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Efficient VLSI Design for Image Zooming Using Bilinear Zoom Technique

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ABSTRACT: In this paper Proposed an Image Zooming of a bilinear ZOOM Technique method is been used to improve the quality of the Scaled image. Image scaling processor is using VLSI technique. A high quality algorithm is proposed which includes sharpening spatial filter and clamp filter used as a combined filter to pre-process the image before interpolating. This increases the quality of the image and as well reduces the drawbacks such as aliasing artefacts produced from bilinear interpolator. some of the other major improvements of this algorithm say utilization of T & inverse T model kernel for combined filter consists of RCU (reconfigurable calculation unit) to control filter operations reduces the memory buffer and Hardware, Reduction in the bilinear interpolation computation results in lesser area for the design in VLSI intern increases the speed and reduces power, cost of overall implementation

KEYWORDS: Bilinear Interpolation, Sharpening filter, Gaussian filter, Smoothening filter.

I. INTRODUCTION

Bilinear interpolation method has high quality and low complexity. By using bilinear interpolation algorithm the target pixel can be obtained by using the linear interpolation model in both of the horizontal and vertical directions. Bicubic interpolation is often chosen over bilinear interpolation or nearest neighbor in image resampling, when speed is not an issue. It is another popular method uses an extended cubic model to acquire the target pixel by a 2-D regular grid. Image scaling has been widely applied in the fields of digital. & imaging devices such as digital cameras, digital video recorders, digital photo frame, high-definition television, mobile phone, tablet PC, etc. An obvious application of image scaling is to scale down the high-quality pictures or video frames to fit the mini size liquid crystal display panel of the mobile phone or tablet PC. As the graphic and video applications of mobile handset devices grow up, the demand and significance of image scaling are more and more outstanding. Interpolation algorithm, by which the target pixel can be obtained by using the linear interpolation model in both of the horizontal and vertical directions. Another popular polynomial based method is the bicubic interpolation algorithm, which uses an extended cubic model to acquire the target pixel by a 2-D regular grid.

II. LITERATURE SURVEY

R.S. KARTHIC1 et.al [1] in this paper proposed a Method for Very Large Scale Integration implementation of an image scaling processor. The anticipated image scaling algorithm consists of a clamp filter, spatial filter and a bilinear interpolation. The spatial and clamp filters are added as pre-filters for reducing the aliasing artifacts resulted by the bilinear interpolation. A T-model and inversed T-model convolution kernels are proposed to reduce the complexity of the design.

John Moses et.al [2] Described for a Image interpolation is widely used in many image processing applications, such as digital camera, mobile phone, tablet and display devices. Image interpolation is a method of estimating the new data points within the range of discrete set of known data points. Image interpolation can also be referred as image scaling, image resizing, image re-sampling and image zooming. This paper presents VLSI (Very Large Scale Integration) architecture of an area efficient image interpolation algorithm for any two dimensional (2-D) image scalars.

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Arul jothi et.al [3] Proposed a Method for The most widely used scaling method is the bilinear interpolation algorithm, by which the target pixel can be obtained by using the linear interpolation model in both of the horizontal and vertical directions. Another popular polynomial based method is the bicubic interpolation algorithm, which uses an extended cubic model to acquire the target pixel by a 2-D regular grid. In recent years, many high-quality non polynomial-based methods have been proposed.

III. PROPOSED SYSTEM

Our proposed method involves few approaches as shown in Figure 1. Initially an input color image is taken and resized. The resized image is then subjected to sharpening filter to remove the blurring effect. This image is then passed to Gaussian filter block to remove the noise encountered in the image. The output of which is written into a text file. This text file is later fed to VLSI7 module of bilinear interpolation using Xilinx software. After applying this interpolation algorithm the output of which is again stored into a text file. This text file containing pixel values are again reshaped to obtain a zoomed image. To obtain the better enhanced image the zoomed image is again fed into bloom filter block to obtain the final smoothened image.

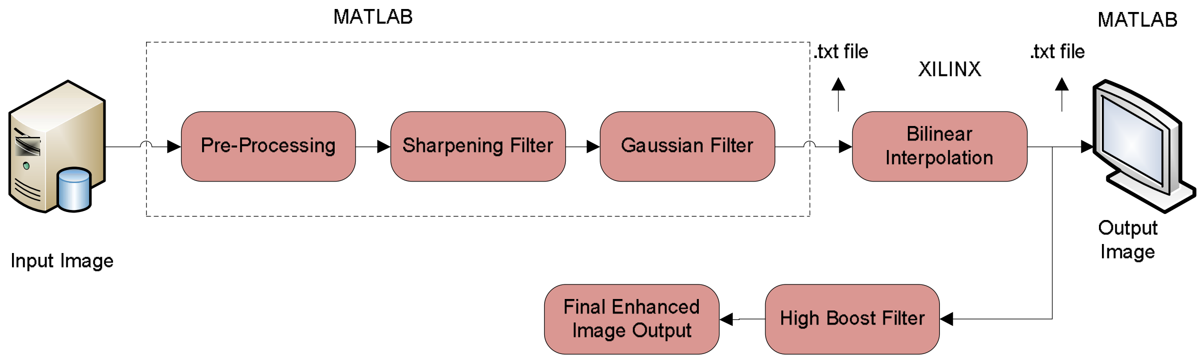

Figure 1: Block Diagram of Proposed System.

A. Sharpening Filter

The sharpening l filter, a kind of high-pass filter, is used to reduce blurring artifacts and defined by a kernel to increase the intensity of a center pixel relative to its neighboring pixels. The clamp filter, a kind of low-pass filter, is a 2-D Gaussian spatial domain filter and composed of a convolution kernel array. It usually contains a single positive value at the center and is completely surrounded by ones. The clamp filter is used to reduce aliasing artifacts and smooth the unwanted discontinuous edges of the boundary regions.

Sharpening filter involves adding signals that are proportional to the high pass filter version of the original image. Figure 2 illustrates this procedure. These are often referred to as un sharp masking on a one dimensional input. As shown in the figure the original image is first subjected to a high pass filter that extracts the high frequency components which is then scaled and added to the original image thus producing a sharpened image of original. The signals having homogeneous regions of the signals where the signals remain constant remain unchanged. The operation involved during this is represented by equation 1,

$$S_{i,j} = x_{i,j} + \lambda F(x_{i,j}) \qquad (1)$$

Where $x_{i,j}$ is the original pixel value at the coordinate (i, j), F (.) is nothing but the high pass filter. λ Is greater than or equal to zero which is a tuning parameter and is the pixel which is sharpened at the coordinate (i, j). Depending on the grade of sharpness desired, the λ value is taken. Sharpness of an image is increased as the λ parameter increases. Choosing the high pass filter in the operation is the key point in the effective sharpening process. The mask used for the process is given in equation 2.

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$$W = \frac{1}{3}\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix} \qquad (2)$$

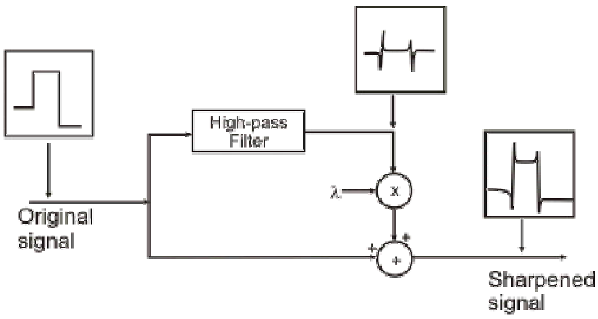

Figure 2:Sharpening Filter

B. Gaussian Filter

Gaussian filtering is used to blur images and remove noise and detail. In one dimension, the Gaussian function is given as in equation 3.

$$G(x) = 1/(2\pi\sigma^{\wedge}2)e^{\wedge}(\frac{x^{\wedge}2}{[\sigma]^{\wedge}2)} \qquad (3)$$

Where σ is the standard deviation of the distribution. The distribution is assumed to have a mean of 0. But when this is working with image we need to use two dimensional Gaussian function and it is given by the equation 4.

$$G(x) = 1/(2\pi\sigma^{\wedge}2)\sigma^{\wedge}(\frac{x^{\wedge}\,2 + y^{\wedge}}{[2\sigma]^{\wedge}2)} \qquad (4)$$

C. Bilinear Interpolation

Interpolation is the process of determining the values of a function at positions lying between its samples. It achieves this process by fitting a continuous function through the discrete input samples. This permits input values to be evaluated at arbitrary positions in the input, not just those defined at the sample points. The process of interpolation is one of the fundamental operations in image processing. The image quality highly depends on the used interpolation technique.

In the proposed scaling algorithm, the bilinear interpolation method is selected because of its characteristics with low complexity and high quality. The bilinear interpolation is an operation that performs a linear interpolation first in one direction and, then again, in the other direction. The output pixel can be calculated by the operations of the linear interpolation in both x- and y-directions with the four nearest neighbor pixels. The target Pixel can be calculated by III.

$$P_{k,1} = (1 - dx) \times (1 - dy) \times P_{(m,n)} + dx \times \qquad (1)$$

$$\times P_{(m,,1,n)} + (1 - dx) \times dy \times P_{(m,n+1)} + dx \times dy \times P_{(m+1,n+1)} \qquad (2)$$

Where $P_{(m,n)}$,$P_{(m,n+1)}$,$P_{(m+1,n)}$, and $P_{(m+1,n)}$and$P_{m+1,n+1)}$are the four nearest neighbour pixel of the original image and the dx and dy are scale parameters in the horizontal and vertical directions it costs a Considerable in the horizontal and vertical direction. It costs a considerable chip area to implement a bilinear interpolator with eight multipliers and seven adders. thus, an algebraic manipulation skill has been used to reduce the computing resource of the bilinear interpolation.

D. High Boost Filter

This filter is simulated by a simple Averaging Kernel/Mask along with a Subtraction and an addition. The quality of the scaled output image is significantly enhanced using the HBF. The bilinear interpolated image is fed in to averaging filter to obtain a smoothened image. This smoothened image output is added with the bilinear interpolated image to get the sharpened image. This sharpened image is added with the bilinear interpolated image to get the final enhanced image [3].

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IV. RESULTS

Outputs obtained at each stage of the process using Matlab and Xilinx is explained briefly below. Fig 1 depicts the input color image of size 128×128. This image is fed into sharpening filter block to get sharpened image as shown in Fig 2. To remove the noise in the image a Gaussian filter is applied to it to get an image as shown in Fig 3. The Matlab zoomed image using bilinear interpolation algorithm after applying high boost filter is shown in Fig 4. In the same way the Xilinx zoomed image obtained after all this procedure is shown in Fig 5. The top level diagram of the bilinear interpolation algorithm is shown in Fig 6. The Final output wave form is shown in Fig 7.


Fig 1.Color Image


Fig 2. Sharpened Image


Fig 3.Clamped Image


Fig 4. Matlab Zoomed Image

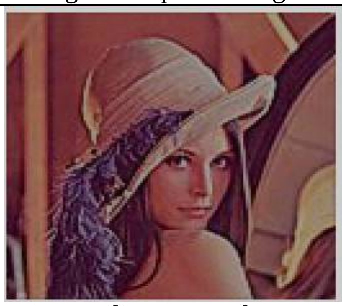
Fig 5. Xilinx Zoomed Image

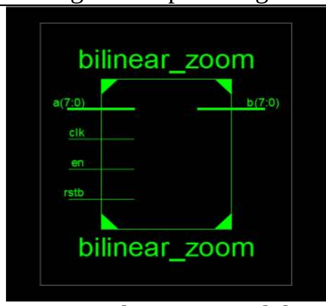

Fig 6. Xilinx Top Module

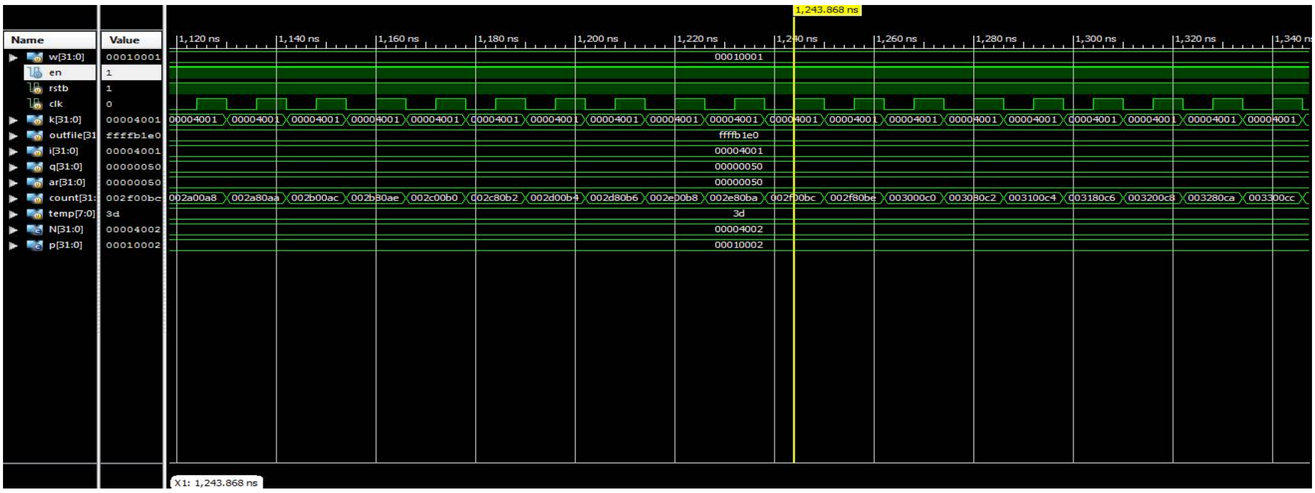

Fig 7.: Bilinear Interpolation Waveform

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V. CONCLUSION

On this Paper Conclude all the scaling techniques are useful for real time image processing. Each technique is different and gives appropriate results for each technique. Everyday new scaling technique is evolving hence selection of suitable scaling technique will lead to maintain the quality of the image and success in scaling process. And VLSI architecture of bilinear interpolator and combined filter was presented for image scaling application. This method consists of three steps such as filtering of images using clamp and spatial 2D filter, bilinear interpolation and VLSI implementation. The computational complexity of function is decreased by combined filter and algebraic manipulation of the bilinear Zoom Technique.

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