

## Edge Detection Technique by Fuzzy Logic CLA and Canny Edge Detector using Fuzzy Image Processing

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**Abstract**-Edge detection in an image is an major issue in image processing. Many hidden objects can be identified using edge detection which gives major clue in identifying actual truth behind the images. In this paper, double thresholding method of edge detection along with canny edge detector is used to identify the small objects in an images. Here threshold plays a major role which extracts the clear image from unclear picture.

**Keywords**-Fuzzy logic, Cellular learning automata, Canny edge detector, Thresholding.

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**1 Introduction**-Modelling various aspects of human brain is the present artificial intelligence. To deal properly with uncertainties and imprecision which arise from human thinking, mentation cognition and perception, some tools are required. Contrast is one of the most important issues in image processing, pattern recognition and computer vision. Fuzzy logic has been found many applications in image processing. Fuzzy set theory is the useful tool for handling uncertainties related with vagueness/imprecision. Image enhancement is employed to transform an image on basis of psychophysical characteristics on human visual system. To visualize an image to human eyes, the modification of intensity's distribution inside small regions of the image should be conducted. The basic idea of direct contrast enhancement method is to obtain a criterion of contrast measurement and enhance the image by improving the contrast and increasing the threshold value. Contrast can be measured globally and locally. It is more appropriate to a local contrast when an image contains textural information. The brightness variation is estimated by local image statistics. so when the brightness change in a region is severe, the degree of enhancement is high and enhancement is relatively low. The image storage in bitmap format is not so used in day-to-day applications; even medical images are stored in JPEG format. The fuzzy enhancement is implemented in the fuzzy characteristic plane, with the help of contrast intensification operator. Whenever image

is converted from one form to another such as digitizing, scanning, transmitting, storing etc. some of the degradation occurs at the output. Hence output image has to undergo image enhancement which consists of collection of techniques to seek improvement in an image. The edge of the object is reflected by the discontinuity of the gray value. The point of edge also exists between the two neighbors, that is to say, one exists in the inner of a bright region, and the other outside. The other features of the image are all deduced by the foundational feature of the edge and the region. The edge has two features of direction and amplitude: the value of the pixel changes very gently along the edge; and the value of the pixel changes very strongly along the plumb direction of the edge. This kind of acuteness may be hop or sloping. The traditional edge detection is based on the original image. Every pixel of the image is detected by the gray value change of neighbors, and make use of the change of the one-order or two-order directional differential coefficient to detect the edge. This kind of method is called the edge detection partial operator. The kinds of the edge can be divided into two parts: one is called the hop change edge, the gray value of the pixels beside the edge is obviously different; the other is called the housetop edge, it locates in the turning point of the gray value from the increasing to the declining change. Edge detection is one of the most important algorithms in image processing. It plays a fundamental role in higher level processing. Edges

potentially have important information about image content. In human visual system, a preprocessing stage, image edges are detected. Regarding to importance of edges in image processing algorithms, such as object detection, capabilities and accuracy of edge detection algorithms are important factors. Image processing with the used of mathematic operations, the edge detection is implemented with using gradient or by using an appropriate filter for extracting image properties in edges, liners, curves and angles. The most important problem in image processing is the edge detection of useless information filter that cause the decrease of data value. The most important property of the detection of the objects is the use of their edges information. In order to improve text extraction accuracy, some text segmentation approaches also use character properties such as size, stroke width, directions, and run-length histogram. Other binarization approaches for document coding have used rate-distortion minimization as criteria for document binarization. Many recent approaches to text segmentation have been based upon statistical models. One of the best commercial text segmentation algorithms, which are incorporated in the DjVu document encoder, uses a hidden Markov model (HMM).

**2. Feasibility study-**It is concerned to select the best system that meets performance requirements. These entities are an identification description, an evaluation of candidate systems and the selection of the best system for the job.

- Economic feasibility
- Technical feasibility
- Behavioural feasibility

#### **Economic feasibility**

Economic analysis is the most frequently used method for evaluating the effectiveness of the candidate system. More commonly known as cost/benefit analysis, the procedure is to determine the benefits and savings that benefits outweigh costs, and then the decision is made to design and implement the system. Otherwise, further justification or alterations in the proposed system will have to be made if it is to have an enhancement to approve.

**Technical feasibility** Technical analysis centre on the existing computer system (Hardware, Software etc) and to what extend it can support the proposed addition. This involves financial considerations to accommodate technical enhancement. If the budget is a serious constraint, then the project is judged not feasible.

**Behavioural feasibility** An estimate should we made of how strong a reaction the user staff is likely to have toward

the development of a computerized system. It is common Knowledge the computer installations have something to do understandable that the introduction of a candidate system requires special effort to educate, sell and train the Staff on new ways of considering business.

**Implementation-** Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

**Get the Text Input:** In this module we're going to get the text input from the matlab workspace.

**Separate the Foreground and Background:** In this module we're going to separate the foreground and background of the text input. Which we have given earlier as the input. We're going to separate the foreground and background using the algorithm.

**Detect the Binary masking:** The term binary masking is defined here in this module as, here the input text image is displayed as normal image as the black all the text input image.

**Decode the Text Input Region:** In this module we're going to decode the text input (i. e. ) we should decode the text input region which we have already given as input.

**Get the Original input Image:** In this module we're going to get the original input image. In order to get the original input image we should browse the image from the particular mat lab folder.

**Separate the image using algorithm:** To improve accuracy in the detection of text with varying size, a multi scale framework into the COS/CCC segmentation algorithm. The multi scale framework allows detecting both large and small components by combining results from different resolutions. Since the COS algorithm uses a single block size (i. e. , single scale).

**Decode Multi scale image:** To measure the segmentation accuracy of each algorithm, that used a set of scanned documents along with corresponding "ground truth" segmentations. Documents were chosen from different document types, including flyers, newspapers, and magazines.

**Decode MRC image:** In this section, we will evaluate our selected prior model. We used the initial segmentation result generated by COS with a single block size 32.

**3. Architecture-** The edge pixels are the pixels whose gray level have high difference with the gray levels of their neighborhood pixels. However, the definition of "high" is quite fuzzy and application-dependant. The edge pixels are the pixels whose gray level have high

difference with the gray levels of their neighborhood pixels. However, the definition of “high” is quite fuzzy and application- dependant.

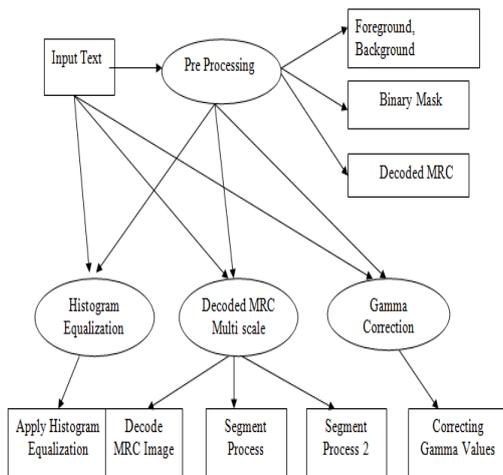


Fig 1 block diagram

**Image fuzzification** The image that read is gray scale image and data might range from 0 to 255. The data 0 belongs to black pixel of the image and data 255 belongs to white pixel of the image. In order to apply the fuzzy algorithm, data should be in the range of 0 to 1 only. The image data are converted to this range that is known as membership plane, after the image data are transformed from gray-level plane to the membership plane (fuzzification); appropriate fuzzy techniques modify the membership values. This can be a fuzzy clustering, a fuzzy rule-based approach and a fuzzy integration approach.

**Defuzzification** From the side of the fuzzy construction, the input grays is ranged from 0-255 gray intensity, and according to the desired rules the gray level is converted to the values of the membership functions . The Mamdani method was chosen as the defuzzification procedure , the output of the FIS according to the defuzzification is presented again to the values from 0-255 and then the black, white and edge are detected.

**Learning automata** It is machines which have a limited number of probabilities and for each of the learning automata a probability vector is allocated. This vector determines that each operation be implemented with what probability. Each selected operation is estimated by probability environment and the result is given to automata as a positive and negative signal.

**Cellular automata-** Cellular automata was posed by Neuman in the late 1940s and after him it was proposed by mathematician Ulam (Ulam, 1972; Zhang, Zhong, & Zhao, 2007) as a model of producing calculations and simulation of systems in which multiple simple components cooperate for producing more complex patterns. Cellular automata are

discrete dynamic systems that the operation is as local relations. In this model space is defined as a network in which each part is called a cell. And it is composed of a limited number of cells. For example two simple components and One-dimensional cellular automata are considered as a liner cell and each of the cells takes either zero or one. The system status in cellular automata is specified with using the total cell status the relationship between adjacencies and environmental rules.

**4. Edge detector algorithm** The edge detector proposed in the paper is based on cellular automata. The algorithm was implemented in MATLAB.

**Step 1:** Input color or grayscale image. If the input image is color image then use either of the following method to convert it to grayscale.

- The Lightness method averages the most prominent and least prominent colors:  $(\max(R, G, B) + \min(R, G, B)) / 2$ . The lightness method tends to reduce contrast.
- The Average method simply averages the values:  $(R + G + B) / 3$ .
- The Luminosity method is a more sophisticated version of the average method. It also averages the values, but it forms a weighted average to account for human perception. We're more sensitive to green than other colors, so green is weighted most heavily. The formula for luminosity is  $0.21 R + 0.71 G + 0.07 B$ . The luminosity method works best overall.

**Step 2:** Binarize the input image using Otsu's method, a global image threshold T1, get a binary image1.

**Step 3:** Binarize the input image using threshold T2, get a binary image2.

**Step 4:** Count the number of non-zero neighbors of each pixel and generate a Neighbor matrix for both image1 and image2.

**Step 5:** For each cell, determine what it should become in the next time step, based on the states of its neighbors, using the cellular automata rule set.

**Step 6:** If the number of neighbors of a pixel P is 5 and its initial state is dead, then mark it dead. Then, find a pixel Q (initially alive) which is one of the four horizontal and vertical neighbors of P, such that the number of neighbors of Q is greater than 5, Mark Q as alive. This rule will solve the problem of concavity.

**Step 7:** If the number of neighbors of a pixel P is less than or equal to 3, and its initial state is alive, then find a pixel Q which is one of the four horizontal and vertical neighbors of P, having number of neighbors equal to 1. If any such pixel exists then mark this pixel P as alive and not dead unlike in the existing algorithm. This rule helps from missing out some edge pixels.

**Step 8:** Obtain the processed image with thin edges.

**Result and Conclusion** Because of the uncertainties that exist in many aspects of image processing, and as image are always dynamic, fuzzy processing is desirable. These uncertainties include additive and non-additive noise in low level image processing, imprecision in the assumptions underlying the algorithms, and ambiguities in interpretation during high level image processing. For the common process of edge detection usually models edges as intensity ridges. Finally by increasing the threshold value greater than 50 and contrast can be improved.



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