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An Area Efficient And High Quality Image Processing Using WLS Filter

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ABSTRACT

In this paper, a low complexity adaptive, edge preserved, less memory requirement, less area and high performance algorithm is proposed for very large scale integration implementation of image processing.This image processing algorithm consist of weighted least square filter, spatial filter and final reconstruction step which is used to reconstruct the output image .Here the weighted least square filter along with spatial filter is known as hybrid spatial filtering. Edge preserving technique is introduced here to reduce complexity and also to reduce halo effect. Compared with the previous methodologies, this work shows better performance with respect to cost and complexity.

Keywords -weighted least square filter, edge preservation, final reconstructionstep.

I. INTRODUCTION

An image processor also called image scaling engine is a specialized digital signal processor used for image processing in digital cameras, mobile phones or other devices. Digital image processing is the use of computer algorithms to perform image processing on digital images. It allows much wider range of algorithm to be applied to the input data and can avoid problems such as the built-up of noise and signal distortion. Image processing allow the use of much more complex algorithms and hence can offer both more sophisticated performance at simple tasks and the implementation of methods which would be possible means.Image filtering allows us to apply various effects on pictures.The trick of image filtering is that we have a 2D filter matrix, and the 2Dimensional image. Then, in the image for each pixel, take

the sum of products. Everyproduct is the color value of the current pixel , with the corresponding value of the filter matrix.in filter matrix.the current pixel is multiplied to the centre pixel .The filters with convolution are relatively simple. More complex filters, that can use many different functions, exist and can do much more complex things (for example the Colored Pencil filter in Photoshop.) Image filters aren't feasible for real time applications and games even today, but they're useful in image processing.Electronic filters and digital audios work with convolution as well, but in 1D.Filtering and Enhancing Images describes methods to enhance images for either human consumption or for further be emphasized orsuppressed automatic operations.

II. EXISTING SYSTEM

This section consist of bilinear interpolation, edge detector and sharpening spatial filter with one linebuffer memory, controller, register bank providing the inputs for edgedetector and sharp filter.

A. Register bank

The register bank is used to store the image pixels.The register bank design can receive only one value of pixel in each time and provide eight values of neighboring pixels as inputs of edge detector and sharp spatial filter.

B. Edge detector

The points at which image brightness changes sharply are typically organized into a set of curved line segments called edges.Edge detector is used to detect the edges . Thereby it reduces the loss of edge information. Edge detection is a fundamental tool in image processing. And edge enhancement improves contrast.

C. Sharpening spatial filter

The sharpening spatial filter which is a kind of high pass filters, can be used to not only enhance the edges but also it removes low frequency noise.in the images.This filter sharpen the image which is very similar to finding edges, original imageis added, and the image after the edge detection , and the result will give a new image where the edges are to be enhanced, and hence it looks sharper. The result will be an image with the same brightness as the original, but it looks little sharper.

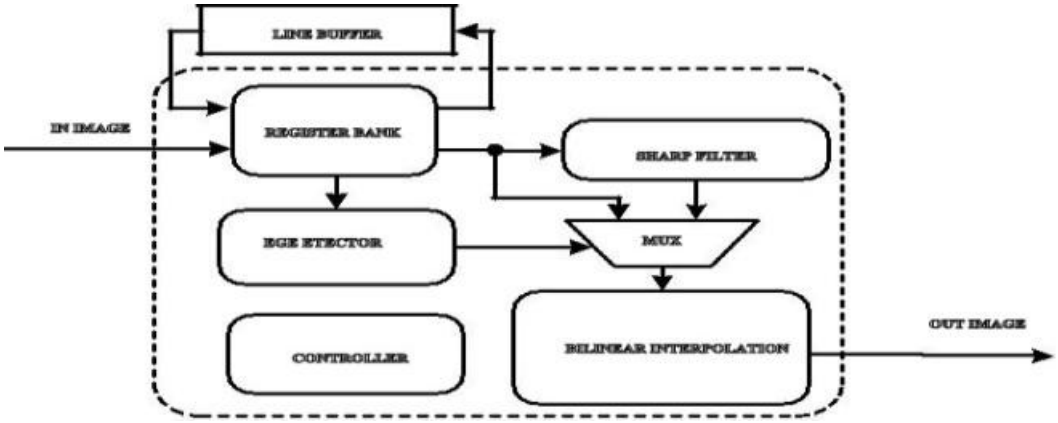

Fig 1.Block diagram of image processing using edge enhancement technique.

D. Controller

The controller is realized by the finite state machine (FSM) which consist of registers and combinational circuits. The controller gives shift commands to make able to the shift registers in the register bank and read/write positioning in the line buffers. The controller also generates signals to control pipelining and timing schedule of the simple bilinear interpolation.

E. Multiplexer

The control signal (M_ctr) in the multiplier is produced by the edge detector, bywhich the multiplexer (MUX) can select source values from the register bank as inputs or filtered values from the sharp filter for bilinear interpolating.

III. PROPOSED WORK

Images are often corrupted by random variations in intensity, illuminations andpoor contrast therefore the image cannot be used directly.so, wegofor filtering process. Filtering process is nothing it transforms pixel intensity values to reveal certain image characteristics.Edge preservation is proposed here. This section begins with weighted least squarefilter, spatial filter, and final reconstruction step(FRS).

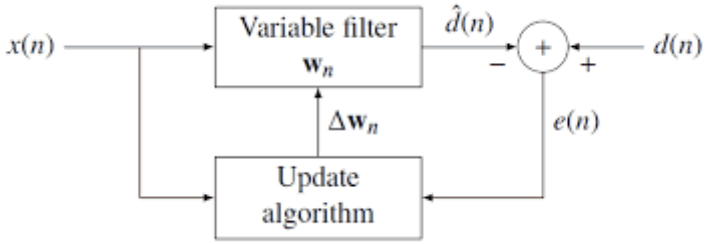

Fig 2. Algorithm diagram for edge preservation

A. Edge preservation

Weighted least square filter is used topreserve the edgesinstead of enhacing them and hence delay time is reduced.Edge enhancement can be applied in image only having noise up to threshold levelso, Edge preservation technique is introuced.Edge preservation increases processing speed of image.

B. Weighted least square filter and spatial filter

Weighted least square filter is a filter that preserves edges and its information an also removes noise in least square error method.The weighted least squares (WLS) adaptive is an algorithm which recursively finds the filter coefficients that minimize a weighted linear least squares cost function relating to the input pixels.This is in contrast to other algorithms such as the least mean squares (LMS) that aim to reduce the mean square error. In the derivation of the WLS, the input image are considered deterministic, while the LMS and algorithm similar to that they are considered as stochastic.the WLS exhibits extremely fast processing of image.It is introduced here to overcome halo effect.The weighted least square filter combine with spatial filter forming hybrid spatial filter.The spatial filter used here consumes more clock cycles.Thereby it reduces delay also.

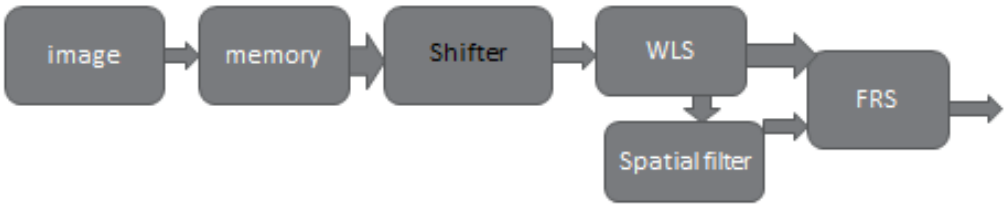

Fig 3. Image processing using weighted least square filter

C. Final reconstruction step

Final reconsruction step or bilinear interpolation is used to combine the filtered or reconstructed image.It also used to determine the intensity of the pixels.

IV. RESULTS AND DISCUSSIONS

To obtain the qualities of the images by various algorithms, the Mean Square Error (MSE) is used to quantify a noisy approximation of the refined image and the original image. In this approach, the m × n refined image is considered as a noisy approximation of the original image. The mean squared error (MSE) is defined as:

$$MSE=1/MN\sum\sum[P(I, J)-Q(I, J)]^2 \quad (1)$$

where M and N are the width and height of the original image. Moreover, the quality of the image can be obtained from the parameter called PSNR.The peak signal to

noise ratio (PSNR) is used for this objective and is measured as

$$psnr = 10log10(\max)\text{^}2/(mse) \quad (2)$$

Since each pixel is represented by eight bits, the maximum value of each pixel (MAX) is 255. Hence, the PSNR value can be calculated.Peaksignal to noise ratio is the ratio between the maximumpossible power of a signal an the power of corrupting noise that affects the fidelityy of its representation. Higher the PSNR value shows that the better image quality.First step is the conversion of image into text file.It is done by using matlab.Then we further simulate it in modelsim.The filtering process is done by modelsim.The output is compared using quartus 9.1.So, therefore to evaluate the qualities of this work matlab tool is used to produce the PSNR values of the refined image and the original image.

Fig 4.input image

Fig 5.output image with enhanced edge

Fig 6.output image without enhanced edge

Fig 7.WLS image

A. WLS image

Here also input image is converted into text first by using matlab and then further simulation is done using model sim.

V. COMPARISION TABLE

Table 1.comparision of various parameters

OUTPUT PARAMETERS	EXISTING SYSTEM	PROPOSED WORK
AREA(TOTAL NO. OF LOGIC ELEMENTS)	690	264
FREQUENCY	59.8Mhz	283.21Mhz
DELAY	16nS	3ns
PSNR	11.73	31.88

CONCLUSION

In this paper, a novel adaptive edge preservation technique is presented to develop a low cost, highquality, less delay and high processing image processing method. Thus by using this technique, area(i.e total no. of logic elements)is reduced. And delay time is reduced(i.e processing speed of image). Also quality had been improved by the parameter PSNR(PEAK SIGNAL TO NOISE RATIO).The VLSI architecture of this workwas implemented by using Verilog and simulation is done by using modelsim.The output parameters of this work can be achieved through quartus 9.1.

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BIOGRAPHIES

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