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# Quality Improvement Of Image Processing Using Fuzzy Logic System

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**Abstract**

Digital image processing is an ever growing and active area with solicitations getting out into routine life such as medication, space assessment, surveillance, endorsement, mechanical industry scrutiny and much more areas. The proposed system mainly focuses on the Fuzzy logic systems in the digital image processing. The main concern of this system is to demonstrate the application of Fuzzy logic in image processing with a short summary to Fuzzy logic and digital image processing. Fuzzy logic, one of the decision-making methods of artificial intelligence, has much more application extents. While it has been exposed to condemnations since its birth, particularly in recent years, Fuzzy logic has been confirmed to be pertinent in almost all systematic fields. The consequences show that the proposed method as reasonably worthy performance with required development in the image processing systems.

## 1. INTRODUCTION

Digital gray scale images achieved through several digital products are often degraded by impulse noise during image acquisition, transmission and reception. Reduction of noise and protection of details are two features of image processing. The significant types of noise occur are impulse noise, multiplicative noise and additive noise. As we know there are many algorithms obtainable for reduction of each type of noise. On every occasion an image is transformed from one form to another such as, digitizing, scanning, transmitting, storing, etc., some of the degradation occurs at the output. Therefore, the output image endures from a different kind of noise. Salt & paper suggestively degrades the image quality. An image denoising is used to remove the additive noise. The objective of image denoising is to estimate the original image from the noisy image. Denoising is one of the important task and pre-processing step in digital image processing. There are many median filters are available for impulse noise reduction although these methods have been improved, but the quality of

denoising image is still not satisfactory. But this method is too time-consuming. Most of these algorithms provide suitable and good results at smaller percent of noise levels and find effort with higher level noises, also this method is too time-consuming and isn't appropriate for real applications. We would communicate the novel method is better than the withdrawing technique. This method has been adopted to eliminate noise from 'TV signal and to reduce interlocked scan related articles at the receiver side. Furthermore, an algorithm for image quality augmentation has been established which tunes nearby the contrast and the brightness of the picture with respect to the global image features. The proposed system familiarizes the objects and obscuring of the images. So it is a task for the researchers to eliminate the impulsive noise from the gray scale images while retaining the important signal features and explore the options of various denoising method for gray scale images.

## 2. FUZZY LOGIC

The applications of fuzzy logic once thought to be an ambiguous scientific interest can be found in many engineering and technical works. Fuzzy logic has been used in various applications such as facial pattern recognition, air conditioners, washing machines, vacuum cleaners, braking systems, and transmission systems, control of subway systems and unmanned helicopters, knowledge-based systems for multi objective optimization of power systems, weather forecasting systems, models for new product pricing or project risk assessment, medical diagnosis and treatment plans, and stock trading. Fuzzy logic has been effectively used in several fields such as control systems engineering, image processing, power engineering, industrial automation, robotics, consumer electronics, and optimization. This branch of mathematics has inspired new life into systematic fields that have been latent for a long time.

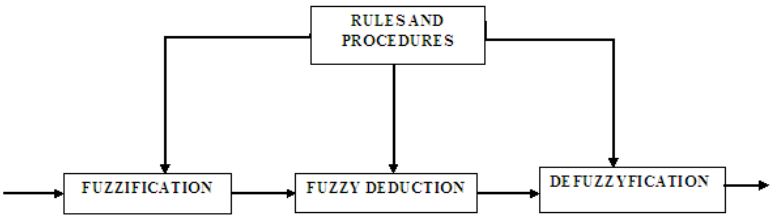


**Fig.1:** A framework of fuzzy logic system

Fuzzy logic is a logical system which is an extension of multi-valued logic. In logics system multi-valued logic is a propositional calculus in which there are more than two truth values. There are only two possible values true or false for any proposition but extension to classical two valued logic is an n-valued logic or n greater than two. Fuzzy logic is conceptually easy to understand and is flexible and is tolerant of imprecise data. Fuzzy logic is to map an input space to an output space and for doing this a list of if then statements called rules are evaluated in parallel .These Rules are useful because they use variables and adjectives that describes those variables. A

typical Fuzzy Logic Controller (FLC) consists of a fuzzification module, fuzzy inference engine, defuzzification module and pre- and post-processing modules.

## 3. FUZZY LOGIC IN DIGITAL IMAGE PROCESSING

Fuzzy image processing is the collection of all approaches that understand, represent and process the images, their segments and features as fuzzy sets. The representation and processing depend on the selected Fuzzy technique and on the problem to be solved. Fuzzy image processing has three main stages: image Fuzzification, modification of membership values, and, if necessary, image Defuzzification as shown in Figure 2.

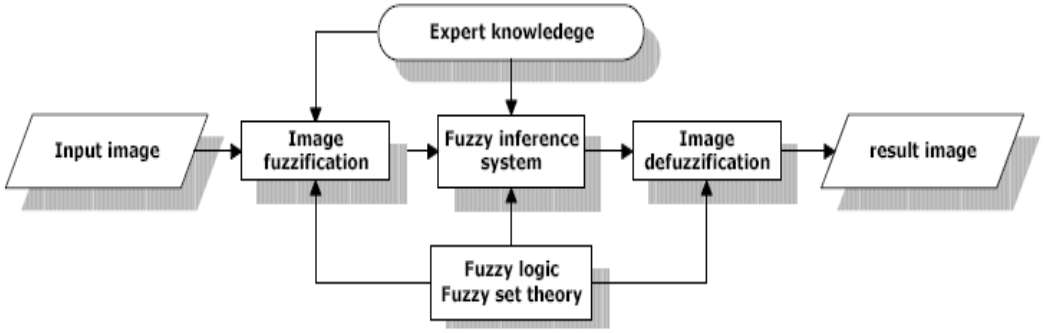


**Fig. 2** The general structure of fuzzy image processing

The Fuzzification and Defuzzification steps are due to the fact that we do not possess fuzzy hardware. Therefore, the coding of image data (fuzzification) and decoding of the results (defuzzification) are steps that make possible to process images with fuzzy techniques. The main power of fuzzy image processing is in the middle step (modification of membership values).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 and so on. In this paper a novel FIS method based on fuzzy logic reasoning strategy is proposed for edge detection in digital images without determining the threshold value or need training algorithm. The proposed approach begins by segmenting the images into regions using floating 3x3 binary matrices. A direct fuzzy inference system mapped a range of values distinct from each other in the floating matrix to detect the edge.

### 3.1 FUZZY IMAGE PROCESSING

Fuzzy image processing is the collection of all approaches that understand, represent and process the images, their segments and features as fuzzy sets. The representation and processing depend on the selected fuzzy technique and on the problem to be solved. Fuzzy image processing has three main stages: image fuzzification, modification of membership values, and, if necessary, image defuzzification as shown in Fig.2. The fuzzification and defuzzification steps are due to the fact that we do not

possess fuzzy hardware. Therefore, the coding of image data (fuzzification) and decoding of the results (defuzzification) are steps that make possible to process images with fuzzy techniques. The main power of fuzzy image processing is in the middle step (modification of membership values). 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 and so on.

### 3.2. INFERENCE RULES DEFINITIONS

The inference rules are to be determined by the weights of the eight neighbors gray level pixels, if the neighbor's weights are degree of blacks or degree of whites. The powerful of these rules is the

ability of extract all edges in the processed image directly. This study is assaying all the pixels of the processed image by studying the situation of each neighbor of each pixel. The condition of each pixel is decided by using the floating 3x3 mask which can be scanning the all grays. In this location, some of the desired rules are explained. The first four rules are dealing with the vertical and horizontal direction lines gray level values around the checked or centered pixel of the mask, if the grays represented in one line are black and the remains grays are white then the checked pixel is edge.

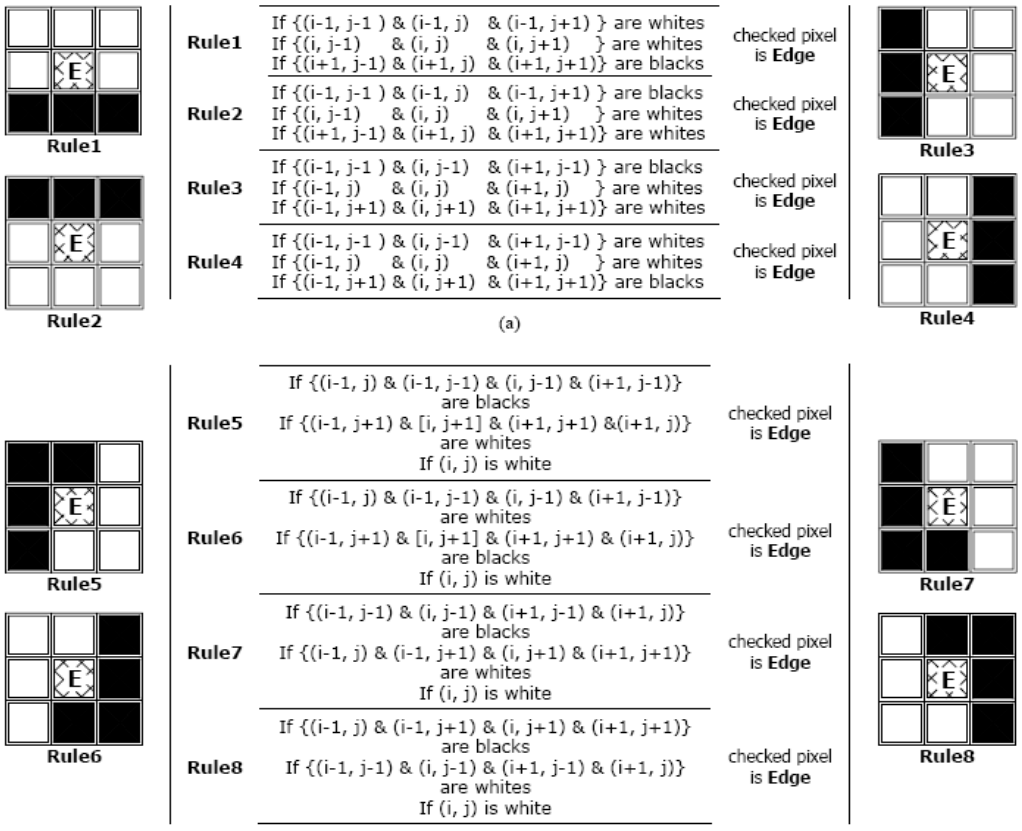


**Fig. 3** The Fuzzy System rules

The second four rules are dealing with the eight neighbors also depending on the values of the gray level weights, if the weights of the four sequential pixels are degree of blacks and the weights of the remain fours neighbors are the degree of whites, then the center pixel represents the edge. The introduced rules and another group of rules are detecting the edges, the white and the black pixels. The result images contribute the contours, the black and the white areas. 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 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. From the experience of the tested images in this study, it is found that the best result to be achieved at the range black from zero to 80 gray values and from 80 to 255 meaning that the weight is white. We analyze two parameters:-

1. Peak Signal to Noise Ratio (PSNR)
2. Mean Square Error (MSE)

PSNR= $10log_{10}\ 255^2/MSE\ \ dB$

Where MSE is given by

$$MSE = \frac{1}{mn}\sum_{i=0}^{m}\sum_{j=0}^{n}(I-K)^2\ pixel$$

Where for MSE

I is input Image i.e. noisy image

K is output image after applying proposed algorithm.

## CONCLUSION

Nowadays, applications need several kinds of images as sources of information for elucidation and analysis. When an image is transformed from one form to another such as digitizing, scanning, and communicating, storing, etc. degradation occurs. Therefore the output image has to undertake a process called image enhancement, which contains of a group of methods that seek to develop the visual presence of an image. Image enhancement is fundamentally enlightening the interpretability or awareness of information in images for human listeners and providing better input for other automatic image processing systems. Fuzzy image processing is a powerful tool form preparation of expert knowledge edge and the combination of inaccurate information from different sources. The intended fuzzy rules are an attractive result to improve the quality of edges as much as possible.

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