ISSN 2395-1621

Construction of Filter for Image Smoothing

#1Gaur Sachin, #2Gudhatwad Laxman, #3Deshmukh Ishwar, #4Prof. P.R.Badadapure

[1]ishwar.deshmukh8@gmail.com
[2]laxmanpg11@gmail.com
[3]sachingaur95@gmail.com

#123Department of Electronics and Telecommunication
#4Prof. Department of Electronics and Telecommunication

JSPM's Imperial College of Engineering and Research, Wagholi.

ABSTRACT

A new image processing filter is proposed. In order to construct this image smoothing filter, one dimensional discrete Fourier invariant signal generated by an iterative design principle based on gradient descent method is used. The filter shape and values in spatial and frequency domain is almost the same. The smoothing filter can be used as a kernel matrix in image processing to perform blurring as well as high frequency noise suppression. Also used as an optimal two dimensional window for spatial-frequency spectral analysis of images.

Keywords : **Image enchantement, 1D conversion, 2D conversion, Kernal matrix.**

ARTICLE INFO

Article History

Received :16th March 2016

Received in revised form : 18th March 2016

Accepted : 20th March 2016

Published online : 23rd March 2016

I. INTRODUCTION

All Fourier invariant signals have very interesting property of shape invariance in time as well as in frequency domain, for example Gaussian signal, Dirac delta function, and hyperbolic secant functions. Two practical methods for the design of one dimensional (1D) discrete Fourier invariant signals are proposed in. The direct design method involves splitting the signal into independent and dependent parts and calculation of the dependent for any independent part by using an obtained connection matrix. This method has accuracy problem for long signals. The iterative design method overcomes the accuracy problem and it is based on a successive approach by using any symmetrical discrete signal as the input. In this paper we use iterative method for the generation of 1D discrete Fourier invariant signals and interpolation techniques are then used to construct a two dimensional (2D) signal. Unlike the 2D Gaussian signal, the 2D signal obtained from this method is not only Fourier invariant but also have almost the same size in spatial domain and frequency domain.

II. LITERATURE SURVEY

Fourier invariant signals have property of shape invariance in time as well as in frequency domain, for example Gaussian signal, Dirac delta function, and hyperbolic secant functions. Two practical methods for the design of one dimensional (1D) discrete Fourier invariant signals are proposed in reference "Maja Temerinac-Ott, and Miodrag Temerinac, "Discrete Fourier invariant signals: design and application", IEEE transactions on Signal processing, vol. 60, no. 3, pp. 1108-1120, March 2012 " This method has accuracy problem for long signals. So, in current proposed method we are using iterative design method overcomes the accuracy problem and which is applicable for long signal transmission also and it is based on a successive approach by using any symmetrical discrete signal as the input.

III.PROPOSED SYSTEM

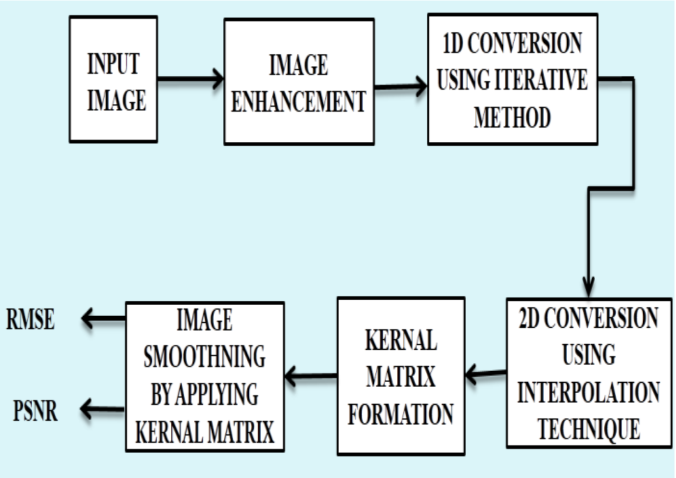

Fig 1. Block diagram

Input image:

An image is nothing more than a two dimensional signal. It is defined by the mathematical function f(x,y) where x and y are the two co-ordinates horizontally and vertically. The value of f(x,y) at any point is gives the pixel value at that point of an image. The image is nothing but a two dimensional array of numbers ranging between 0 and 255.

The RGB color model relates very closely to the way we perceive color with the r, g and b receptors in our retinas. RGB uses additive color mixing and is the basic color model used in television or any other medium that projects color with light. It is the basic color model used in computers and for web graphics, but it cannot be used for print production.

The secondary colors of RGB – cyan, magenta, and yellow are formed by mixing two of the primary colors (red, green or blue) and excluding the third color. Red and green combine to make yellow, green and blue to make cyan, and blue and red form magenta. The combination of red, green, and blue in full intensity makes white.

Iterative method:

First we are considering image as an input signal from that we form 1D signal by iterative method.Then we are forming a kernel matrix. That kernel matrix is used as filter, this kernel filter is used as image smoothing application.Input image is converted into 1D form by iterative method principle based on gradient descent method.Which is having the shape of filter same in spatial domain as well as in frequency domain.The accuracy problem are reduced by using iterative method and it is based on a iterations.The termination criteria is used to terminate the number of iterations in iterative method.Gradient descent method is also called as steepest descent, or the method of steepest descent. steepest descent is a first-order optimization algorithm. To find a local minimum of a function using gradient descent, one takes steps proportional to the negative of the gradient (or of the approximate gradient) of the function at the current point. If instead one takes steps proportional to the positive of the gradient, one approaches a local maximum of that function; the procedure is then known as gradient ascent.

Advantages of Iterative Method:

1) Iteration matrix is virtually unaltered by most method.
2) Methods are generally self-correcting.
3) Methods are generally simple to program.

Interpolation method:

From 1D signal it will convert into 2D form and that 2D form is used as Kernel Matrix.

Interpolation algorithm generate 2D matrix.

The mesh grid method used to generate two arrays containing the x- and y-coordinates at each position in a rectilinear grid. for e.g. [X,Y] = mesh grid(-5:1:5) returns two 11×11 matrices.

The X matrix defines the x-coordinates and the Y matrix the y-coordinates at each position in an 11 × 11 grid.

A finer sampling of the function can be obtained by decreasing the step size, for example using meshgrid(-5:.2:5,-10:.2:10).

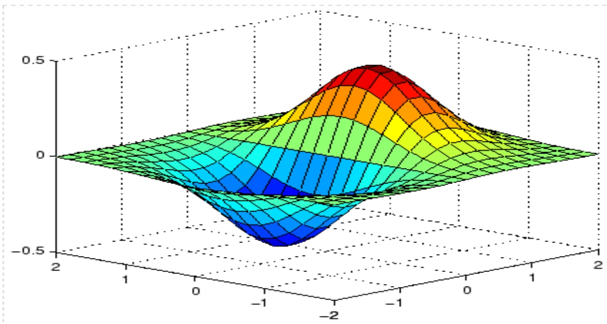

Fig 2. Mesh grid

After converting 1D signal into 2D signal by using interpolation method (i.e meshgrid method). After 2D signal, formation of 2D matrix has to be done. This 2D matrix is used as a kernal matrix. This kernal matrix is applied on any image to smooth the image. Amount of smoothness of image is depended on the standard deviation, and also by using kernal matrix we can calculate RMSE(Root means square error),PSNR(Peak Signal to noise ratio) of image.

Formulaes:

RMSE (Root Mean Square Error**):** From these we can calculate error rate of our desired system

$$MSE = \sum \left(S_{original} - S_{noisy}\right)^2$$

$$RMSE = \sqrt{MSE}$$

Peak Signal to Noise Ratio:

PSNR = 10 * log10 (256*256/MSE)

IV. APPLICATION AND ADVANTAGES

ADVANTAGES:

1. Computationally efficient.
2. The degree of smoothing is controlled by deviation σ(larger σ for more intensive smoothing)
3. Remove noise & adequate smoothing of image by blurring.

APPLICATIONS:

1. It is applicable in digital image processing system to suppress noise.
2. for long distance transformation in communication vision.

V. CONCLUSION

The 2D Fourier invariant kernel matrix constructed using the discrete Fourier invariant signal generated by the iterative method can be used as a novel image smoothing filter which provides optimum spatial localization and high frequency noise suppression. It can also be used as an optimal 2D window for spatial-frequency spectral analysis of images.

REFERENCE

[1] Maja Temerinac-Ott, and Miodrag Temerinac, "Discrete Fourier invariant signals: design and application", IEEE transactions on Signal processing, vol. 60, no. 3, pp. 1108-1120, March 2012.

[2] A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, Signals and Systems. Englewood Cliffs, NJ: Prentice-Hall, 1997.

[3] Rafel C. Gonzalez, Richard E. Woods, Digital Image Processing. Third edition, Prentice-Hall, 2008.

[4] D. Marr; E. Hildreth, "Theory of edge detection" Proceedings of the Royal Society of London. Series B, Biological Sciences, Vol. 207, No. 1167, Feb. 29, 1980), pp. 187-217.

