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using Algorithm Level Encoging (ALE) For Edge Detection and Enhancement In The Images

A Project
Submitted to the Department of Computer Science, College of science, University of Baghdad in a Partial Fulfillment of the Requirements for the Degree of B. Sc. in Computer Science

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الاهداء

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القلوب التي رافقتني ليالي السهر

والعيون التي تفيض دموعها فرحا لسعادتي

امي وابي

الى

من احببتهم دوما

اخوتي واصدقائي

الى

كل من علمني حرفا وانار امامي طريق العلم

استاذتي الفاضله

اهدي ثمره جهدي حبا ووفاءا لكم

بسم الله الرحمن الرحيم

”وما اوتيم من العلم الا قليلاً "

صدق الله العلي العظيم

Tabel of content

Abstract

Edge in an image can be detected by analyzing sharp patterns in the pixel values. But the difficulty lies in detecting these patterns in the image. Any pixel by pixel method of detecting them will be cumbersome . The ALE is found to be useful in this regard. We partition the image matrix into sub-matrices and subsequently compute their Checksum Rows and Columns . The ALE algorithm can be made use of effectively for image enhancement purposes too First, the edge are detected ,using the ALE as explained . This can be done in a non-uniform manner . Subsequently, the boundary pixels so obtained can be analyzed and separated from the relatively unimportant aspects of the image . since, the encoding is selectively done depending upon the criticality of the bootstrapped image , the decoded image can be claimed to be noise free. This is followed by a stage that can distinctively separate out the image edges and can aid in image segmentation.

Chapter One

Chapter One

1.1 Image Processing:

Image processing is computer imaging where the application involves a human being in time visual loop in other words, the images are to be examined and acted upon by people. For these types of application we require seine understanding of how the human visual system opera
The major topics within the field of image processing include image restoration, image enhancement, and image compression. image analysis is often used as preliminary work in the development of image processing algorithms, but the primary distinction between computer vision and image processing is that the output image is to be used a human being. Image restoration is the process of taking an image with some known, or estimated, degradation, and restoring it to its original appearance. Image restoration is often used in the field of photography or publishing where an image was somehow degraded but needs to be improved before it can be printed for this type of application , we need to know something about the degradation process in order to develop a model for the distortion When we have a model for the degradation process.

This type of image restoration is often used in space exploration—for example, to eliminate artifacts generated by mechanical filter in a spacecraft or to compensate for distortion in the optical system of a telescope. image enhancement involve taking an image and improving it visually, typically by taking advantage of the human visual system's response. One of the simplest and often most dramatic enhancement techniques is to simply stretch the contrast of an image. Enhancement methods tend to be problemspecific.

For example, a method that is used to enhance satellite image may not be suitable for enhancing medical images. Although enhancement and restoration are similar in aim, to make an image look better, they differ in how they approach the problem. bvcfdlkjuhyg dfs-o098ihgy7tf6d54ra3eQ2 `Restoration methods attempt to model the distortion to the image and reverse this degradation, whereas enhancement methods use knowledge of the human visual system's response to improve an image visually[1].

1-2 Image Enhancement

the aim of image enhancement is to improve the interpretablitiy or perception of information in images for human viewers,or to provide 'better' input for other automated image processing techniques.

image enhancement techniques can be divided into two board categories:

1.spatial domain methods, which operate directly on pixels.

2. frequncy domain methods,which operate on the fourier transform of an image.

unfortunately, there is no general theory for determining ehat is 'good' image enhancement when it comes to human perception.if it looks good ,it is good!

however , whenimage enhancement techniques are used as pre-processing tools for other image processing techniques, then quantative measures can determine which techniques are most approptiate[3].

Chapter Two

Chapter Two

Edge Detection

What is edge detection? What are the techniques of it?

-*1*Sobel operator
-2Level Encoding
-2Roberts operator
-3Prewitt operator
-4Laplacian operator
-5Frel-chen masks

The edges of an image hold much information in that image. The edge tells where object are, their shape and size,,and something about their texture. An edge is where the intensity of an image moves from a low value to a high value or vice versa.

There are numerous applications for edge detection, which is often used for various special effects. Digital artists use it to create dazzling image outlines.

The output of an edge detector can be added back to an original image to enhance the edges. Edge detection is often the first step in image segmentation. Image segmentation, a field of image analysis, is used to group pixels into regions to determine an image's composition.

Edge detection is also used in image registration. Image registration aligns two images that may have been acquired at separate times or from different sensors. There are infinite number of edge orientations, width and shapes. Some edges are straight while others are curved with varying radii. There are many edge detection techniques to go with all these edges, each having its own strengths. Some edge detectors may work well in one application and perform poorly in others. Sometimes it takes experimentation to determine what is the best edge detection technique for an application.

Chapter Two

2-1 Sobel edge detection (Sobel operator)

The sobel edge detection masks look for edge in both the horizontal and vertical directions and then combine this information into a single metric. The masks are as follows:

ROW MASK	COLUMN MASK
-1 -2 -1	-1 0 1
0 0 0	- 2 0 2
1 2 1	- 2 0 1

These masks are each convolved with the image. At each pixel location we now have two numbers: s_1, corresponding to the result from the row mask, and s_2, from the column mask, we use these numbers to compute two metrics, the edge magnitude and the edge direction[2]. Which are defined as follows:

Edge magnitude sqrt (sqr s_1 - sqr s_2). Edge direction tan $(s_1 / s_2$.

2- 2 Using Algorithm Level Encoding for Edge Detection

Edges in an image can be detected by analyzing sharp patterns in the pixel values. But the difficulty lies in detect-ing these patterns in the image. Any pixel by pixel method of detecting them will be cumbersome. The ALE is found to be useful in this regard. We partition the image matrix into submatrices and subsequently compute their Check-sum Rows and Columns.

1 2
3 4

After ALE

1 2 3

3 4 7

4 6 X

In the provided example, the third row and third column represent the checksum row and checksum column respec-tively.
The ALE can applied to a block of pixel values by window-ing it across the image. The checksums of this window and that of the corresponding image blocks are compared and any sudden increase or decrease in the pixel values indicate the presence of an edge. The windowing can be skipped if it is found that the checksum values do not show an appreciable change, when performed on a couple of blocks. The ALE algorithm can be made use of effectively for image enhancement purposes too. First, the edges are detected, using the ALE as explained. This can be done in a non-uniformmanner. Subsequently, the boundary pixels so obtained can be analyzed and separated from the rel tively unimportant aspects of the image. Since, the encoding is selectively done depending upon the criticality of the bootstrapped image, the decoded image can be claimed to be noise free. This is followed by a stage that can distinctively separate out the image edges and can aid in image segmentation.

The edge detection operation can be viewed as inherent preprocessing technique of the image analysis system. This method will prove to be vital for the unification process of the image processing techniques[4].

Chapter Three

“using Algorithm Level Encoding”

```
Private Sub ALE1_Click()

 wid = Picture1.ScaleWidth

  hgt = Picture1.ScaleHeight


Threshold = Val(Text1.Text)

  ReDim img(wid, hgt)

 For i = 0 To wid - 1
  For j = 0 To hgt - 1
    img(i, j) = Picture1.Point(i, j) Mod 256

  Next
 Next
 For i = 1 To 1: For j = 1 To 1

 di = img(i, j) + img(i, (j + 1))
  di1 = img((i + 1), j) + img((i + 1), (j + 1))

   dj = img(i, j) + img((i + 1), j)
 dj1 = img(i, (j + 1)) + img(i + 1, j + 1)

  X1 = Abs((di + di1) + (dj + dj1))
   Next
   Next
   For i = 0 To wid - 1

 For j = 0 To hgt - 1

  di = img(i, j) + img(i, (j + 1))
  di1 = img((i + 1), j) + img((i + 1), (j + 1))



 dj = img(i, j) + img((i + 1), j)
 dj1 = img(i, (j + 1)) + img(i + 1, j + 1)



  X2 = Abs((di + di1) + (dji + dj1))

  s = Abs(X1 - X2)
  If (s) > Threshold Then gr = 1 Else gr = 0

   If gr = 1 Then
  x = Int(Rnd * 60000000)
  Picture2.PSet (i, j), RGB(gr * 255, gr * 255, gr * 255)
  Picture3.PSet (i, j), img(i, j)
  Picture4.PSet (i, j), (img(i, j)) * 256
  Picture5.PSet (i, j), (img(i, j)) * 65536
  k = Picture1.Point(i, j) + Picture2.Point(i, j)
  Picture6.PSet (i, j), k
```

```
  Picture7.PSet (i, j), Picture2.Point(i, j)
  Picture8.PSet (i, j), RGB(gr * 255, gr * 255, gr * 255)
  Picture9.PSet (i, j), x
  End If

   If gr = 0 Then
   x = Int(Rnd * 60000000)
   Picture2.PSet (i, j), vbBlack
   Picture3.PSet (i, j), vbBlack
   Picture4.PSet (i, j), vbBlack
   Picture5.PSet (i, j), vbBlack
   Picture6.PSet (i, j), vbBlack
   Picture7.PSet (i, j), Picture1.Point(i, j)
   Picture8.PSet (i, j), x
   Picture9.PSet (i, j), vbBlack

   End If

X1 = X2

Next: Next


End Sub
```

“using Edge Detection of Sobel”

```
Private Sub sobel_Click()

  wid = Picture1.ScaleWidth
  hgt = Picture1.ScaleHeight

Threshold = Val(Text1.Text)

  ReDim img(wid, hgt), imgE(wid, hgt), f(wid, hgt)

 For i = 0 To wid - 1
  For j = 0 To hgt - 1
    img(i, j) = Picture1.Point(i, j) Mod 256

  Next
 Next

For i = 2 To wid - 1: For j = 2 To hgt - 1
 men = (img(i - 1, j - 1) + img(i + 1, j - 1) + img(i - 1, j + 1) + img(i + 1, j + 1) + img(i, j + 1) + img(i, j - 1) + img(i + 1, j) + img(i - 1, j)) / 8
  di = -img(i - 1, j - 1) - 2 * img(i + 1, j - 1) + img(i - 1, j + 1) + img(i + 1, j + 1) + 2 * (img(i, j + 1) - img(i, j - 1))
 dj = -img(i - 1, j - 1) + 2 * img(i + 1, j - 1) - img(i - 1, j + 1) + img(i + 1, j + 1) + 2 * (img(i + 1, j) - img(i - 1, j))

  gr = Sqr(di * di + dj * dj)
  If Abs(gr - men) > Threshold Then gr = 1 Else gr = 0
  f(i, j) = gr
  If gr = 1 Then

  Picture2.PSet (i, j), RGB(gr * 255, gr * 255, gr * 255)
  Picture3.PSet (i, j), Picture2.Point(i, j)

  End If

   If gr = 0 Then
    Picture2.PSet (i, j), vbBlack
   Picture3.PSet (i, j), Picture1.Point(i, j)


   End If
Next
DoEvents
Next

End Sub
```

Chapter Four

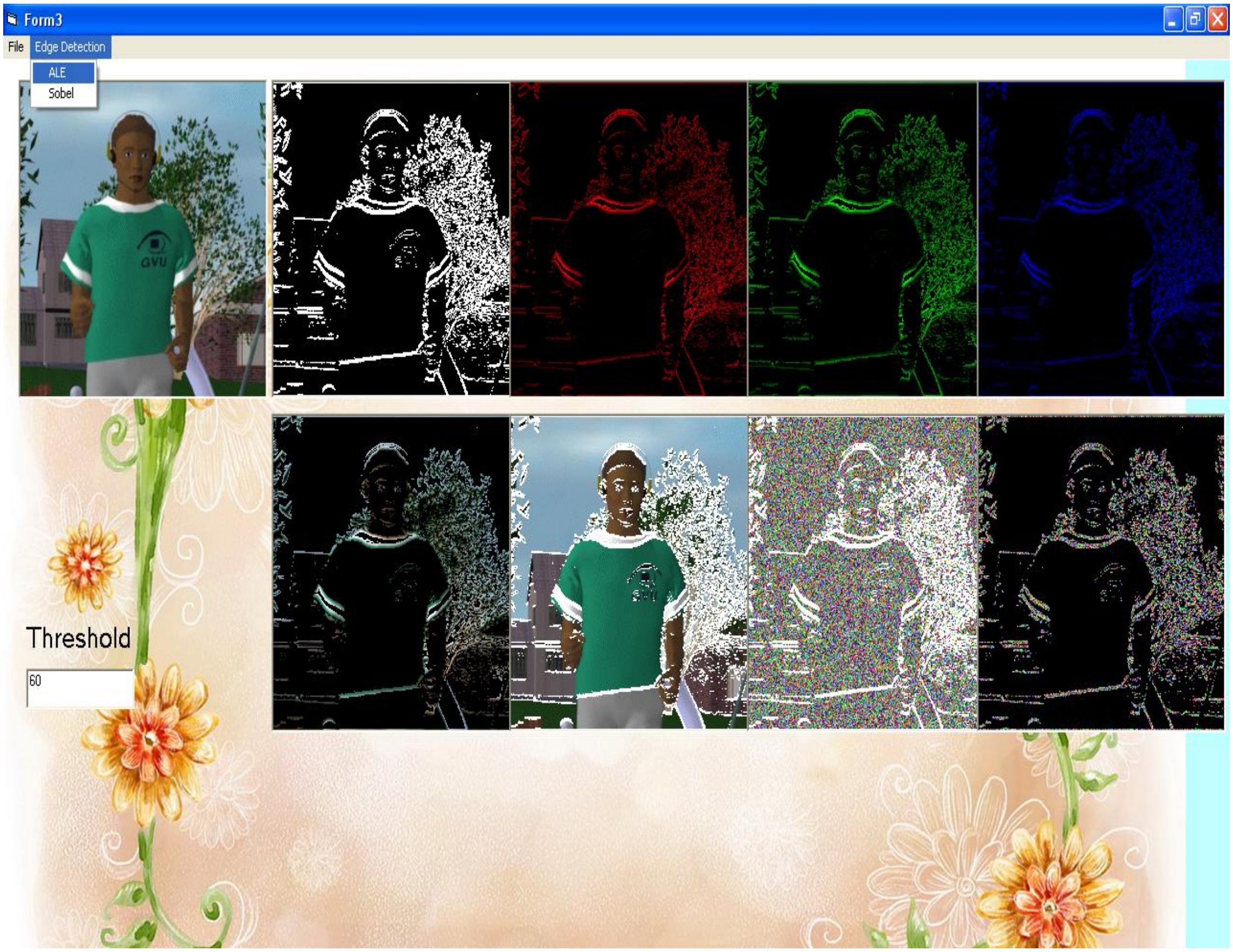
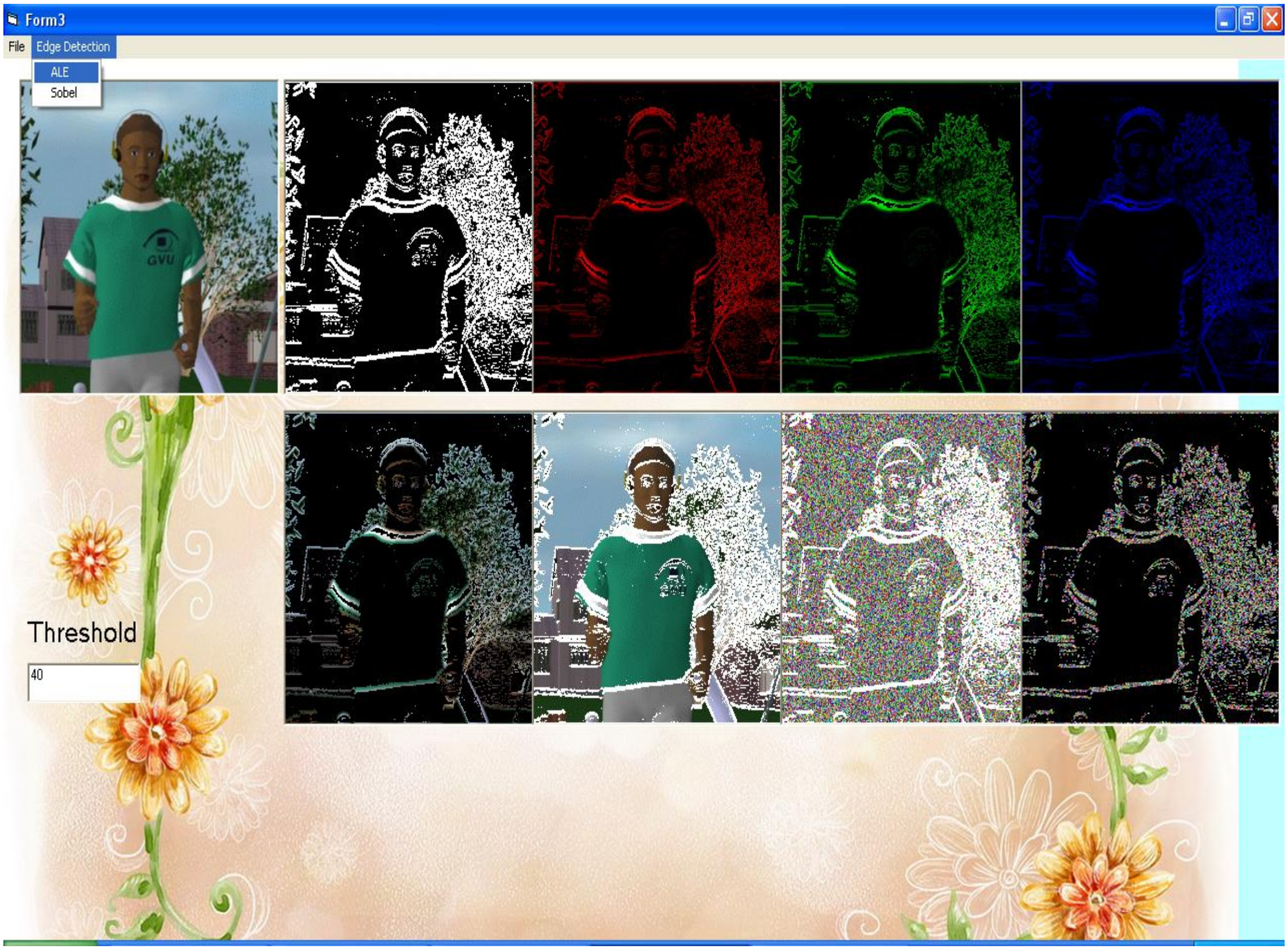


figure (1)   Edge Detection using ALE

with threshold =60



Threshold: 40

figure (2)   Edge Detection using ALE

with Thresold =40

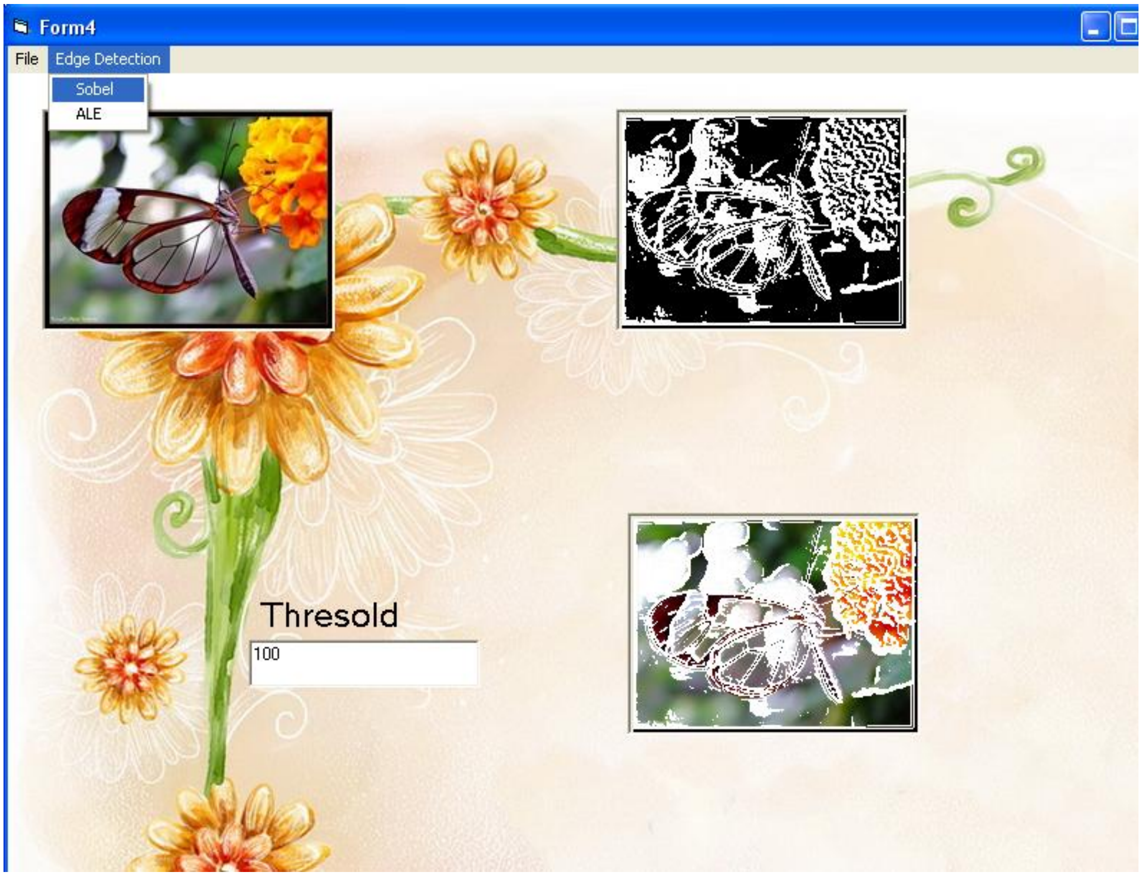


figure (3) Edge Detection using sobel

with Thresold =100

References

[1] Galbiati,L.J.,Machine Vision and Digital Image Processing Practice Hall 1990.

[2] Gonzalese,R.C.,and Woods,R.F.,Digital Image Processing, 1998.

[3] Jain, A.K.,"Fundamental of Digital Image Processing'Trantice Hall 1989.

[4] www.ece.rutgers.edu