

## A New Method of Image contrast Enhancement By Using Fuzzy Technique

Abdullah H. Muhammad

physics department collage of science , University of Kirkuk , Kirkuk , Iraq

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### Abstract

Image enhancement in Spatial Domain is the process of improving the quality of a digitally stored image by manipulating the image pixel values with the help of software. Manipulation of pixel values perception . This paper focuses mainly on spatial domain techniques for image enhancement using fuzzy concepts which includes histogram distribution analysis, smoothing and fuzzy technique .

The proposed technique is able to improve the contrast of the image. The proposed technique is tested on different type of images, like gray level low contrasted images, color low contrasted images .

**Keywords :** Spatial Domain Techniques, software, point operations, Fuzzy, Membership Function .

### Introduction

Image Enhancement is one of the key research fields in image processing as it is useful in many applications such as Satellite Image processing, medical, military, print media etc., which improves the image quality of a display and visual perception of human beings . Image enhancement Techniques can be broadly divided into three categories [1] :

- a. Frequency domain methods, which operate on the Fourier transform of an image
- b. Spatial domain methods, which operate directly on pixels .

- c. Fuzzy domain, which treats Image as Fuzzy set [1, 5, 8] and operates on these sets . In the literature, several classical image enhancement techniques have been introduced and developed by different authors, such as histogram equalization, contrast stretching [4], bit-plane slicing, averaging; point processing etc . These techniques have uncertainties such as Edge Detection [2] and over smoothing . The continued application of these methods causes blurring and deformation of edges usually the edges appear more curvy and will result in a constant intensity image, if the evolution is not stopped after a finite number of iterations .

Fuzzy filtering has several advantages over other methods, capable of dealing with vague and uncertain information. Sometimes it is required to recover a heavily noise corrupted image where a lot of uncertainties are present and in this case fuzzy set theory is very useful . Fuzzy Image Enhancement treats image as fuzzy set and operates on those sets .

Fuzzy technique has been applied for various

methods used for image Processing. Fuzzy image Enhancement is increasing in popularity because of rapid extension of fuzzy set theory, the development of various fuzzy set based mathematical modeling, and its successful and practical application in image processing, pattern recognition and computer vision system .

The fuzzy systems [1,5] are knowledge based systems [2], and their performance can be optimized by an adoptive learning process .

K. Pal et al proposed the fuzzy enhancement [1,6,7] Algorithm which involves extraction of fuzzy properties corresponding to each pixel and then successive application of fuzzy operator contrast intensification' on the property plane .

Using English script as input with different indexes of fuzziness System performance is explained. Debashis Sen and Sankar K. Pal proposed Automatic Exact Histogram Specification for Contrast Enhancement [2,4] .The desired histogram is obtained by subjecting the image histogram to a modification process that increases the overall discriminability among samples in the histogram, and then maximizing a measure that represents increase in information entropy and decrease in average image ambiguity. This technique is used for global and local contrast enhancement [4] of gray scale images .

Fuzzy Technique mainly contains Three steps (1) Image Fuzzification (2) Enhancing Intensity component (3) Image Defuzzification .

### Fuzzy Technique

In Fuzzy image each pixel of a image is processed on the basis of rules applied to the pixels .

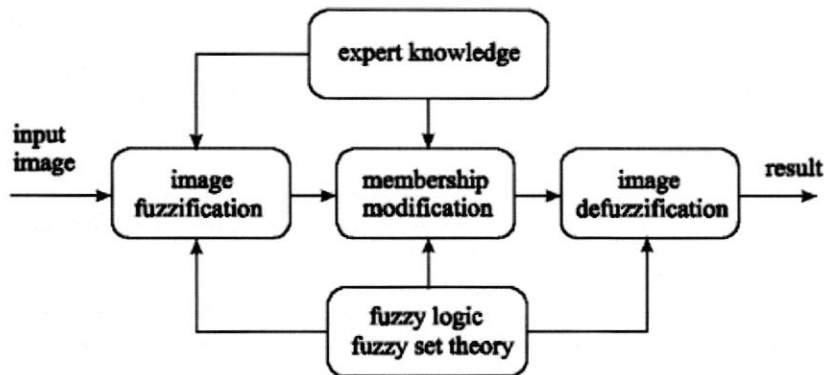


Fig. 1 : Phases in Fuzzy Enhancement [2]

A Gray Image pixel contains 256 intensity levels. So membership functions which are used for enhancing Intensity component of a pixel can be defined in the universe of discourse [0,255] [3]. Let  $s(n_1, n_2)$  be the variable representing the intensity value of the pixel of coordinates  $(n_1, n_2)$  in the source image and  $f_v(n_1, n_2)$  be the corresponding fuzzy variable in the resulting image after being enhanced.

IF  $s(n_1, n_2)$  is DARK, THEN  $f_v(n_1, n_2)$  is BRIGHT.

IF  $s(n_1, n_2)$  is MED, THEN  $f_v(n_1, n_2)$  is MED.

IF  $s(n_1, n_2)$  is BRIGHT, THEN  $f_v(n_1, n_2)$  is DARK.

#### Fuzzy domain

Fuzzy set theory is thus useful in handling various uncertainties in computer vision and Image processing applications. Fuzzy image processing is a collection of different fuzzy approaches to image processing that can understand, represent, and process the image.

It has three main stages, namely, image fuzzification, modification of membership function values, and defuzzification. Fuzzy image enhancement is based on gray level mapping into membership function. The aim is to generate an image of higher contrast than the original image by giving a larger weight to the gray levels that are closer to the mean gray level of the image that are farther from the mean [8,9].

**Proposed Algorithm** The algorithm is given below

The steps which are carried out in the sequence to get the desired output to enhance image using fuzzy technique. The algorithm starts with the initialization of the image parameters; size, minimum, mid and maximum gray level. The fuzzy rule-based approach is a powerful and universal method for many tasks in the image processing. The algorithm is described as below:

- 1) Read the original image.
- 2) Calculate size of original image.
- 3) Apply fuzzy inference Engineering.
- 4) Normalization of pixel values.
- 5) Passing parameters to the FIS.
- 6) Compare the enhanced image with the other

#### Algorithm to enhance image using fuzzy technique

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gray level. The fuzzy rule-based approach is a powerful and universal method for many tasks in the image processing.

The algorithm is described as bellow:

#### Morphological processing

- 1) Read the image.
- 2) Convert it into Gray scale image if it is RGB image.
- 3) Find the minimum, maximum gray level of the image also find the average gray level of the image.
- 4) Apply fuzzy inference system as follow:
  - i) Image Fuzzification: Transforming Image to Fuzzy Set.
  - ii) Enhance Intensity component: Contrast Enhancement
  - iii) Image Defuzzification: Transforming Modified Fuzzy Set to Image

#### Step-1: Convert the image data into Fuzzy domain data

For  $x=0$  to  $M$

• For  $y=0$  to  $N$

a) if  $data_{rgb\_}$  value between min and mid Then  $fdata = 1 / (mid - min) * mid - 1 / (mid - min) * data_{rgb}$

b) If  $data_{rgb\_}$  value between mid and max Then  $fdata = 1 / (max - mid) * data_{rgb} - 1 / (max - mid) * mid$ .

#### Step-2 Membership Modifications

For  $x=0$  to  $M$

For  $y=0$  to  $N$

//if the pixel is dark then make it darker

//if the pixel is bright then make it

i) If  $fdata$  between 0 and 0.5

Then  $fdata = 2 * (fdata)^2$ .

ii) Else if  $fdata$  between 0.5 and 1

Then  $fdata = 1 - 2 * (1 - fdata)^2$ .

#### Step-3 Defuzzification

For  $x=0$  to  $M$

For  $y=0$  to  $N$

a) If  $data_{rgb\_}$  value = min

Then  $enhanced\_data = data_{rgb\_}$  value

b) If  $data_{rgb\_}$  value between min and mid

Then  $enhanced\_data = -(mid - min) * fdata + data_{rgb}$

c) If  $gray\_$  value between mid and max

Then  $enhanced\_data = (max - mid) * fdata + data_{rgb}$ ;

5) displaying the Enhanced image.

i) Show the original image.

ii) Show the enhanced image.