图 象 处 理

实验指导书

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实验一： 图象显示

一、实验目的：

了解数字图像的存储格式，掌握编写软件在计算机上显示图象的方法

二、实验要求

1、熟悉参考程序。

2、输入图象显示源程序，建立程序调试环境。

3、在计算机屏幕上显示指定的图象。

4、修改程序，在屏幕上显示 128*128 的灰度图象

三、参考程序：

1、主程序模块：

```
Dim i, j
Dim Imagem
Dim AletatorioX, AletatorioY
Dim Pixel&
Dim Red As Integer, Green As Integer, Blue As Integer
Dim p(1 To 9), u(1 To 9), ld(1 To 9), o(1 To 9), w(1 To 9), hh(1 To 9), u1(0 To 255),
u2(0 To 255), u3(0 To 255), v1(-1 To 255), v2(-1 To 255), v3(-1 To 255), w1(-1 To
255), w2(-1 To 255), w3(-1 To 255), t1(-1 To 255), t2(-1 To 255), t3(-1 To 255) As
Integer
Dim a, b, z, k, l, m, hd, h, iii, oo, la, q, s As Integer

Private Sub a1_Click()
Form1.Show
End Sub
```

```
Private Sub a2_Click()
Form3.Show
End Sub

Private Sub b2_Click()
Call loading(i, j)
    For i = 0 To Y - 1
        For j = 0 To X - 1
            Red = 255 - ImageArray(0, i, j)
            Green = 255 - ImageArray(1, i, j)
            Blue = 255 - ImageArray(2, i, j)
            Picture1.PSet (j, i), RGB(Red, Green, Blue)
        Next
    Picture1.Refresh
    Next
End Sub

Private Sub 保存_Click()
On Error GoTo r
CommonDialog1.DefaultExt = ".bmp"
CommonDialog1.Filter = "Bitmap Image (*.bmp)|*.bmp"
CommonDialog1.ShowSave
If CommonDialog1.FileName <> "" Then
    SavePicture Picture1.Image, CommonDialog1.FileName
End If
r: Exit Sub
End Sub

Private Sub 打开_Click()
```

```
Dim fname As String
On Error GoTo bb
CommonDialog1.CancelError = True
CommonDialog1.Filter = "所有文件(*.*)|*.*|图片文件(*.bmp)|*.bmp|图像文件
(*.jpg)|*.jpg"
CommonDialog1.FilterIndex = 1
CommonDialog1.Flags = &H10&
CommonDialog1.ShowOpen
fname = CommonDialog1.FileName
If fname <> "" Then
Picture1.Picture = LoadPicture(fname)
End If
Form1.Caption = "新建文件 1"
a1.Caption = "新建文件 1"
X = Picture1.ScaleWidth
Y = Picture1.ScaleHeight
If X > 1024 Or Y > 1024 Then
    MsgBox "Please, choose a smaller picture"
    X = 0
    Y = 0
    Exit Sub
End If
bb: Exit Sub
End Sub

Private Sub 复制_Click()
Clipboard.Clear
Clipboard.SetData Picture1.Image
End Sub
```

```
Private Sub 关闭_Click()
End
End Sub

Private Sub 恢复原始图像_Click()
Picture1.Picture = LoadPicture(CommonDialog1.FileName)
End Sub

Private Sub 剪切_Click()
Clipboard.Clear
Clipboard.SetData Picture1.Image
Picture1.Picture = LoadPicture("")
End Sub

Private Sub 另存为_Click()
Dim sfile As String
CommonDialog1.CancelError = True
On Error GoTo errhandler
CommonDialog1.Filter = "所有文件(*.*)|*.*|图片文件(*.bmp)|*.bmp|图像文件
(*.jpg)|*.jpg"
CommonDialog1.Flags = &H4&
CommonDialog1.DefaultExt = "jpg"
CommonDialog1.ShowSave
sfile = CommonDialog1.FileName
SavePicture Picture1.Picture, sfile

Exit Sub
errhandler:
Exit Sub
End Sub
```

```
Private Sub 新建_Click()
Form3.Show

Form3.Caption = "新建文件 2"
a2.Caption = "新建文件 2"
End Sub

Private Sub 粘贴_Click()
Picture1.Picture = Clipboard.GetData
End Sub
```

2、图像内存数组模块：

```
Global ImageArray(0 To 2, -4 To 900, -4 To 900) As Integer
Global X, Y As Integer
Global ii(0 To 255, 0 To 255) As Integer

Sub loading(i, j)
Form5.Show
Form5.Refresh
    For i = 0 To Y - 1
        For j = 0 To X - 1
            Pixel& = Form1.Picture1.Point(j, i)
            Red = Pixel& Mod 256
            Green = ((Pixel& And &HFF00) / 256&) Mod 256&
            Blue = (Pixel& And &HFF0000) / 65536
            ImageArray(0, i, j) = Red
            ImageArray(1, i, j) = Green
            ImageArray(2, i, j) = Blue
```

```
        Next
        Form5.ProgressBar1.Value = i * 100 / (Y - 1)
    Next
Form5.Hide
End Sub
```

四、实验图像：

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实验二 图象的增强

（直方图均衡化、线性增强、规定化增强）

一、 实验目的：

掌握在计算机上进行直方图均衡化、线性增强以及规定化增强的方法，理解灰度直方图进行图像增强原理。

二、 实验要求

1、编写直方图均衡化、线性增强及规定化增强的程序及相应的显示程序。

2、对指定图象进行直方图均衡化和线性增强，将原始图象及增强后的图象都显示于屏幕上，比较增强的效果。

3、用图形设置规定的直方图，再进行规定化直方图增强，比较增强的效果。

三、参考程序：

1、直方图均衡化：

```
Private Sub sl_Click()
Call loading(i, j)
    For i = 1 To Y - 1
        For j = 1 To X - 1

            Red = ImageArray(0, i, j)
            Green = ImageArray(1, i, j)
            Blue = ImageArray(2, i, j)

             u1(Red) = u1(Red) + 1
           u2(Green) = u2(Green) + 1
            u3(Blue) = u3(Blue) + 1
            Next j
            Next i

            For s1 = 0 To 255
            v1(s1) = u1(s1) / 262144
            v2(s1) = u2(s1) / 262144
            v3(s1) = u3(s1) / 262144
            Next s1

          For q1 = 0 To 255
          w1(q1) = w1(q1 - 1) + v1(q1)
          w2(q1) = w2(q1 - 1) + v2(q1)
```

```
            w3(q1) = w3(q1 - 1) + v3(q1)
            Next q1

             For d1 = 0 To 255
             t1(d1) = Int(w1(d1) * 255 + 0.5)
             t2(d1) = Int(w2(d1) * 255 + 0.5)
             t3(d1) = Int(w3(d1) * 255 + 0.5)



              Next d1

    For i1 = 1 To X - 1
        For j1 = 1 To Y - 1

             Red = ImageArray(0, i1, j1)
             Green = ImageArray(1, i1, j1)
             Blue = ImageArray(2, i1, j1)

           If t1(Red) > 255 Then t1(Red) = 255
           If t1(Red) < 0 Then t1(Red) = 0
            If t2(Green) > 255 Then t2(Green) = 255
            If t2(Green) < 0 Then t2(Green) = 0
            If t3(Blue) > 255 Then t3(Blue) = 255
            If t3(Blue) < 0 Then t3(Blue) = 0

         Picture1.PSet (j1, i1), RGB(t1(Red), t2(Green), t3(Blue))
       Next
         Picture1.Refresh
    Next
End Sub
```

2、直方图规定化：

```
Private Sub 规定化_Click()
Dim gr(0 To 255), re(0 To 255), t1(-1 To 255), t2(-1 To 255), t3(-1 To 255), p(1
To 255), u(1 To 255), w(1 To 255), c(-1 To 256) As Integer
Dim k1, l1, d1, q0, q1, q2, q3, q4, q5, h1, s1, d11, d12, d13, d14, t As Integer

Dim i11(0 To 255), i22(0 To 255), i33(0 To 255), u1(-2 To 262144), u2(-2 To 262144),
u3(-2 To 262144) As Double
Dim a1(0 To 255), a2(0 To 255), a3(0 To 255), w1(-1 To 255), w2(-1 To 255), w3(-1
To 255), w4(-1 To 256), w5(-1 To 256), w6(-1 To 256) As Double
    Screen.MousePointer = 11
    Call loading(i, j)
```

```
      For i = 0 To x
For j = 0 To y
 r = m(0, i, j)
    g = m(1, i, j)
   b = m(2, i, j)
    u1(r) = u1(r) + 1
    u2(g) = u2(g) + 1
    u3(b) = u3(b) + 1
    Next j
    Next i


For s1 = 0 To 255
    a1(s1) = u1(s1) / all
      a2(s1) = u2(s1) / all
        a3(s1) = u3(s1) / all
     Next s1
     For q1 = 0 To 255
     w1(q1) = w1(q1 - 1) + a1(q1)
     w2(q1) = w2(q1 - 1) + a2(q1)
     w3(q1) = w3(q1 - 1) + a3(q1)
     Next q1

     q2 = InputBox("输入一个真方图值(共三个,和小于 1):")     '给 q2 用对话框赋值
     q2 = Val(q2)
     q3 = InputBox("输入一个真方图值(共三个,和小于 1):")
      q3 = Val(q3)
     q4 = InputBox("输入一个真方图值(共三个,和小于 1):")
      q4 = Val(q4)
     For q0 = 0 To 255
   w4(1) = q2
   w4(2) = q3
   w4(3) = q4          '给不同灰度级赋值
   w5(1) = q2
   w5(2) = q3
   w5(3) = q4
   w6(1) = q2
   w6(2) = q3
   w6(3) = q4
   Next q0
     For q5 = 0 To 255            '累计规定化直方图
     w4(q5) = w4(q5 - 1) + a1(q5)
     w5(q5) = w5(q5 - 1) + a2(q5)
     w6(q5) = w6(q5 - 1) + a3(q5)
```

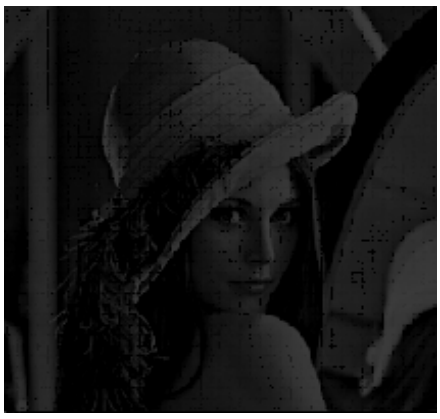
```
  Next q5

For d1 = 0 To 255                                   'SML 映射
c(d1 - 1) = 1
 For d11 = d1 To 255
 c(d11) = Abs(w1(d1) - w4(d11))
 If c(d11) > c(d11 - 1) Then

 c(d11) = c(d11 - 1)
 Else
 t = d11
 End If
 Next d11
 t1(d1) = t
 t2(d1) = t
 t3(d1) = t
 Next d1



    For i1 = 0 To Picture1.ScaleWidth

    For j1 = 0 To Picture1.ScaleHeight
    r = m(0, i1, j1)
    g = m(1, i1, j1)
    b = m(2, i1, j1)
 If t1(r) > 255 Then t1(r) = 255
    If t1(r) < 0 Then t1(r) = 0
    If t2(g) > 255 Then t2(g) = 255
    If t2(g) < 0 Then t2(g) = 0
    If t3(b) > 255 Then t3(b) = 255
    If t3(b) < 0 Then t3(b) = 0
        Form1.Picture2.PSet (i1, j1), RGB(t1(r), t2(g), t3(b))


        DoEvents
    Next j1
    Next i1
    Screen.MousePointer = 0
End Sub
```

3、线性增强

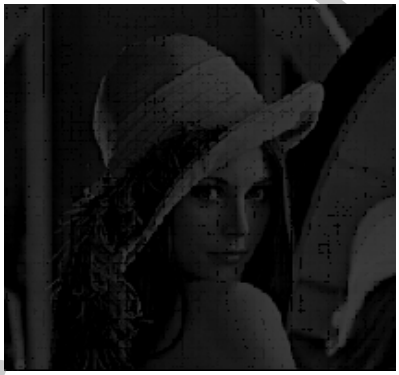
```
Private Sub 线性增强_Click()
Form2.Show
Form2.Text1.Text = 0
```

```
Form2.Text2.Text = 0
Form2.Text3.Text = 0
Form2.Text4.Text = 0
Form2.Picture1.Refresh
Form2.Picture1.Line (0, 255)-(90, 200)
Form2.Picture1.Line (90, 200)-(190, 50)
Form2.Picture1.Line (190, 50)-(255, 0)
Form2.Text1.Text = ""
Form2.Text2.Text = ""
Form2.Text3.Text = ""
Form2.Text4.Text = ""
Form2.Label14 = "(X2,Y2)"
Form2.Label13 = "(X1,Y1)"
End Sub
```

四、实验图像：



直方图均衡化前后对比



直方图规定化前后对比

线性增强前后对比

实验三：图象的增强（平滑、中值滤波）

一、 实验目的：

掌握在计算机上进行图象平滑、中值滤波平滑的方法，学会去除图像中的噪声。

二、 实验要求

1、编写 4 点平滑、8 点平滑、中值滤波的相应程序。

2、对指定图象进行 4 点平滑、8 点平滑、中值滤波增强，将原始图象及增强后的图象都显示于屏幕上，比较增强的效果。

三、参考程序：

1、4 点平滑：

```
Private Sub 四点平滑_Click()
Call loading(i, j)
    For i = 1 To Y - 2
        For j = 1 To X - 2
            Red = ImageArray(0, i + 1, j) + ImageArray(0, i - 1, j) + _
            ImageArray(0, i, j + 1) + ImageArray(0, i, j - 1)

            Green = ImageArray(1, i + 1, j) + ImageArray(1, i - 1, j) + _
            ImageArray(1, i, j + 1) + ImageArray(1, i, j - 1)

            Blue = ImageArray(2, i + 1, j) + ImageArray(2, i - 1, j) + _
            ImageArray(2, i, j + 1) + ImageArray(2, i, j - 1)

          Picture1.PSet (j, i), RGB(Red / 4, Green / 4, Blue / 4)
        Next
Picture1.Refresh
    Next
```

```
End Sub
```

2、8点平滑：

```
Private Sub 八点平滑_Click()
Call loading(i, j)
    For i = 1 To Y - 2
        For j = 1 To X - 2
            Red = ImageArray(0, i - 1, j - 1) + ImageArray(0, i - 1, j) + ImageArray(0,
i - 1, j + 1) + _
            ImageArray(0, i, j - 1) + ImageArray(0, i, j + 1) + _
            ImageArray(0, i + 1, j - 1) + ImageArray(0, i + 1, j) + ImageArray(0,
i + 1, j + 1)



            Green = ImageArray(1, i - 1, j - 1) + ImageArray(1, i - 1, j) +
ImageArray(1, i - 1, j + 1) + _
            ImageArray(1, i, j - 1) + ImageArray(1, i, j + 1) + _
            ImageArray(1, i + 1, j - 1) + ImageArray(1, i + 1, j) + ImageArray(1,
i + 1, j + 1)

            Blue = ImageArray(2, i - 1, j - 1) + ImageArray(2, i - 1, j) + ImageArray(2,
i - 1, j + 1) + _
            ImageArray(2, i, j - 1) + ImageArray(2, i, j + 1) + _
            ImageArray(2, i + 1, j - 1) + ImageArray(2, i + 1, j) + ImageArray(2,
i + 1, j + 1)

            Picture1.PSet (j, i), RGB(Red / 8, Green / 8, Blue / 8)
        Next
    Picture1.Refresh
    Next
End Sub
```

3、中值滤波增强

```
Private Sub 中值_Click()
Call loading(i, j)
    For i = 1 To Y - 2
        For j = 1 To X - 2
            p(1) = ImageArray(0, i - 1, j - 1)
            p(2) = ImageArray(0, i - 1, j)
            p(3) = ImageArray(0, i - 1, j + 1)
            p(4) = ImageArray(0, i, j - 1)
            p(5) = ImageArray(0, i, j + 1)
            p(6) = ImageArray(0, i + 1, j - 1)
            p(7) = ImageArray(0, i + 1, j)
            p(8) = ImageArray(0, i + 1, j + 1)
```

```
 p(9) = ImageArray(0, i, j)

 u(1) = ImageArray(1, i - 1, j - 1)
 u(2) = ImageArray(1, i - 1, j)
 u(3) = ImageArray(1, i - 1, j + 1)
 u(4) = ImageArray(1, i, j - 1)
 u(5) = ImageArray(1, i, j + 1)
 u(6) = ImageArray(1, i + 1, j - 1)
 u(7) = ImageArray(1, i + 1, j)
 u(8) = ImageArray(1, i + 1, j + 1)
 u(9) = ImageArray(1, i, j)

 w(1) = ImageArray(2, i - 1, j - 1)
 w(2) = ImageArray(2, i - 1, j)
 w(3) = ImageArray(2, i - 1, j + 1)
 w(4) = ImageArray(2, i, j - 1)
 w(5) = ImageArray(2, i, j + 1)
 w(6) = ImageArray(2, i + 1, j - 1)
 w(7) = ImageArray(2, i + 1, j)
 w(8) = ImageArray(2, i + 1, j + 1)
 w(9) = ImageArray(2, i, j)

 For s = 1 To 9
 For q = 1 To 9 - s
If p(q) > p(q + 1) Then
t = p(q)
p(q) = p(q + 1)
p(q + 1) = t
End If
Next q
Next s
Red = p(5)

For a = 1 To 9
 For b = 1 To 9 - a
If u(b) > u(b + 1) Then
t = u(b)
u(b) = u(b + 1)
u(b + 1) = t
End If
Next b
Next a
Green = u(5)
```

```
        For oo = 1 To 9
             For z = 1 To 9 - oo
            If w(z) > w(z + 1) Then
            t = w(z)
            w(z) = w(z + 1)
            w(z + 1) = t
             End If
            Next z
            Next oo
           Blue = w(5)

          Picture1.PSet (j, i), RGB(Red, Green, Blue)
          Next j
       Picture1.Refresh
       Next i
End Sub
```

四、实验图像：


4 点平滑前后对比


8 点平滑前后对比


中值平滑前后对比

实验四：图象的增强（锐化、拉普拉斯算子）

一、 实验目的：

掌握在计算机上进行图象锐化、拉普拉斯算子锐化的方法，理解图象锐化原理。

二、 实验要求

1、编写简单锐化（ROBERT 算子）及拉普拉斯算子锐化的程序以及相应的显示程序。

2、对指定图象进行简单锐化和拉普拉斯算子增强，将原始图象及增强后的图象都显示于屏幕上，比较增强的效果。

三、参考程序：

1、简单锐化：

```
Private Sub Command1_Click()
Call loading(i, j)
    For i = 1 To Y - 2
        For j = 1 To X - 2
        p(1) = Abs(ImageArray(0, i, j) - ImageArray(0, i + 1, j - 1))
        p(2) = Abs(ImageArray(0, i, j - 1) - ImageArray(0, i + 1, j))
        p(3) = Abs(ImageArray(0, i, j) - ImageArray(0, i + 1, j + 1))
        p(4) = Abs(ImageArray(0, i, j + 1) - ImageArray(0, i + 1, j))
        p(5) = Abs(ImageArray(0, i, j) - ImageArray(0, i - 1, j + 1))
        p(6) = Abs(ImageArray(0, i - 1, j) - ImageArray(0, i, j + 1))
        p(7) = Abs(ImageArray(0, i - 1, j - 1) - ImageArray(0, i, j))
        p(8) = Abs(ImageArray(0, i - 1, j) - ImageArray(0, i, j - 1))

        u(1) = Abs(ImageArray(1, i, j) - ImageArray(1, i + 1, j - 1))
        u(2) = Abs(ImageArray(1, i, j - 1) - ImageArray(1, i + 1, j))
        u(3) = Abs(ImageArray(1, i, j) - ImageArray(1, i + 1, j + 1))
        u(4) = Abs(ImageArray(1, i, j + 1) - ImageArray(1, i + 1, j))
        u(5) = Abs(ImageArray(1, i, j) - ImageArray(1, i - 1, j + 1))
```

```
u(6) = Abs(ImageArray(1, i - 1, j) - ImageArray(1, i, j + 1))
u(7) = Abs(ImageArray(1, i - 1, j - 1) - ImageArray(1, i, j))
u(8) = Abs(ImageArray(1, i - 1, j) - ImageArray(1, i, j - 1))

w(1) = Abs(ImageArray(2, i, j) - ImageArray(2, i + 1, j - 1))
w(2) = Abs(ImageArray(2, i, j - 1) - ImageArray(2, i + 1, j))
w(3) = Abs(ImageArray(2, i, j) - ImageArray(2, i + 1, j + 1))
w(4) = Abs(ImageArray(2, i, j + 1) - ImageArray(2, i + 1, j))
w(5) = Abs(ImageArray(2, i, j) - ImageArray(2, i - 1, j + 1))
w(6) = Abs(ImageArray(2, i - 1, j) - ImageArray(2, i, j + 1))
w(7) = Abs(ImageArray(2, i - 1, j - 1) - ImageArray(2, i, j))
w(8) = Abs(ImageArray(2, i - 1, j) - ImageArray(2, i, j - 1))

    For k = 1 To 7
     If p(k) > p(k + 1) Then
     p(k + 1) = p(k)
     End If
     Next k
Red = (a1 - 1) * ImageArray(0, i, j) + p(8)
  For b = 1 To 7
   If u(b) > u(b + 1) Then
  u(b + 1) = u(b)
  End If
   Next b
  Green = (a1 - 1) * ImageArray(1, i, j) + u(8)
 For z = 1 To 7
   If w(z) > w(z + 1) Then
  w(z + 1) = w(z)
   End If
   Next z
```

```
            Blue = (a1 - 1) * ImageArray(2, i, j) + w(8)


         Form66.Picture1.PSet (j, i), RGB(Red, Green, Blue)
          Next j
        Form66.Picture1.Refresh
        Next i
End Sub
```

2、拉普拉斯算子锐化：

```
Private Sub 拉普拉斯算子锐化_Click()
Call loading(i, j)
    For i = 1 To Y - 2
        For j = 1 To X - 2
            Red = 2.05 * ImageArray(0, i, j) - (ImageArray(0, i - 1, j) + ImageArray(0,
i - 1, j - 1) + _
            ImageArray(0, i, j - 1) + ImageArray(0, i + 1, j - 1) + ImageArray(0,
i + 1, j) + ImageArray(0, i + 1, j + 1) + _
           ImageArray(0, i, Y + 1) + ImageArray(0, i - 1, j + 1)) / 8

            Green = 2.05 * ImageArray(1, i, j) - (ImageArray(1, i - 1, j) +
ImageArray(1, i - 1, j - 1) + _
            ImageArray(1, i, j - 1) + ImageArray(1, i + 1, j - 1) + ImageArray(1,
i + 1, j) + ImageArray(1, i + 1, j + 1) + _
           ImageArray(1, i, Y + 1) + ImageArray(1, i - 1, j + 1)) / 8

            Blue = 2.05 * ImageArray(2, i, j) - (ImageArray(2, i - 1, j) +
ImageArray(2, i - 1, j - 1) + _
            ImageArray(2, i, j - 1) + ImageArray(2, i + 1, j - 1) + ImageArray(2,
i + 1, j) + ImageArray(2, i + 1, j + 1) + _
           ImageArray(2, i, Y + 1) + ImageArray(2, i - 1, j + 1)) / 8
If Red > 255 Then Red = 255
            If Red < 0 Then Red = 0
            If Green > 255 Then Green = 255
            If Green < 0 Then Green = 0
            If Blue > 255 Then Blue = 255
            If Blue < 0 Then Blue = 0
            Picture1.PSet (j, i), RGB(Red, Green, Blue)
        Next
Picture1.Refresh
    Next
End Sub
```

四、实验图像：

简单锐化前后对比

拉普拉斯算子锐化前后对比