of histogram values for each color level)

(a chart of histogram values for each color level)

Apply histogram to image program

```
For Me.i = 0 To 255
   histo(i) = 0
Next

For Me.i = 0 To x - 1
   For Me.j = 0 To y - 1
      pixel = c_img.GetPixel(i, j)
      r = pixel.R
      histo(r) = histor(r) + 1
   Next
Next
TextBox1.SelectedText = "Red" & "   " & vbnewline
For Me.i = 0 To 255
   TextBox1.SelectedText = Str(i) & "=" & Str(histo(i)) & vbNewLine
Next
```

Histogram modification

Histogram stretch

Input (Load an image and execute previews histogram program)

output (an image)

Apply Histogram stretch to image program

Note: the code written only on the red value level in the actual code must be applied on red, green and blue levels

```
For Me.i = 255 To 0 Step -1
    If histor(i) > maxr Then
        r_max_lev = i:   Exit For
    End If
Next
For Me.i = 0 To 255
    If histor(i) < minr And histor(i) <> 0 Then
        r_min_lev = i:   Exit For
    End If
Next
Dim min As Integer, max As Integer
min = 0 : max = 255
For Me.i = 0 To x - 1
    For Me.j = 0 To y - 1
        pixel = c_img.GetPixel(i, j):  r = pixel.R
r = ((r - r_min_lev) / (r_max_lev - r_min_lev)) * (max - min) + min
        stretch_img.SetPixel(i, j, Color.FromArgb(r, g, b))
    Next
Next
PictureBox2.Image = stretch_img
```

Histogram shrink

Input (Load an image and execute previews histogram program and enter shrink max and shrink min values)

output (an image)

Apply Histogram shrink to image program

Note: the code written only on the red value level in the actual code must be applied on red, green and blue levels

```
For Me.i = 255 To 0 Step -1
    If histor(i) > maxr Then
        r_max_lev = i:   Exit For
    End If
Next
For Me.i = 0 To 255
    If histor(i) < minr And histor(i) <> 0 Then
        r_min_lev = i:   Exit For
    End If
Next
Dim min As Integer = 75, max As Integer = 175
For Me.i = 0 To x - 1
    For Me.j = 0 To y - 1
        pixel = c_img.GetPixel(i, j): r = pixel.R
r = ((max - min) / (r_max_lev - r_min_lev)) * (r - r_min_lev) + min
        shrink_img.SetPixel(i, j, Color.FromArgb(r, g, b))
    Next
Next
PictureBox2.Image = shrink_img
```

Histogram slide

Input (Load an image and enter offset value)

output (an image)

Apply Histogram slide to image program

```
Offset=textbox1.text
For Me.i = 0 To x - 1
    For Me.j = 0 To y - 1
        pixel = c_img.GetPixel(i, j)
        r = pixel.R +offset
        c_img.SetPixel(i, j, Color.FromArgb(r, g, b))
    Next
Next
PictureBox2.Image = c_img
```

Histogram features

Input (Load an image)

output (Histogram features in texts)

Apply Histogram feature program

```
Dim c_img As New Bitmap(PictureBox1.Image)
Dim zero_order As New Bitmap(PictureBox1.Width * 2 + 1,
PictureBox1.Height * 2 + 1)
Dim histor(0 To 255) As Integer
Dim mean_r As Double, mean_g As Double, mean_b As Double Dim
stand_dev_r As Integer, stand_dev_g As Integer, stand_dev_b As
Integer
Dim energy_r As Double, energy_g As Double, energy_b As Double
Dim entropy_r As Double, entropy_g As Double, entropy_b As Double
Dim histog(0 To 255) As Integer
Dim histob(0 To 255) As Integer
Dim pixel As New Color
Dim size As Integer
        For Me.i = 0 To 255
            histor(i) = 0
            histog(i) = 0
            histob(i) = 0
        Next
        size = x * y
        For Me.i = 0 To x - 1
            For Me.j = 0 To y - 1
                pixel = c_img.GetPixel(i, j)
                r = pixel.R : g = pixel.G : b = pixel.B
                histor(r) = histor(r) + 1
                histog(g) = histog(g) + 1
                histob(b) = histob(b) + 1
            Next
        Next
```

```
        For Me.i = 0 To 255
            pr(i) = Math.Round(histor(i) / size, 2)
            pg(i) = Math.Round(histog(i) / size, 2)
            pb(i) = Math.Round(histob(i) / size, 2)
        Next
        For Me.i = 0 To 255
  TextBox1.SelectedText = Str(i) & "  " & pr(i) & vbNewLine
'print the prbability
        Next
        For Me.i = 0 To 255
            mean_r = mean_r + i * pr(i)
            mean_g = mean_g + i * pg(i)
            mean_b = mean_b + i * pb(i)
        Next
        TextBox2.SelectedText = "mean r=" & mean_r & "  "_
& "mean g=" & mean_g & "  " & "mean b=" & mean_b &
vbNewLine
       For Me.i = 0 To 255
       stand_dev_r = stand_dev_r + (i - mean_r) ^ 2 * pr(i)
       stand_dev_g = stand_dev_g + (i - mean_g) ^ 2 * pg(i)
       stand_dev_b = stand_dev_b + (i - mean_b) ^ 2 * pb(i)
       Next
        TextBox2.SelectedText = "stand r=" &_
Math.Round(Math.Sqrt(stand_dev_r), 2) & " " & "stand g=" &_
Math.Round(Math.Sqrt(stand_dev_g)) & "  " & "stand b=" &_
Math.Round(Math.Sqrt(stand_dev_b)) & vbNewLine
        For Me.i = 0 To 255
            energy_r = energy_r + pr(i) ^ 2
            energy_g = energy_g + pg(i) ^ 2
            energy_b = energy_b + pb(i) ^ 2
        Next
        TextBox2.SelectedText = "energy r=" & energy_r &_
"   " & "energy g=" & energy_g & "  " & "energy b=" &_
energy_b & vbNewLine
```

```
 For Me.i = 0 To 255
        If pr(i) <> 0 Then entropy_r = entropy_r + pr(i) *_
(Math.Log(pr(i)) / Math.Log(2))
        If pg(i) <> 0 Then entropy_g = entropy_g + pg(i) *_
(Math.Log(pg(i)) / Math.Log(2))
          If pb(i) <> 0 Then entropy_b = entropy_b + pb(i)_
* (Math.Log(pb(i)) / Math.Log(2))
        Next

TextBox2.SelectedText = "entropy r=" & entropy_r / -1 &_
"   " & "entropy g=" & entropy_g * -1 & "   " & "entropy b="_
& entropy_b * -1 & vbNewLine
```

YCbCr format program

Input (Load an image)

output (YCbCr format image)

Apply YCbCr format program

```
Dim color_pic As New Bitmap(PictureBox1.Image)
Dim j_pic = New Bitmap(x, color_pic.Height) ',
Dim pixel As Drawing.Color
For Me.i = 0 To x - 1
 For Me.j = 0 To y - 1
  pixel = color_pic.GetPixel(i, j)
  r = pixel.R : g = pixel.G : b = pixel.B
  yy = (77 / 256) * r + (150 / 256) * g + (29 / 256) * b
  cr = -(44 / 256) * r - (87 / 256) * g + (131 / 256) * b + 125
  cb = (131 / 256) * r - (110 / 256) * g - (21 / 256) * b + 125
  j_pic.SetPixel(i, j, Color.FromArgb(yy, cb, cr))
  Next
Next
PictureBox2.Image = j_pic
```

convert YCbCr format to RGB program

Input (Load YCbCr format image)

output (RGB format image)

Apply convert YCbCr format to RGB program

```
Dim j_pic As New Bitmap(PictureBox2.Image)
Dim color_pic = New Bitmap(x, j_pic.Height)
Dim pixel As Drawing.Color
        For Me.i = 0 To x - 1
            For Me.j = 0 To y - 1
                pixel = j_pic.GetPixel(i, j)
                yy = pixel.R : cr = pixel.G : cb = pixel.B
                r = yy + 1.371 * (cr - 128)
                g = yy - 0.698 * (cr - 128) - 0.336 * (cb - 128)
                b = yy + 1.732 * (cb - 128)
                If r > 255 Then r = 255
                If g > 255 Then g = 255
                If b > 255 Then b = 255
                If r < 0 Then r = 0
                If g < 0 Then g = 0
                If b < 0 Then b = 0
                color_pic.SetPixel(i, j, Color.FromArgb(r, g, b))
            Next
        Next
        PictureBox3.Image = color_pic
```

Image Segmentation program

Input (Load an image)

output (Segmented images)

Apply Image Segmentation program

```
Dim x As Integer, y As Integer
Dim color_pic As New Bitmap(PictureBox1.Image)
Dim pixel As Drawing.Color
Dim seg_img As New Bitmap(x, y)
Dim seg _img2 As New Bitmap(x, y)
Dim seg _img3 As New Bitmap(x, y)
Dim seg _img4 As New Bitmap(x, y)
Dim i As Integer, j As Integer

  For i = 0 To (x / 2) - 1
     For j = 0 To (y / 2) - 1
        pixel = color_pic.GetPixel(i, j)
        r = pixel.R : g = pixel.G : b = pixel.B
        seg _img.SetPixel(i, j, Color.FromArgb(r, g, b))
      Next
  Next
  PictureBox2.Image = stretch_img

 For i = (x / 2) - 1 To x - 1
    For j = (y / 2) - 1 To y - 1
       pixel = color_pic.GetPixel(i, j)
       r = pixel.R : g = pixel.G : b = pixel.B
       seg _img2.SetPixel(i, j, Color.FromArgb(r, g, b))
    Next
  Next
  PictureBox3.Image = seg _img2

  For i = x / 2 To x - 1
      For j = 0 To y / 2
       pixel = color_pic.GetPixel(i, j)
       r = pixel.R : g = pixel.G : b = pixel.B
       seg _img3.SetPixel(i, j, Color.FromArgb(r, g, b))
      Next
  Next
  PictureBox4.Image = stretch_img3
```

```
For i = 0 To x / 2
   For j = (y / 2) To y - 2
     pixel = color_pic.GetPixel(i, j)
     r = pixel.R : g = pixel.G : b = pixel.B
     seg _img4.SetPixel(i, j, Color.FromArgb(r, g, b))
   Next
Next
PictureBox5.Image = seg _img4
```

Run-length coding program

Input ((8*8) matrix)

output (text contain matrix values run length)

Apply Run-length coding program

```
Dim rlc(,) as integer ={{0,0,0,0,0,0,0,0},
                        {1,1,1,1,0,0,0,0},
                        {0,1,1,0,0,0,0,0},
                        {0,1,1,1,1,1,0,0},
                        {0,1,1,1,0,0,1,0},
                        {0,0,1,0,0,1,1,0},
                        {1,1,1,1,0,1,0,0},
                        {0,0,0,0,0,0,0,0}}
        count_0 = 0 : count_1 = 0
        flag_0 = 0 : flag_1 = 0
        For Me.i = 0 To 7
            For Me.j = 0 To 7
                If j = 0 And rlc(i, 0) <> 0 Then
Me.TextBox1.SelectedText = Str(0) & " ,"
                If rlc(i, j) = 0 Then
                    count_0 = count_0 + 1
                    If rlc(i, j + 1) <> 0 Or j = 7 Then
                      Me.TextBox1.SelectedText = Str(count_0) & " ,"
                      count_0 = 0
                    End If
                End If
                If rlc(i, j) = 1 Then
                    count_1 = count_1 + 1
                    If rlc(i, j + 1) <> 1 Or j = 7 Then
                     Me.TextBox1.SelectedText = Str(count_1) & " ,"
                        count_1 = 0
                    End If
                End If
            Next
            Me.TextBox1.SelectedText = vbNewLine
        Next
```

Run-length coding program

Input (Load an image)

output (text contain pixels run length)

Apply Run-length coding program

```
Dim bin_img As New Bitmap(PictureBox1.Image)
        Dim pixel As New Color, pixel2 As New Color
        count_0 = 0 : count_1 = 0
        For Me.i = 0 To x - 2
            For Me.j = 0 To y - 2
                pixel = bin_img.GetPixel(i, j)
                pixel2 = bin_img.GetPixel(i, j + 1)
                If j = 0 And pixel.R <> 0 Then
Me.TextBox1.SelectedText = Str(0) & " ,"
                If pixel.R = 0 Then
                    count_0 = count_0 + 1
                    If pixel2.R <> 0 Or j = y - 2 Then
                     Me.TextBox1.SelectedText = Str(count_0) & " ,"
                        count_0 = 0
                    End If
                End If
                If pixel.R = 255 Then
                    count_1 = count_1 + 1
                    If pixel2.R <> 255 Or j = y - 2 Then
                    Me.TextBox1.SelectedText = Str(count_1) & " ,"
                        count_1 = 0
                    End If
                End If
            Next
            Me.TextBox1.SelectedText = vbNewLine
        Next
```

Write a complete program to convert decimal numbers to binary

Input (4 ; 5 ; 8 or 10)

output (100;101;1000;1010)

Decimal to Binary program

```
Public Class Form1
    Dim d As Integer
    Dim temp As String
    Private Sub Button1_Click() Handles Button1.Click
        TextBox2.Clear()
        Temp=””
        d = TextBox1.Text
        While d > 0
            temp = Str(d Mod 2) & temp
            d = Int(d / 2)
        End While
        TextBox2.Text = temp
    End Sub
End Class
```

Write a complete program to convert decimal numbers to binary using function

Input (4 ; 5 ; 8 or 10)

output (100;101;1000;1010)

Decimal to Binary program using function

```
Private Sub Button1_Click() Handles Button1.Click
    TextBox2.Clear()
    d = TextBox1.Text
    TextBox2.Text = dtob(d)
End Sub
Public Function dtob(d As Integer) As String
    Dim temp As String = ""
    While d > 0
        temp = Str(d Mod 2) & temp
        d = Int(d / 2)
    End While
    dtob = temp
End Function
```