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Estimating the Age of the Human by using Fuzzy Logic and Image Processing

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Abstract: ***Estimating the age of human by analyzing the facial image using image-processing and fuzzy logic techniques have lots of potential real-world application, such as human-computer interaction and multimedia communication. Several face detection methods are developed to track a human face in a motion scene. Edges can be recognized using fuzzy logic methods. The amount of data and filtering of unwanted or insignificant information are reduced significantly by edge detection and gives significant information in an image. An efficient algorithm is developed to detect edges of an image for recognizing age of human by using fuzzy logic. The system is achieved and simulated in Matlab and its performance is tested on real images.***
Keywords: Age, Fuzzy Logic, Edge detection, image segmentation, Edges.

I. INTRODUCTION

An edge in an image is defined as a boundary or contour where an abrupt change occurs in some physical aspects such as the gray level value of an image. Edge detection is one of the most important tasks in image processing. Especially registration, identification and recognition are based on edge detection algorithm. Here, Edge detection is carried out by Fuzzy Interference System and the edge detected output image is generated from the fuzzy Interference system. This output image is converted into binary image in order to calculate the number of edges in a facial image.[1]

Fuzzy logic is a form of many-valued logic that roughly deals with approximations, rather than fixed and exact conditions. Compared to traditional binary logic (where variables may take on true or false values). Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false.[2]

Image processing is any form of signal processing in which the input is an image or series of images or videos. The output of image processing can be either an image or a set of characteristics or parameters related to the image.[3]

Image gradient[4] is a directional change in the intensity or color in an image. The gradient of the image is one of the fundamental building blocks in image processing. It gives information of two pieces. The gradient has magnitude and direction in which the magnitude tells us how quickly the image is changing and direction tells us the direction in which the image is changing most rapidly. The gradient of an image is given by the formula: $\nabla f = \frac{\delta f}{\delta x}\bar{x} + \frac{\partial f}{\partial y}\bar{y}$.

Where, $\frac{\delta f}{\delta x}$ and $\frac{\partial f}{\partial y}$ are the gradients in x and y directions.

II. LITERATURE SURVEY

Canny Edge Detection [5] is a popular edge detection algorithm. John F. Canny developed it in 1986. It is a multi-stage algorithm and we will go through each stage.

1) *Noise Reduction:* Since edge detection is susceptible to noise in the image, the first step is to remove the noise in the image with *a Gaussian filter.*
2) *Finding Intensity Gradient of the Image:* Noise removed image is then filtered with a Sobel kernel operator in both horizontal and vertical directions to get the first derivative in the horizontal direction and second derivative from vertical direction. From these two derivatives, we can find the edge intensity and direction for each pixel.
3) *Non-maximum Suppression:* After getting the edge intensity and direction, a full scan of the image is done to remove any unwanted pixels which may not constitute the edge. For this, at every pixel, the pixel is checked if it is a local maximum in its neighborhood in the direction of the gradient.

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III. METHODOLOGY

The methodology is exposed in the flow chart. The flow chart is exposed in the figure 1.

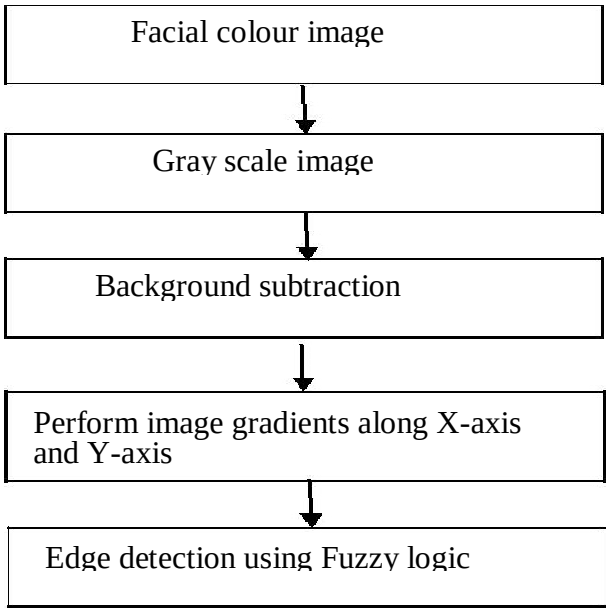

Fig 1. Flow chart

A. Reading of Input Image

The colour of any pixel is determined by the combination of the red, green, and blue intensities stored in each colour plane at the pixel's location. The input image is in a RGB format is exposed in figure 2.

Fig 2. Input Color Image(Facial Image)

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B. Convert The Input Image Into The Gray Image

This algorithm works on Gray level image. Hence, the colored image is converted into the Gray scale image.Grayscale image contains luminance(brightness) information and no color information that is why maximum luminance is white and zero luminance is black. That is why grayscale images contain only shades of gray. Gray scale image is also known as achromatic image. The intensity image which is extracted from the Input colour image using the formula(rgb2gray).The gray scale image is exposed in figure 3.

Fig 3. Color image to Grayscale image

C. Background Subtracted Image

The background subtracted image which is obtained from the original input image by performing one of the morphological image gradient operations like opening and closing operation. All information available for the image segmentation process is usually held in a single image, but this information is often not sufficient to provide good segmentation output. The background subtracted image is exposed in figure 4.

Fig 4. Background Subtracted Image

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D. Image Gradient Operation Outputs

Image gradients are most commonly used is in edge detection. After gradient images have been computed, pixels with large gradient values become edge pixels and edges may be traced in the direction perpendicular to the gradient direction. One example of an edge detection algorithm that uses gradients is the Canny edge detector.The figure 5 an Image gradient operation along x-axis which is obtained from the original input image by using convolution filters and the image gradient filters.The figure 6 is an Image gradient operation along y-axis which is obtained from the original input image by using convolution filters and the image gradient filters. The image gradient operation along x-axis and y-axis is exposed in the figure 5 and 6.

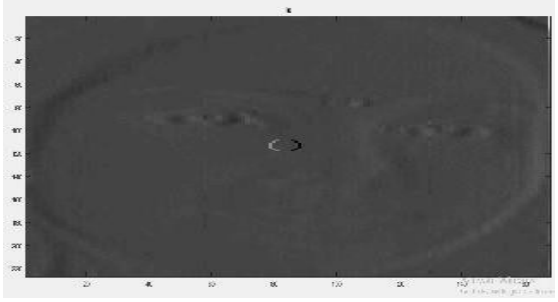

Fig 5. Image Gradient Operation along X-axis

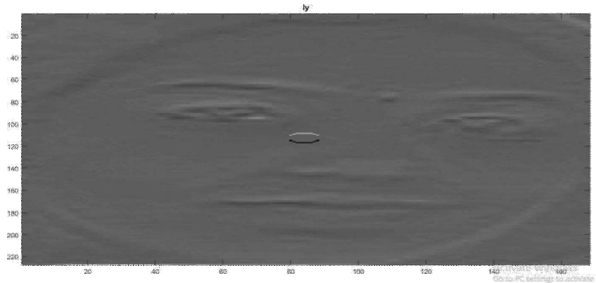

Fig 6. Image Gradient Operation along Y-axis

E. Membership Functions of Inputs Andoutputs

The membership functions[6] allow us to graphically represent a fuzzy set. The *x* axis represents the universe of discourse, whereas the *y* axis represents the membership grades or degrees of membership in the [0,1] interval. Figure 7 represents the membership functions for both input variables Ix and Iy, and for output variable Iout. These are obtained from the fuzzy logic interference system. The membership functions is exposed in figure 7.

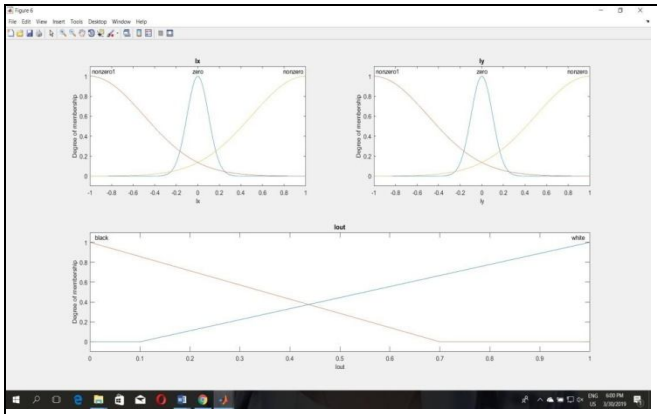

Fig 7. Membership Functions

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F. Edge Detected Output

Fuzzy techniques can manage the vagueness and ambiguity efficiently and an image can be represented as a fuzzy set. Fuzzy Logic is a powerful tool to represent and process human knowledge in the form of fuzzy if-then rules. Edges are extracted from the enhanced image by a two-stage edge detection operator that identifies the edge candidates based on the local characteristics of the image. The edge detected output is exposed in figure 8.

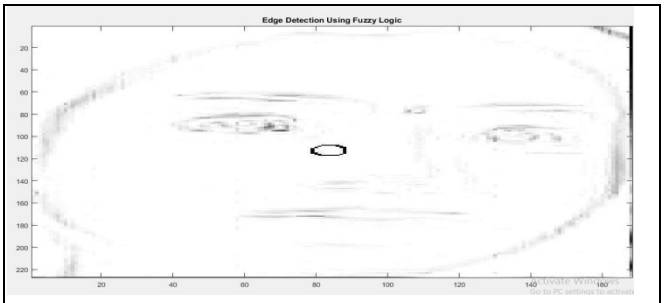

Fig 8. Edge Detected Output Image

G. Final Output Image

Figure 9 is the obtained age detected image which is showing the age-group of the women in the facial image. The output image is showing an age group of women as "middle age" person.

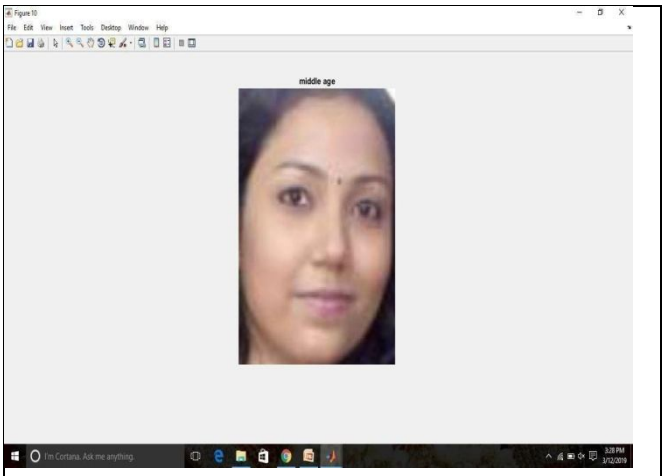

Fig 9. Final Output Image

IV. APPLICATIONS

1) *Business:* Decision making support systems and in personal evaluation in a large company.
2) *Chemical Industry:* To Control pH, drying, chemical distillation processes, a coke oven gas cooling plant.
3) *Electronics:* Control of automatic exposure in video cameras, humidity in a clean room, vacuum cleaners, microwave ovens.
4) *Financial:* Banknote transfer control, fund management, stock market productions.
5) *Medical:* Medical diagnostic support system, control of arterial pressure during anesthesia, radiology diagnosis.

V. CONCLUSION

In this, age grades have been achieved using the application of edge detection using fuzzy logic, where binarization applied on image for enhancing minute details further more. Image gradient technique that has been used is advantageous to know about the pixel intensity levels in both the X-axis and Y-axis. Edge detection that has been performed in the application significantly reduces the amount of data and filters out unwanted information and gives the significant information in an image. Fuzzy logic is very efficient in taking number of possible cases or rules into consideration and categorizes the input into ages based groups like old age, middle age and small age.

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The Fuzzy logic performs the edge detection based on the image gradient method to locate breaks in uniform regions. The output of image gradients will be inputs for Fuzzy interference system. Thus, the edges in the image will be refined and the edge count will be obtained. This edge count is at last used to finalize the age category of input image.In this we, detected the edges of images for recognizing age of humans by using fuzzy logic as mentioned above. Based upon the experimental results conducted by us we can say that the proposed approach can enhance the required result.

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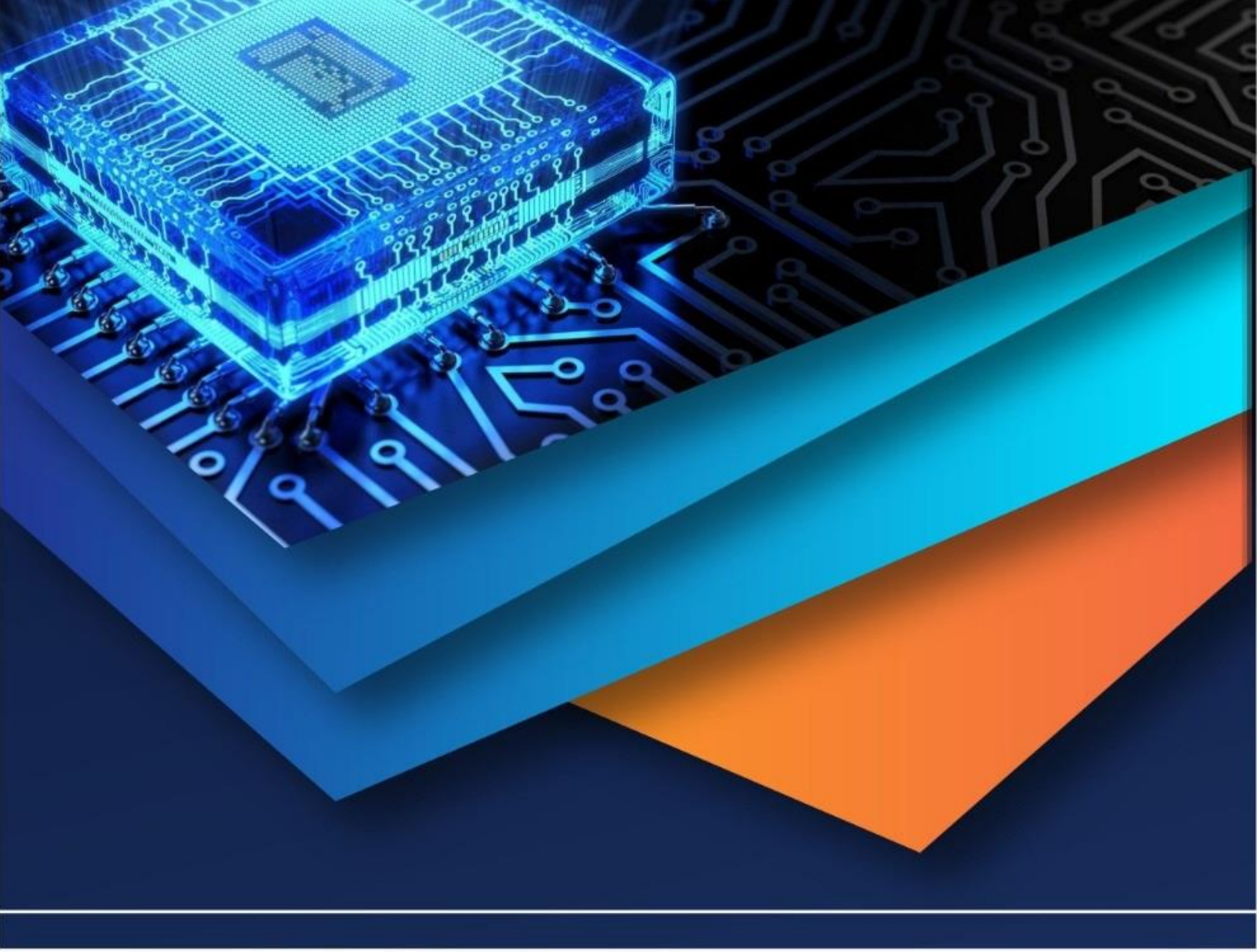

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