

A Comparative Study on Various Image Enhancement Techniques

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Abstract: *In this Paper, simulation technique is explained in the field of digital image processing. With the help of simulation, various image enhancement techniques are implemented. After reading this paper, anyone can easily understand the complex process of digital image processing. It is proved that Frequency Domain is better than Spatial Domain.*

Keywords: *Simulation, Frequency Domain, Spatial Domain, PSNR, NCC.*

I. INTRODUCTION

Reenactment is a virtual portrayal of the truth .It is the way toward knowing the attributes and displaying conduct of a specific physical framework. Once in a while any new student faces some issue to see any physical framework conduct however in the event that he sees the pragmatic utilization of the framework at that point can comprehend it effectively. That is the reason the critical genuine methods of picture upgrade, for example, fundamental dark level strategies, utilizing number juggling and intelligent activities, utilizing spatial separating and furthermore in the recurrence area different channels like Low Pass Filters, High Pass channels have been recreated on Matlab and examined.

In this paper, different picture upgrade strategies, their methodology, applications and their necessities have been talked about. Numerous mimicked consequences of these strategies are additionally talked about. Nowadays equipment execution of the Image preparing are being done however for the correct usage the best possible comprehension of the procedure is must. In this paper, it is reasoned that the reenactment of these mind boggling methods make the student significantly more agreeable to comprehend the different recreation result.

A. Image Enhancement Techniques:

The target of Image upgrade is to process an Image to get the outcome which is more appropriate than the first Image for a particular application. Picture Enhancement approach extensively characterized into two classifications: Spatial Domain and Frequency Domain strategies. The term spatial area alludes to picture plane itself, and methodologies in this class depend on coordinate control of pixels in an image.[3]

Recurrence space preparing procedures depend on altering the Fourier change of a picture. In this paper both the spatial and in addition recurrence area techniques have been talked about.

II. LITERATURE SURVEY

S.N.	Year	Title	Author's Name	Methodolgy	Identified Problem
1	2006	A Study on Image Enhancement Techniques for Fingerprint Identification	Anto Melvin Paul	Enhancement using filtering techniques	Wavelet filtering technique is complex and time consuming than other existing filtering techniques
2	2007	Simulation of Image Enhancement Techniques Using Matlab	Atul Bansa, Rochak Bajpai, J. P. Saini	Butter worth Low Pass Filter, Ideal High Pass Filter, Gaussian Low Pass Filter, Butter worth High Pass Filter	These filters cannot produce much attractive results in many cases and they result in results in noise amplification when the images has major low intensity area
3	2012	Image Enhancement and Image Quality Analysis using Fuzzy Logic Techniques	Alexey Saenk, Galina Polte and Victor Musalimov	Edge detection methods, fuzzy sets, image quality analysis, fuzzy image enhancement methods	This technique imbalance the colour of the output image which leads to degraded edges
4	2014	Image Enhancement in Spatial Domain: A Comprehensive Study	Shanto Rahman, Md. Mostafijur Rahman and Khalid Hussain, Shah Mostafa	Peak signal to noise ratio (PSNR), MSE	Synthetic enhancement occurs as well as fails to preserve brightness for non-symmetric distribution

			Khaledand Mohammad Shoyaib		
5	2015	Image Enhancement Techniques: A Study	P. Janani, J. Premaladha and K. S. Ravichandran	Various filters to identify which filter is efficient in removing particular noises by comparing the values obtained in PSNR and MSE values	It suffers from two problem : Blurring and Ringing caused due to undulation associated with spatial domain filter

III. METHODOLOGY

A. Histogram Equalization:

Histogram balance (HE) is a critical system and is utilized as a part of general for picture improvement [1]. To upgrade a given picture, HE tries to spread the pixels power of that picture in view of the entire picture data. Accordingly, there may be where some low force pixels are changed with a high rate and make over-improvement.



Fig. 2.(a). Original MRI Image

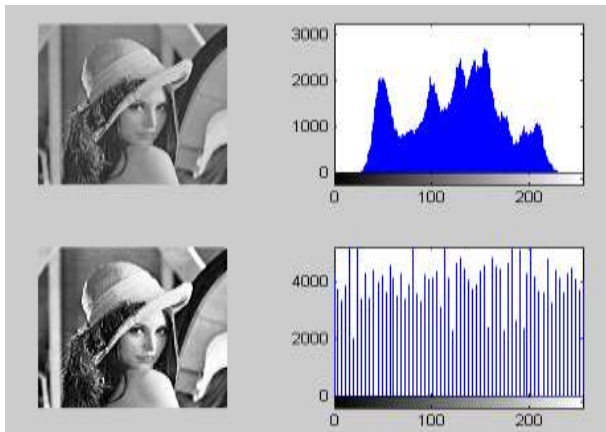


Fig. 1. Test Images for Lena with Histogram Equalisation

B. Spatial Domain:

In this segment Image Enhancement in spatial space has been examined. The different essential dark level changes utilizing scientific tasks are talked about underneath: Image Negative [1]: The negative of a picture with dim levels in the range [0, L-1] is acquired by utilizing the negative change, which is given by the articulation (1)

$$s = L - 1 - r \tag{1}$$

where r and s mean the estimations of pixels when the preparing. Turning around the force level of a picture in this way delivers what might as well be called a photographic negative. This sort of handling is especially suited for improving white or dark detail installed in dull locales of a picture. For instance, as appeared in the Fig. 3. (an) and Fig. 3. (b) A MRI Image in therapeutic framework is taken and the Image Negative procedure is connected on that Image. [3]



Fig. 2.(b). Processed MRI Image

C. Frequency Domain:

Recurrence area is just the space characterized by estimations of the Fourier change and its recurrence factors. In this segment different Image improvement Techniques in recurrence area are being examined. Sifting in recurrence space is very basic and clear. Here after pre-preparing the picture the Fourier change of the picture is being taken which is being duplicated by the channel capacity and after that the reverse Fourier of the item is being taken and the Image is being recovered after post handling.

The different points of interest in the Image, for example, edges and commotion are the consequence of high frequencies while low frequencies are in charge of the general dim level appearance over smooth zones. A channel which passes low frequencies and constricts high frequencies are called Low Pass Filter and keeping in mind that invert is the situation for High pass Filters. Low Pass Filter: Three kinds of low pass channels have been considered and reenacted that are i.) Ideal ii.) Butter worth and iii.) Gaussian channel. Low pass channel is utilized for smoothening (obscuring) the picture by weakening particular high-recurrence segments. As we move from perfect to Gaussian the smoothness increments and furthermore the issue of

ringing diminishes as plainly appeared in the Fig. 3(a), (b), (c) and (d).



Fig. 3. (a). Original Image



Fig.3 (b). Ideal Low Pass Filter



Fig. 3.(c). Butter Worth Low



Fig. 3.(d).Gaussian Low Pass Filter

High Pass Filter: High Pass channel plays out the switch activity as talked about for the low Pass Filter. Three sorts of High Pass channels have been considered and reenacted that are I.) Ideal ii.) Butter worth and iii.) Gaussian channel. High Pass channel is utilized for honing the picture by weakening particular low-recurrence segments. With respect to Low pass channel the Butter worth high pass channel gives a change from the honing of Ideal High Pass channel to Gaussian High Pass Filter as appeared in the Fig. 4 (a), (b), (c) and (d).



Fig. 4.(a). Original Image



Fig. 4.(b). Ideal High Pass Filter



Fig. 4. (c). Butter Worth High



Fig. 4. (d). Gaussian High Pass Filter

IV. RESULT ANALYSIS

Upgrade or change of the visual nature of a picture is a subjective issue since it could shift from individual to individual. Through quantitative estimations, we need to set up a scientific verification of whether the nature of a picture is improved or not. Despite the fact that quantitative assessment of picture upgrade isn't a simple undertaking because of the satisfactory foundation, we survey the execution of improvement methods utilizing four quality measurements, for example, PSNR, NCC.[1] is utilized for estimating the contrast amongst information and yield picture. Table II. From the Table II, we can presume that high distinction exists in HE and EHS implies that the rate of improvement or changing is high in HE and EHS. Subsequently, HE

creates high rate of relics which is likewise demonstrated by subjective evaluation of the picture.

1) *Peak Signal-To-Noise Ratio*: In a large portion of the cases the more the PSNR, the better visual nature of the picture has. Table I speaks to discrete measurable information of PSNR for each picture in the wake of applying upgrade systems .From the factual outcome, we can infer that LDR has the most elevated PSNR in the majority of the cases. Along these lines, for this situation the execution of LDR is ideal.

Table 1. PSNR (Peak Signal-To-Noise Ratio)

Image Name	HE	HMF	LDR
Cameraman	19.1	26.68	33.22
Bean	11.76	19.13	12.69
Building	9.10	19.30	23.61
Women	8.74	8.76	22.64

2) *Normalized Cross-Correlation*: Normalized cross connection is utilized for estimating the distinction amongst information and yield picture. Table II. From the Table II, we can infer that high distinction exists in HE and EHS implies that the rate of upgrade or changing is high in HE and EHS. Therefore, HE creates high rate of antiques which is additionally demonstrated by subjective evaluation of the picture.

Table 2. NCC (Normalized Cross-Correlation)

Image Name	HE	HMF	LDR
Cameraman	1.09	1.06	0.96
Bean	1.23	1.02	1.00
Building	1.09	1.04	1.00
Women	0.58	0.27	2,48



(a). Original



(b). HE



(c). HMF



(d). LDR

Fig. 5. Test Image for Cameraman



(a) Original



(b) HE



(c) HMF



(d) LDR

Fig. 6. Test image for Beans



(a) Original



(b) HE



(c) HMF



(d) LDR

Fig. 7. Test Image for Building



(a) Original



(b) HE



(c) HMF



(d) LDR

Fig. 8 Test Image for Woman

V. CONCLUSION

The above dialog and different outcomes inferred that sifting in the recurrence space is easier and more proficient for a similar size of channel in spatial area. The execution of picture upgrade systems is surveyed by a few assessment measurements. Utilizing PSNR metric we can presume that LDR performs best. In Cross-Correlation, the greater part of the cases HE have the most elevated amount of improvement that implies HE has the most extreme rate of deviation between the first and the upgraded picture.

VI. REFERENCES

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