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Edge Detection for a Live Video Image

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Abstract: **Edge detection is a pre-processing step towards high-level image analysis. A way for improving the accuracy and quality of edge detection of noisy contaminated image is to preserve edge details while removing noise. In this paper Prewitt edge detection technique for a live video image is analyzed. To reduce the influence of noise when detecting edge, the Prewitt operator enlarges edge detection operator template from two by two to three by three to compute difference operator. Using the Prewitt operator can not only detect edge points, but also restrain the noise. The MATLAB/SIMULINK is used to produce model for edge detection technique.**

Keyword: **Types of edge, Edge detection techniques. Prewitt operator**

1. INTRODUCTION

Image processing is a vital cost-effective technology in many fields today including astronomy, medicine, crime, remote sensing, manufacturing, entertainment and multimedia. [1] Image segmentation continues to be important and active research in image analysis. In order to analyze complicated image signals, engineers and mathematicians have been searching for a simple yet well understood representation. [2]

To prepare the picture for a circle fit algorithm, there are number of steps which we have first to take. The first is edge detection. An edge in a digital image is a boundary or contour at which a significant change occurs in some physical aspect of an image, such as the surface reflectance, illumination or the distances of the visible surfaces from the viewer. Changes in physical aspects manifest themselves in a variety of ways, including changes in colour, intensity and Texture. Edge always indwells in two neighbouring areas having different grey level. It is the result of grey level being discontinuous. [3]

Edge detection is a kind of method of image segmentation based on range non-continuity. Image edge detection is one of the basal contents in the image processing and analysis, and also is a kind of issues which are unable to be resolved completely so far. When image is acquired, the factors such as the projection, mix, aberrance and noise are produced. These factors bring on image feature is blur and distortion, consequently it is very difficult to extract image feature. Moreover, due to such factors it is also difficult to detect edge. The method of image edge and
outline characteristic's detection and extraction has been research hot in the domain of image processing and analysis technique. Detecting edges is very useful in a number of Contexts. Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of objects in a scene. Classical methods of edge detection involve convolving the image with an operator, which is constructed to be sensitive to large gradients in the image while returning values of zero in uniform regions. There are an extremely large number of edge detection operators available, each designed to be sensitive to certain types of edges. Edge detection is the process of finding sharp contrasts in intensities in an image. This process significantly reduces the amount of data in the image, while preserving the most important structural features of that image. [4]

Classical methods of edge detection involve convolving the image with an operator (a 2-D filter), which is constructed to be sensitive to large gradients in the image while returning values of zero in uniform regions. There are an extremely large number of edge detection operators available, each designed to be sensitive to certain types of edges. [5]

The filters are used in the process of identifying the image by locating the sharp edges which are discontinuous. These discontinuities bring changes in pixels intensities which define the boundaries of the object. The object is shark fish and a new methodology is applied to identify the shark type using its morphological features. [6]

There are number of different edge detection algorithms in MATLAB. Before you can apply an edge detection algorithm to a picture, the picture must be converted into a binary image, otherwise known as an intensity image. MATLAB's edge detection function takes a binary image 1 as its input, and returns a binary image BW of the same size as I, with 1's where the function finds edges in I and 0's elsewhere.

2. EDGE FINDING METHODS

Edge Detection Techniques are classified as follows: the primary order by-product of selection in image process is that the gradient. The second order derivatives of selection in image process are typically computed exploitation Laplacian.

The **Sobel method** finds edges using the Sobel approximation to the derivative.

The **Prewitt method** finds edges using the Prewitt approximation to the derivative.

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The **Roberts method** finds edges using the Roberts approximation to the derivative. It returns edges at those points where the gradient of I is maximum.

The **Laplacian of Gaussian method** finds edges by looking for zero crossings after filtering 1 with a Laplacian of Gaussian filter.

The **zero-cross method** finds edges by looking for zero crossings after filtering 1 with a filter you specify.

The **Canny method** finds edges by looking for local maxima of the gradient of 1. The gradient is calculated using the derivative of a Gaussian filter. The method uses two thresholds, to detect strong and weak edges, and includes the weak edges in the output only if they are connected to strong edges. This method is therefore less likely than the others to be "fooled" by noise, and more likely to detect true weak edges.

In my paper I have used Prewitt method. To reduce the influence of noise when detecting edge, the Prewitt operator enlarges edge detection operator template from two by two to three by three to compute difference operator. Using the Prewitt operator can not only detect edge points, but also restrain the noise.

The primary advantages of the classical operator are simplicity. The Roberts cross operator provides a simple approximation to the gradient magnitude. The second advantages of the classical operator are detecting edges and their orientations. In this cross operator, the detection of edges and their orientations is said to be simple due to the approximation of the gradient magnitude. The disadvantages of these cross operator are sensitivity to the noise, in the detection of the edges and their orientations. The increase in the noise to the image will eventually degrade the magnitude of the edges. The major disadvantage is the inaccuracy, as the gradient magnitude of the edges decreases. Most probably the accuracy also decreases.

Variables concerned within the choice of a footing detection operator include:

Edge orientation: The pure mathematics of the operator determines a characteristic direction during which it's most sensitive to edges. Operators are optimized to seem for horizontal, vertical, or diagonal edges.

Noise environment: Edge detection is troublesome in screeching pictures, since each the noise and therefore the edges contain high-frequency content tries to cut back the noise lead to blurred and distorted edges. Operators used on screeching pictures area unit usually larger in scope, in order that they will average enough information to discount localized screeching pixels. This leads to less correct localization of the detected edges.

Edge structure: Not all edges involve a step amendment in intensity. Effects like refraction or poor focus may end up in objects with boundaries outlined by a gradual amendment in intensity. The operator has to be chosen to be alert to such a gradual amendment in those cases. Newer wavelet-based techniques really characterize the character of the transition for every draw near order to tell apart, for instance, edges related to hair from edges related to a face.

3. BLOCK DIAGRAM & ITS EXPLANATION

The figure 1 shows the block diagram of the complete system. The block diagram of the system consists of input block, edge detector, compositing, original image block, overlay block and edges.

The input video is acquired live from camera image. In this, the block acquires intensity data from the camera and outputs it at every simulation time step.

This finds the edges of objects in the video input. The higher you make the threshold, the smaller the amount of edges.

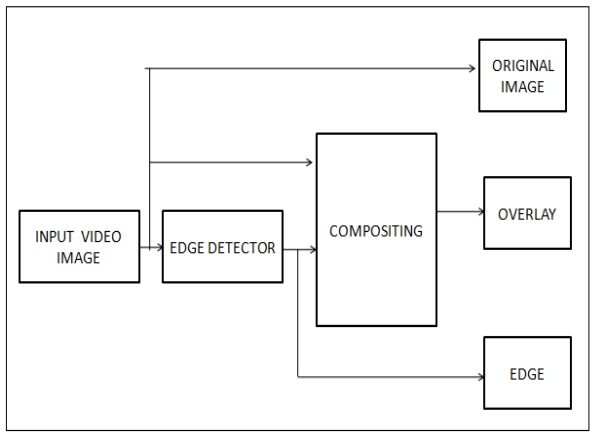

Fig 1: Block diagram of the complete system

The Prewitt method is applied to find the edges of objects in the input video. Suppose that the pixel number in the 3×3 sub-domain of image is as follows:

A0 A1 A2
A7 $f(x, y)$ A3
A6 A5 A4

We order that

$$X = (A0+2A1 +A2) - (A6+2A5+A4)$$

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And Y = (A0+2A7 +A6) - (A2+2A3+A4)

Then Prewitt operator is as follows:

$$G[f(i,j)] = (\sqrt{X^2 + Y^2})$$

$$G[f(i,j)] = |X| + |Y|$$

Prewitt operator is said in figure 2 in the form of the template.

1	-1	1
1	-1	0
1	-1	-1

1	1	1
0	0	0
-1	-1	-1

Fig 2: Prewitt operator

4. SIMULATION AND ITS RESULTS

In order to know about the advantages and disadvantages of edge detection using operators, we detect edge using prewitt operators. The simulation model and its corresponding results are shown in figures below.

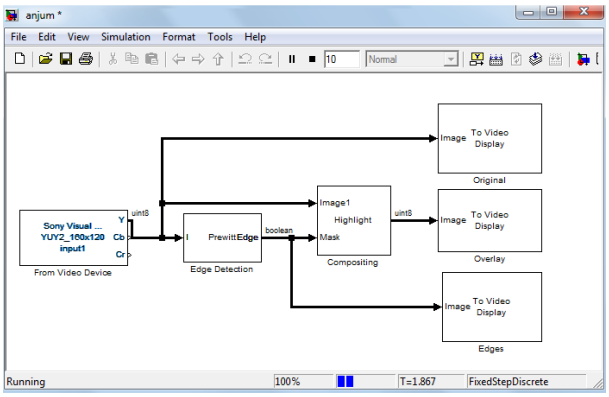

Fig 3: Simulation model

Fig 4: Original image

Fig 5: Gray scale image

Fig 6: Edges

Fig 7: Overlay

5. CONCLUSION

Edge detection forms a pre-processing stage to remove the redundant information from the input image, thus dramatically reducing the amount of data to be processed while at the same time preserving useful information about the boundaries. These edge detection operators can have better edge effect under the circumstances of obvious edge and low noise. But the actual collected image has lots of noises. So many noises may be considered as edge to be detected. Here we are dealing with the edge detection technique in modelling type by using the Matlab/Simulink. We are concentrating only how the edge detection technique works. This technique of detecting the edge gives good

result. Yet its effect will be better if those simulation images processed above are again processed through edge thinning and tracking. Although there are various edge detection methods in the domain of image edge detection, certain disadvantages always exist. For example, restraining noise and keeping detail can□t achieve optimal effect simultaneously. Hence we will acquire satisfactory result if choosing suitable edge detection operator according to specific situation in practice.

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