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Image Quality Improvement Using Adaptive Post Filtering

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***Abstract*– Nowadays, mobile and video gaming has become more popular in younger generation. When an image gets displayed from one type of display unit to other, the down-sampling or Super-sampling is used. Down-sampling is used to display a high resolution image on the device supporting low resolution. During down sampling there are the chances of data loss which effectively blurs the image. So, to avoid this data loss we use the adaptive post filtering technique. This method is useful for low-cost mobile applications such as computer game consoles and palm computers, where the important design factors are low implementation cost and low power consumption. The main motive for this work is to allow human beings to obtain an image of high quality or the descriptive characteristics of the original image. There are different algorithms available for the same but it has some advantages as well as disadvantages. Here in this paper, the positive results of two different algorithms have been clubbed together to get better results and overcome with the drawbacks of both methods by getting improved results.**

***Index Terms*– Aliasing, Anti-aliasing, Curve fitting, Adaptive Post Filtering, Edge detection and Pixel re-shading**

I. INTRODUCTION

ALIASING of an image is an artifact occurred when the Nyquist criterion is not satisfied. In computer synthesized images, Aliasing is observed in which smooth curves and other lines become jagged. This is because the resolution of the graphics device or file is not high enough to represent a smooth curve. Due to aliasing the stair case or the zigzag effect can be clearly observed on the edges of the letter as shown in Fig 1. In the past few years a large number of algorithms for anti-aliasing of an image have been developed. Different techniques like the Z-Buffer method and Super-sampling method have been used to reduce this aliasing effect. But many drawbacks still persist. Therefore, we have chosen the adaptive post filtering approach to overcome the existing drawbacks.

This technique involves fitting curves to the discontinuity edges extracted from the aliased images and reshape those edge pixels. Our method involves very little increase in computational and memory cost as possible. It is particularly suitable for low-cost mobile applications such as computer game consoles and palm computers, where the important design factors are low implementation cost and low power consumption. It will also improve the visual quality with a very little increase in computational cost, and therefore will improve battery power consumption. . Other techniques like the super sampling and z-buffer method face the disadvantages such as high computational and memory costs.

II. LITERATURE SURVEY

Aliasing or the stair case effect is mostly observed in case of the computer synthesized images. This aliasing effect has many disadvantages. Different methods have been proposed to minimize this aliasing effect. But these methods suffer from high computational and memory costs. In this paper, the objective is to develop a low-cost anti aliasing method that would reduce the aliasing problem of output video images in various gaming environments. The different algorithms to overcome aliasing effects are:

A) Z-buffer method

It is also called as Visual Surface Determination (VSD) algorithm and is used in the management of image depth coordinates in three- dimensional (3-D) graphics. It is one solution to the visibility problem, which is the problem of deciding which elements of a rendered scene are visible, and which are hidden [1], [4].

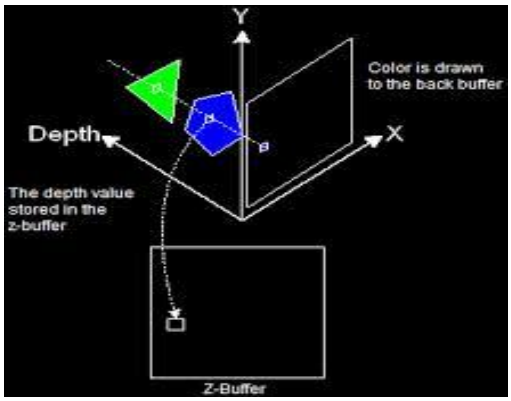

Fig. 1. Z-buffer approach

The Fig. 1 shows how the z-buffer algorithm helps in management of image depth coordinates in three-dimensional (3-D) graphics. It shows how the depth of a generated pixel (z coordinate) is stored in a buffer (the z-buffer or depth buffer).

B) Super sampling method

To solve the aliasing problem, most systems also apply the super sampling technique [1], [6]. This is done by taking colour samples at several instances inside the pixel (not just at the center as normal), and an average colour value is calculated.

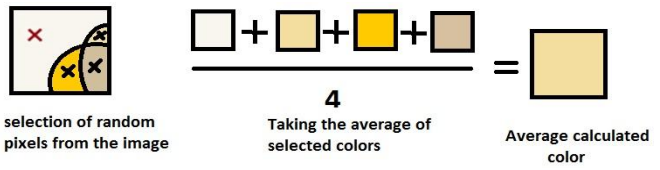

Fig. 2. Super sampling approach

Fig. 2 shows the concept of super sampling and the manner in which it is performed. But this method requires a large computation time and the overall cost required is also large.

III. ADAPTIVE POST FILTERING

This figure (Fig. 3) shows the system architecture of adaptive post filtering. This shows all the steps required for the process. Image acquisition involves capturing of real time and off time images and converting those images to a suitable form. The second step i.e., the image enhancement involves different processes like RGB to Graylevel conversion and histogram equalization of the image. Edge detection technique aims at identifying points in a digital image at which the image brightness changes sharply or has discontinuities. The filter implementation is the point where the adaptive post filtering comes into picture and the required algorithm is implemented on the image. The Pixel Re- shading block is used to compute the color value of each pixel with the re shade bit set where the re-shade bit is used to indicate if the pixel should be re-shaded. Then the image reconstruction block is used to remove the aliasing effect by calculating the average of all the theta values and the curve is made smooth. Finally, the anti-aliased image is obtained.

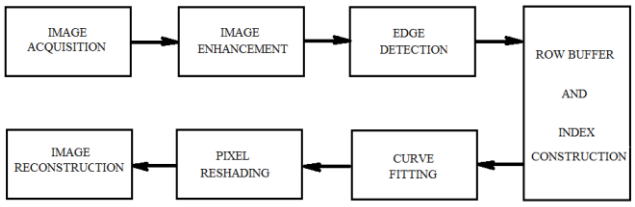

Fig. 3. System architecture

A) Algorithm and flow chart

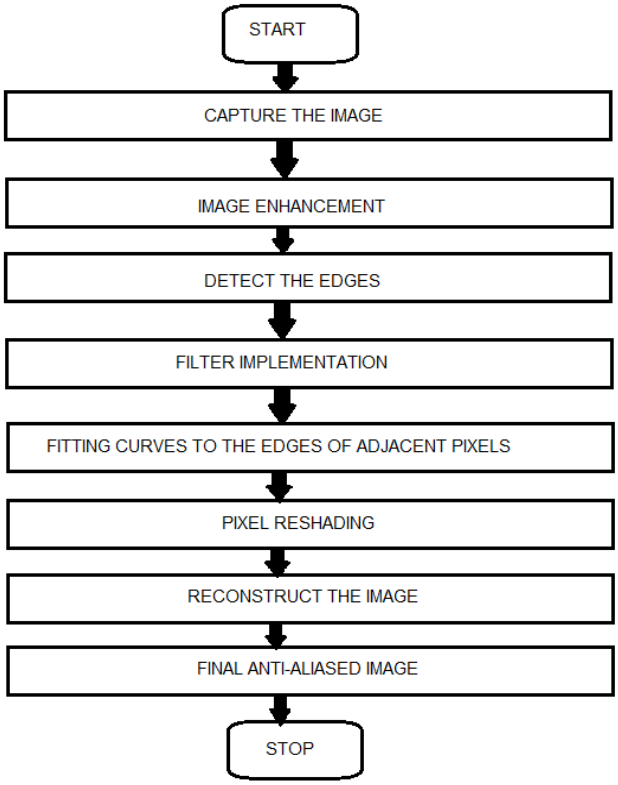

Fig. 4. Anti-aliasing Technique

Fitting of the curves

The edge pixels are linked up in order to fit a curve. To link up these edge pixels two important techniques are used- 8 connected approach and the chain coding method. In general an edge pixel named P_n has two pixels P_{n-1} and P_{n+1} neighbouring it. Sometimes there may be more than two edge pixels surrounding. A generalized criteria for selecting the neighbouring edge pixels is as follows:

- Due to smaller Euclidean distance for 4connected neighbours as compared to the diagonal neighbours they are given more preference.
- If the above stated criteria does not satisfies then we select the one that continues from previous edge direction.

Forming the indices

To join the edge pixels we have considered 5X5 pixel region, centered at the edge pixel to be re-shaded. For this a bit mask of 5X5 pixel region is proposed to be constructed with each edge pixel having a value “1” and each non edge pixel having value “0”. This bit mask is very helpful in obtaining many types of information such as the theta value, details of the fitted curve and the location of the background and the foreground colour.

Forming the index table

This index table is calculated in MATLAB software. This table contains 5X5 blocks based on the overall size of the image. The theta value for each of the curve present in that 5x5 block is calculated and feed in the index table. Finally the

average of all these theta values is calculated and the anti-aliased image is obtained.

IV. RESULTS AND ANALYSIS

These are the results obtained up till now; the result in Fig. 5 shows various image enhancement techniques implemented on the image. These include obtaining grey image from the original image, histogram equalization, and edge detection.

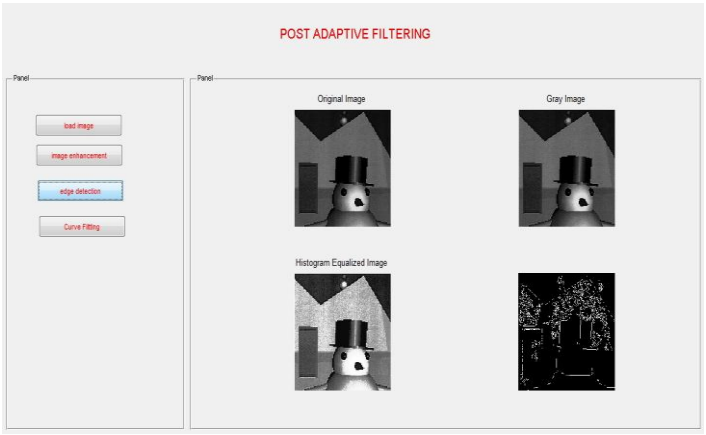

Fig. 5. Image enhancement techniques

Index table

The Table I shows the values of theta for each 5X5 block. The positive and negative sign of theta depends on the clockwise and anticlockwise shift of the curve. To remove the aliasing effect the average of all these values is taken and finally the curve is made smooth.

These rows and columns are the corresponding pixels for an image and contain the theta value for those pixels.

Table I: Index table

Rows / Columns	1	2	3	4	5	6	7	8	9
1	90	0	0	0	0	0	0	0	0
2	90	0	0	0	0	0	0	0	0
3	90	0	0	0	0	0	0	0	0
4	90	0	0	0	0	0	0	0	0
5	90	0	0	0	0	0	0	0	0
6	0	-52.67	0	0	0	0	0	0	0
7	0	0	-34.09	-28.15	0	0	0	0	0
8	0	0	90	11.30	-83.95	0	0	0	0

GUI developed for adaptive post filtering

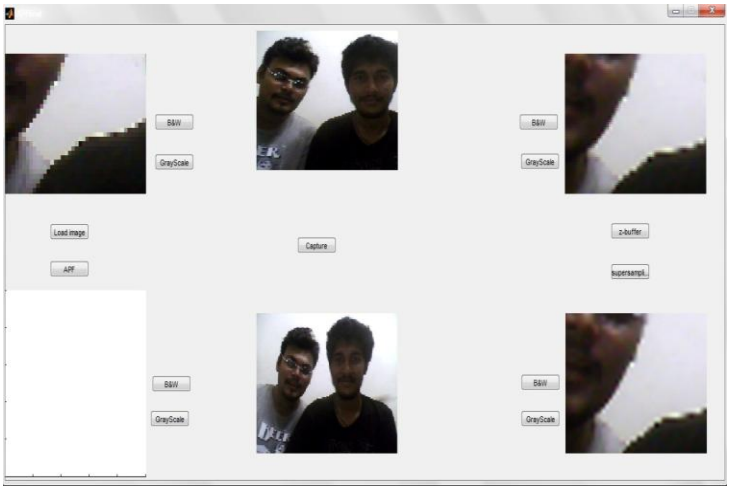

Fig. 6. GUI showing comparisond with other algorithms

V. CONCLUSION AND FUTURE SCOPE

In this paper, techniques like curve fitting and post filtering are used for anti aliasing. First, all the possible edge patterns are identified and curves are fitted to each of these patterns. Pre-computation of index table is done to store all the fitting information. To form indices into this table, the local edge patterns are used to obtain the desirable information for re-shading. In conclusion, the adaptive post-filtering method is very simple to implement and efficient. The analytical comparison of its strengths and limitations with other techniques is done. Also, demonstration of this performance has been carried out.

- Applications of adaptive post filtering are echo cancellation, image enhancement, and noise cancellation.
- It is used to reduce blocking effects and ringing noise in decompressed images.
- It is used for low-bit-rates image coding, because it restores the decoded image with low computation complexity.
- This method can also be used to reduce the aliasing problem of output video images of various gaming environments.
- The processed data obtained from this method can be used to assist in locating the discontinuity edges with a higher accuracy. Also, the pre processing time can be kept low using this process.
- Image restoration is an important and widely studied problem in computer vision and image processing. This problem can be solved with the help of adaptive post filtering.

REFERENCES

[1]. Rynson W. H. Lau, An Efficient Low-Cost Anti aliasing Method Based on Adaptive Post filtering, IEEE Transactions on circuits and systems for video technology, Vol. 13, No. 4, March 2003.

[2]. Paulo S.R. Diniz, Adaptive Filtering Algorithms and Practical Implementation, Chapter 1, Kluwer Academic Publishers.

[3]. Rafael C. Gonzalez,Richard E. Woods & Steven L. Eddins, "Digital Image Processing using MATLAB", Chapter 1 & 2, 2nd Edition Gatesmark Publishing 2009.

[4]. Suranek, P. Mahdal, M. Tuma, "Comparison of antialiasing filters in A / D converters," Carpathian Control International Conference (ICCC), 2013, Vol. 03, pp.373-376, 26-29 May 2013.

[5]. Maule, M. Comba, J.L. Torchelsen, R. Bastos, "Transparency and Anti-aAliasing Techniques for Real-Time Rendering," Graphics, Patterns and Images Tutorials (SIBGRAPI-T), 2012, Vol. 2, pp. 50-59.

[6]. Lu Fang, Ketan Tang, Katsaggelos, "Antialiasing Filter Design for Subpixel Downsampling via Frequency-Domain Analysis," Image Processing, IEEE Transactions, Vol. 21, No. 3, pp.1391-1405, March 2012.

[7]. Kai Guo, Xiaokang Yang, Hongyuan Zha, Weiyao Lin, Songyu Yu, "Multiscale Semilocal Interpolation With Antialiasing," Image Processing, IEEE Transactions on Image processing, Vol.21, No.2, pp.615-625, Feb 2012.