ENHANCEMENT OF DIGITAL IMAGES USING FUZZY SET THEORY – A COMPREHENSIVE STUDY

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Abstract:

Image enhancement means to enrich the perception connected with images. It can reduce noise, sharpen the edges with the help of different image enhancement strategies. Fuzzy techniques can take care of the uncertainty and imperfection of an image which may be represented as a fuzzy set. Fuzzy logic enables you to process human knowledge in the form of fuzzy if-then rules.

The accumulation of most these approaches come nearly the theory of fuzzy image processing, which is usually divided into 5 sub processes: Acquire Image, Image Digitization, Image fuzzification, membership function application, and image defuzzification. This paper presents a quick description of a variety of image enhancement techniques in order to make familiar with the enhancement of your blurred image, noise removal, setting your brightness, contrast along with degradations in photos in image processing, which concludes the higher quality approach for the future research.

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1. Introduction

Images are often degraded simply by random noise. Noise can take place during picture capture, tranny or running, and can be dependent in or separate of picture content. Noise is normally described simply by its probabilistic attributes. Gaussian noise [1] is a good approximation involving noise that comes about in numerous practical case. The ultimate goal involving restoration techniques would be to improve a photo in some pre-defined sense.

Although you will find areas involving overlap, image enhancement is largely a subjective process, while picture restoration is for the most part an target process. [2] Restoration attempts to reconstruct or recover a photo that is degraded simply by using a priori knowledge of the degradation phenomenon. Thus refurbishment techniques tend to be oriented in the direction of modeling the particular degradation as well as applying the particular inverse process as a way to recover an original image. This method usually entails formulating some sort of criterion involving goodness which will yield a good optimal estimate from the desired end result.

By comparison, enhancement strategies basically tend to be heuristic procedures made to manipulate a photo as a way to use the psychophysical facets of human graphic system. As an example, histogram equalization is recognized as an advancement technique since it is primarily about the pleasing aspects it might present on the viewer, whereas removing of picture blur by applying a deblurring function is recognized as a refurbishment technique.

2. Related Work

In this section, we are presenting the research work of some prominent authors in the same field and explaining a short description of various techniques used for image enhancement.

Xiwen Liu "An Improved Image Enhancement Algorithm Based on Fuzzy Set", (2012) [9] According to the weak points in the regular fuzzy enhancement algorithms, a number of upgrades are suggested. Within the much better formula, the particular membership characteristics and also fuzzy enhancement agent comprise of piecewise continual characteristics, and also the image is actually broken down directly into a couple of places by

simply OTSU process, you are substantial grey place, additional is actually small grey place, pixels inside substantial grey place are increased, and also pixels inside small grey place are reduced. Simulation results indicate that formula provides beneficial power to enhance blur and also little tips, in fact it is a simple yet effective and also useful approach to raise image's comparison.

Adin Ramirez Rivera, Byungyong Ryu, and Oksam Chae, "Content-Aware Dark Image Enhancement Through Channel Division", 2012 [3] proposed a content-aware algorithm that enhances dark images, sharpens edges, reveals details in textured regions, and preserves the smoothness of flat regions. This algorithm produces an ad hoc transformation for each image, adapting the mapping functions to each image's characteristics to produce the maximum enhancement. They analyzed the contrast of the image in the boundary and textured regions, and group the information with common characteristics. These groups model the relations within the image, from which the transformation functions were extracted. The results were then adaptively mixed, by considering the human vision system characteristics, to boost the details in the image.

Deepak Ghimire and Joonwhoan Lee ," Nonlinear Transfer Function-Based Local Approach for Color Image Enhancement,"2011 [4] proposed a method in which the image enhancement was applied only on the V (luminance value) component of the HSV color image and H and S component were kept unchanged to prevent the degradation of color balance between HSV components. The V channel was enhanced in two steps. First the V component image was divided into smaller overlapping blocks and for each pixel inside the block the luminance enhancement was carried out using nonlinear transfer function. In the second step, each pixel was further enhanced for the adjustment of the image contrast depending upon the center pixel value and its neighborhood pixel values. Finally, original H and S component image and enhanced V component image were converted back to RGB image.

Sudharsan Parthasarathy, Praveen Sankaran," Fusion Based Multi Scale RETINEX with Color Restoration for Image Enhancement,"2012 [5] proposed that a fusion based approach on Multi Scale Retinex with Color Restoration(MSRCR) would give better image enhancement. Lower dynamic range of a camera as compared to human visual system causes images taken to be

extremely dependent on illuminant conditions. MSRCR algorithm enhances images taken under a wide range of nonlinear illumination conditions to the level that a user would have perceived it in real time. One of the enhancement techniques that tries to achieve color constancy is Retinex. In Multi Scale Retinex(MSR),they average multiple SSR(Single Scale Retinex) images to obtain a net improved image.

S. Bronte, L. M. Bergasa, P. F. Alcantarilla, "Fog Detection System Based on Computer Vision Techniques", [6] proposed a real-time fog detection system using an on-board low cost b&w camera, for a driving application. This system was based on two clues: estimation of the visibility distance, which was calculated from the camera projection equations and the blurring due to the fog. Because of the water particles floating in the air, sky light gets diffuse and, focus on the road zone, which is one of the darkest zones on the image. The apparent effect is that some part of the sky introduces in the road. Also in foggy scenes, the border strength is reduced in the upper part of the image. These two sources of information were used to make the system more robust. The final purpose of this system was to develop an automatic vision-based diagnostic system for warning ADAS of possible wrong working conditions.

Zhang Chaofu, MA Li-ni, Jing Lu-na ," Mixed Frequency domain and spatial of enhancement algorithm for infrared image", 2012 [7] proposed a hybrid technique to enhance the image. It makes use of the Gauss filter processing to enhance image details in the frequency domain and smooth the contours of the image by the top-hat and bot-hat transforms in spatial domain. To enhance the infrared image, this algorithm did not enhanced only the details of the image, but the outline of the image had also been smooth.

A. Poljicak, L. Mandic, M. Strgar Kurecic ," Improvement of the Watermark Detector Performance Using Image Enhancement Filters,"2012 [8] considered the influence of some image processing techniques on the watermark detection rate. Watermarking methods are still very sensitive to complex degradation attacks such are JPEG compression, or printscan process, so the detection rate of a watermark method decreases considerably after such attacks on a watermarked image. To improve the detection rate they reduced the degradation of the image by using unsharp, Laplacian or deconvolution filter. For the experiment dataset of 1000 images

were watermarked and then compressed or printed and scanned. Degraded images were enhanced using unsharp, Laplacian and blind deconvolution filter. The watermark detection rate before and after enhancement was measured and compared.

3. Problem Description

The key aim of this research study is to contribute in the field of image processing and to perform an algorithmic method reinforced with fuzzy rules for image enhancements. In the previous research studies, the existed means will be able to improve grey scale images. Therefore it's an issue to apply the modified approach to colour images.

Image advancement boosts a picture physical appearance by means of escalating dominance regarding a number of functions as well as by means of lowering ambiguity concerning various parts of the actual image. Histogram primarily based image advancement strategy is primarily based on equalizing the actual histogram in the image along with escalating the actual active selection corresponding to the image.

4. Conclusion

This paper provides a brief outline of various image improvement techniques to make aware with the actual image enhancement of the blurred picture, noises removal, establishing the actual brightness, form a contrast along with degradations throughout photos throughout picture processing. Fuzzy based enhancement is the latest as well as good technique for the actual picture denoising and also insight photos generally confronts the actual noises in the course of picture processing. The particular fuzzy logic comes with a mathematical platform for representation and processing of specialist knowledge. The concept of if-then rules be involved in approximation on the variables like cross over point. Likewise the concerns within graphic processing tasks will not be always due to randomness yet often due to vagueness in addition to ambiguity. Fuzzy strategies enables us to handle these problems effectively.

5. References

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