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

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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 [0255] [3]. Let s(nl, n2) be the variable representing the intensity value of the pixel of coordinates (nl, n2) in the source image and fv(nl, n2) be the corresponding fuzzy variable in the resulting image after being enhanced.

IF s (nl,n2) is DARK, THEN fv(nl,n2) is BRIGHT.

IF s (nl, n2) is MED, THEN fv(nl,n2) is MED.

IF s (nl, n2) is BRIGHT, THEN fv(nl,n2) 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 bellow :

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) \* datargb - 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 Deffuzification

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 .

iii) Compare the enhanced image with the other **Results and Discussion** 

In this section, the proposed work is tested under visual basic v6, compared with traditional algorithms,

for it has been proved that its algorithm was better than the other Image Enhancement Techniques and the following results obtained.







Fig (3) (a)Histogram of Input color Image (b) Histogram of Enhanced color Image using Fuzzy Technique (c) Histogram of Enhanced color Image using Histogram equalization



Fig (4) (a) Input gray Image (b) Enhanced gray Image using Fuzzy (c) Enhanced gray Image using Histogram equalization



Fig (5) (a)Histogram of Input gray Image (b) Histogram of Enhanced gray Image using Fuzzy Technique (c) Histogram of Enhanced gray Image using Histogram equalization

Images	variance	μ	SNR	contrast
Gray image	400.3	161.68	8	0.396
Histogram eq	1415	129.7	1.75	1
Fuzzy processing	1415	159.26	4.23	0.764

Table (1) comparison of influence of the processing on the gray image

Table	(2)	com	parison	of	inf	luence	e of	the	proc	essing	on	the	color	imag	ge
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Red image	variance	μ	SNR	contrast
Input image	3022	137.8	2.5	0.76
Histogram eq	5286	126.8	1.74	1
Fuzzy processing	9279	125.7	1.305	1
Green image	variance	μ	SNR	contrast
input image	2524	118.7	2.36	0.67
Histogram eq	5235	127.35	1.76	1
Fuzzy processing	7818	110.1	1.245	1
Blue image	variance	μ	SNR	contrast
Input image	2084	113.8	2.49	0.63
Histogram eq	5286	126.8	1.7	1
Fuzzy processing	5984	106	1.37	1

Our Algorithm utilizes fuzzy decision to enhance the contrast of image by two methods histogram equalization and fuzzy technic ,from figures 2and 4 we see that the amount of enhancement of fuzzy technic do as we like and is the better than in the case of histogram equalization . A New Fuzzy Based Enhancement Technique is proposed. This method is

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effectively reduced the algorithm complexity. The result shows that the proposed algorithm can preserve the details and produces better result than the results of histogram equalization because we will get the magnitude of the variance and SNR very high according to the magnitude that we will get from fuzzy technic as in table 1 and table 2.

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# طريقه جديدة لتحسين تباين الصورة الرقمية باستخدام التقنية الضبابية Fuzzy

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#### الملخص

تعتبر عملية تحسين الصور الرقمية في الفضاء المكاني هي عملية تحسين نوعية الخزن الرقمي للصورة بواسطة معالجة القيم الرقمية لعناصر الصورة . كما ان عملية معالجة قيم عناصر الصورة نتضمن عمليات نقطية حيث ان في هذا النوع من العمليات تتم معالجة الصورة بمعالجة كل عنصر على انفراد طبقا لمعادلة خطية وبشكل مستقر عن العناصر الاخرى كي تكون النتائج اكثر ملائمة عند مقارنتها بالصورة الاصلية ولتطبيقات متتوعة وغالبا ماتكون اكثر ملائمة للادرتك الحسي . وقد ركز هذا البحث على تقنية الفضاء المكاني لتحسين الصور الرقمية باستخدام المفاهيم الضبابية . وفي هذا البحث اظهرت النتائج قدرة التقنية الصبابية المقترحة على تحسين تباين الصوره وقد طبقت هذه التقنية على عدة انواع من الصور كالصور الرمادية والملونه قليلة التباين .

الكلمات المفتاحية : تقنية الفضاء المكاني ، البرامجيات ، عمليات نقطية ، التقنية الضبابية ، دالة العضوية .