Comparison between two forms of Unsharp Masking enhancement method

Nahla Ibraheem Jabbar Al-Dhifery
Ms.C in Computer Science
Babylon University

Abstract

Unsharp masking method is used to improve the visual quality of an image in order to enhance the edges of image. Edges enhancement means first isolating the edges in an image, amplification them and then adding them back into the image. In this work, demonstrate this method in two forms, comparison between them and detect the best form to perform the edges enhancement that is giving suitable results which makes it more pleasant to the human eye.

First form of unsharp masking enhancement method:-

Unsharp masking approach for image enhancement as a fraction of the high pass filtered image is added to the original one to form the enhanced image, the input output relation:-

X'=x+lamda*z

Where **X**': output enhanced image, **x**: orginal image, **z**: process image after applied high pass filter, **lamda**: is represent as adaptive control of details added to image is used.

Figure (1) is shown the unsharp masking structure using high pass filter and taken parameter for gray level adjustment [1,2].

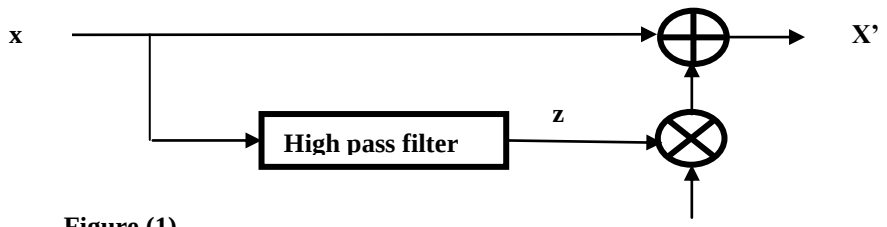

Figure (1)

Second form of unsharp masking enhancement method:-

This method applied to avoid the week point in previous unsharp masking method, figure (2) illustrated a procedure steps for enhancement

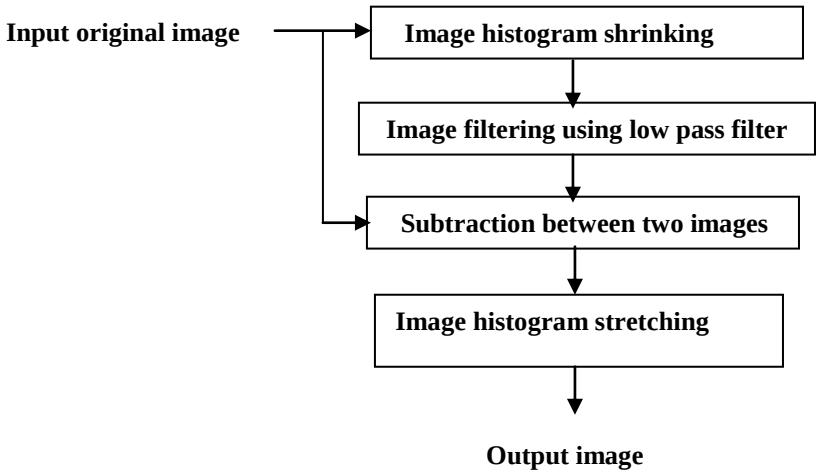

Figure (2)

The low pass filter is applied on the original image (mean filter or median filter) . By scaling the low pass with histogram shrinking, we can control on the amount of edge emphasis desired, when the shrink increased the greater edge emphasis[2,3].

$$shrink(i,j) = ([shrink_{\max} - shrink_{\min}]/[I_{\max} - I_{\min}])[I - I_{\min}] + shrink_{\min}$$

I: is represent the image intensities (gray level value of image)

$I_{\max}$: is the largest gray level value in the image I

$I_{\min}$: is the smallest gray level value in I

$shrink_{\max}$ & $shrink_{\min}$ correspond to the maximum and minimum desired the compressed histogram.

Subtraction happened between the original image and the image after shrink, means that the subtraction happened between the slowly changing edge (low pass filter) and the faster change (original image). The visual effect of casing overshoot and undershoot at the edge which effect on the emphasizing the edge. The image contrast can be restored through stretching the histogram of the image after subtraction process. The stretch equation:-

$$stretch(i,j) = ([I((i,j) - I_{\min}]/[I_{\max} - I_{\min}]) * [\max - \min] + \min$$

$I_{\min}$ & $I_{\max}$ represent the minimum and maximum values of the image.

min and max are represent the stretch range[5,6,7].

Implementation and Results:-

Two forms of unsharp masking enhancement method are applied on two examples that are present in Fig. (3) and Fig. (5), the result after performing this method illustrated in Fig. (4) and Fig. (6). In the first form, must be focused on the selection of lamda values, lamda values ranged from 0 into 1 which is depend on the nature of image. In the second form, the selection of shrink and stretch range depends on the image histogram.

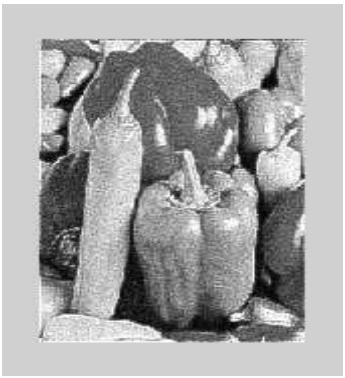

Figure (4a), the first form of the method with lamda = (0.3)

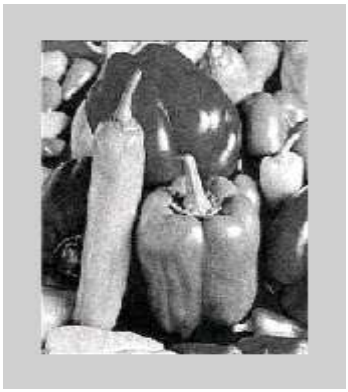

Figure (4b), the second form of method with shrink range (20to60) stretch range (0to300

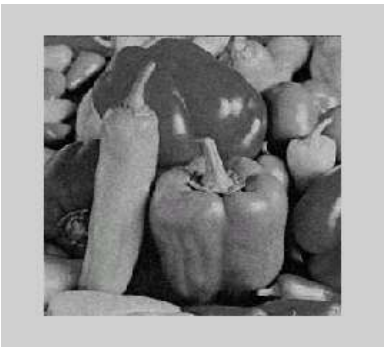

Figure (3), the first example

Figure (6a), the first form of the method with lamda = (0.6)

Figure (6b), the second form of method with shrink range (0to500)& stretch range (0to65)

Figure (5), the second example

People use the second form of unsharp masking rather than a sharpening filter because sometime, blurring is physically easier than sharpening (e.g. with photography or because of computational advantages(reduce change of overshoot) [3]

Conclusion:-

The first form of unsharp masking method is simple, but it has two major drawbacks: first it enhances the noise present in the image, second it enhances too much the sharp transitions which leads to excessive overshoot on sharp edges. The second form which introduced in the previous section is less

sensitive to noise. It tries to avoid the noise amplification through used another form to the unsharp masking method that is give a suitable results which makes it more pleasant to the human eye. Simulations results show that the processed image by the second form of this method presents sharp edges which make it more pleasant to the human eye. Moreover, the amount of noise in the image is clearly reduced which compared with the first form of method that created some of problem.

References:-

[1] Gonzalez R.C. and Woods R.E., "**Digital Image Processing**", Addison-Wesley publishing company, 1992.

[2] William K.Pratt, "Digital Image Processing ", Tohn Wiely, USA, 1978.

[3] Scott E. Umbaugh, ***"Computer Vision and Image Processing: Practical Approach Using CVLP tool***s", Prentice Hall PIR, 1998.

[4] ***"Image Processing Toolbox for Use with Matla***b", the Math Works Inc., 1993.

[5] Anil K.Jain, ***"Fundamentals of Digital Image Processing*** ", Prentice, Hall of India, 2000.

[6] W.David Schwaderer, ***"Digital Imaging in C and the World We***b", Wordware Publishing Inc., 1997.

[7] R.Weeks, Jr., ***"Fundamentals of Electronic Image Processin***g", Published by IEEE Press, 1996.

.