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Survey on Image Scaling With Edge Detection and Interpolation Methods

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Abstract

Image scaling is widely used for digital image processing.Image scaling deals with tradeoff betweenefficiency, sharpness andsmoothness. Resizing of image leads to undesirable softening of image.Obtaining high resolution images after scaling becomes utmost important. This paper tells us about the various existing edge detection and interpolation methods used for scaling of image.

Keywords: *SharpeningFilter,Edge detector, Interpolation algorithm.*

1.INTRODUCTION

Image scaling is all about resizing a digital image which involves tradeoff between efficiency,sharpness and smoothness.Image scaling is used in various applications such as image zooming, sharpening of image , computer vision,etc. Resizing of an image results in loss of quality of image. Many interpolation algorithms have been proposed for image scaling. Along with these interpolation algorithms the use of filters and edge detectors helps to improve the quality of image and obtain high resolution image.

This paper is a survey about different existing interpolation algorithms,filters and edge detectors. The paper is organised as follows In section 2 we discuss about the use of filter,edge detector and interpolation algorithms for scaling. In section 3 , literature review. In section 4 ,conclusion of the above survey is given.

2.SHARPENING FILTER, EDGE DETECTOR AND INTERPOLATION ALGORITHMS

2.1 *Sharpening Filter*

Sharpening refers to techniques for enhancing the transition intensity.Digital images need sharpening to overcome the effects of interpolation and anti-aliasing filters.Sharpening is done to enhance the line structures and other details in an image.The sharpening process depends on the choice of High Pass Filter. Image sharpening consists of adding a signal to the original image proportional to a High Pass Filter of original image.

2.2 Edge Detector

Edge detector is of fundamental importance in image processing. It detects the sharp changes in the edges or image discontinuities and filters out less relevant information , while preserving important properties of an image. Edge detector is used for image segmentation and data extraction in image processing , machine vision, etc.

2.3 .Interpolation Algorithms

A *Nearest Neighbour Algorithm*

It is the simplest of all the algorithms. It takes the nearest twopixel value and outputs new pixel value. This algorithm is very simple to implement but it suffers from blocking and aliasing artifacts resulting in jagged images.

B *Bilinear Interpolation*

It is an extension of linear interpolation. It is selected because of its high quality and low complexity. It takes the weighted average of the four nearest pixel and outputs new pixel value.It reduces the anti-aliasing effects.

C *Bicubic Interpolation*

This interpolation produces a smooth ,less blurred image and has negligible artifacts. This method provides better scaling compared to nearest neighbour and bilinear interpolation.It uses the value of nearest 16 pixel and obtains the output. This technique is more complex and requires more memory and can be used whenever speed is not an issue.

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3. LITERATURE SURVEY

1)Real- Time Canny Edge Detection Parallel Implementation for FPGAs

This paper [1] presents a parallel canny edge detection technique which uses an edge detection algorithm for image processing.

Canny edge detector uses an edge detection algorithm which detects sharp changes in the edges even in the presence of Gaussian noise. It was developed by John F. Canny in 1986. In his paper, he followed a list of criteria to improve current methods of edge detection. The first and most obvious is low error rate. It is important that edges occuring in images should not be missed and that there be no responses to non-edges. The second criterion is that the edge points be well localized. In other words, the distance between the edge pixels as found by the detector and the actual edge is to be at a minimum. A third criterion is to have only one response to a single edge. This was implemented because the first 2 were not substantial enough to completely eliminate the possibility of multiple responses to an edge.

2) A Real-Time High Performance Edge Detector for Computer Vision Applications

This paper [2] presents an edge detection architecture for image processing applications.
Most of the edge detection algorithms have been proposed in order to detect the strong and weak edges. So an edge detection algorithm based on ADM (absolute difference mask) is shown in this paper. In order to efficiently carry out image processing. In order to detect the edges this ADM performs three stages of processing.The Edges produced are localised and single pixel wide. The three stages include (1)semi –Gaussian filter is applied. (2) Finding edge strength and (3)producing final edge map.The ASIC design was laid out and fabricated using Samsung's 0.8pm double-metal CMOS process.

3) An Efficient Architecture of Extended Linear Interpolation for Image Processing

This paper [3] presents one of the interpolation technique such as extended linear interpolation which is compatible with bicubic interpolation. It provides a low-cost and high-speed hardware architecture.
Extended linear interpolation improves the quality of linear interpolation. Extended linear interpolation uses first and third order polynomial interpolation method and also includes co-ordination calculation unit. This method decomposes horizontal and vertical interpolations.

4) An Efficient Low cost Image scaling Technique for less power Consumption

This paper [4] presents a method of improving the image quality while scaling by using a image scaling algorithm that consists of a spatial filter,clamp filter along with bilinear interpolation.

Sharpening spatial filter is a kind of High Pass Filter and can be used to reduce the blurring effects.
Clamp filter is a kind of Low Pass Filter and is used to reduce the aliasingartifacts and also smoothens the unwanted discontinuous edges.These two filters are combined and used to reduce the blurring and aliasing artifacts produced by bilinear interpolation.In order to reduce the complexity and memory consumption of sharpening filter and clamp filter T-model and inversed T-model convolution kernels are proposed.

5) Spline based Interpolation methods For Image Magnification

This paper [5] tells us about various existing interpolation algorithms and comparisons between these algorithm and how to improve these techniques.

Some of the algorithms are nearest neighbour algorithm, bilinear algorithm and bicubic interpolation.

Nearest neighbour algorithm is the fastest method but it suffers from aliasing and blurring effects. So bilinear interpolation can be used to overcome this which calculates unknown pixels but consumes more memory compared to nearest neighbour algorithm.Bicubic interpolation is another complex method which produces negligible artifacts and requires more memory. So spline based interpolation provides more clear image without loss in image detail. It improves the sharpness of image , and has low computaional complexity, smooth behaviour , and easy to implement.

6) Cubic Convolution Interpolation for Digital Image Processing

This paper [6] presents cubic convolution method for image scaling.

Modified cubic convolution developed by Rifman and Bernstein is discussed in this paper and it is compared with other interpolation techniques. The interpolation kernel must be symmetric and ensures smooth and continuous

interpolation. This cubic convolution method has accuracy between that of nearest neighbour and linear interpolation.The image produced by it will be slightly sharper and will not have disjointed appearance compared to other interpolation methods.

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4. CONCLUSION

In this paper, different types of edge detector and various interpolation techniques as seen in [1], [2], [3], [4] ,[5] and [6] are over viewed. Bilinear Interpolation based algorithms are used to obtain a low memory, high quality and high resolution image after scaling. Because of its simple architecture and low complexity it can be efficiently implemented.

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