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Color Edge Detection Based On The Fusion Of Hue Component And Principal Component Analysis

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ABSTRACT
This paper evaluates the performance of HUE, PCA and fusion of HUE and PCA based colour edge detection techniques. Edge detection has found to be most significant part of many critical vision applications. It really results in the black and white (binary) image where each object is differentiate by lines (either black or white). Edges are basically the location in the image where sharp changes exist. It's been discovered that the all of the existing techniques has neglected the utilization of colours while detecting the edges however in many applications an area could be categorized in relation to the colour. This paper indicates that a majority of the existing techniques fail in the event of images with complex background.

Index terms: Edge detection, PCA, Hue, Morphological operations.

INTRODUCTION

1.1 EDGE DETECTION

Edge detection [1] plays an important role in vision processing. Edge recognition may be term for some mathematical methods which target at classifying points in a image at that the image intensity varies sharply or, has discontinuities. The points where digital image intensity turns sharply are stereo typically ordered into some line segments called edges. The identical problem of discovering discontinuities in 1D signal is identified as step detection and the issue of discovering signal discontinuities over the full time is known as change detection. Edge detection is really a essential instrument in vision processing, machine vision and digital image processing, mainly in the aspects of feature recognition.

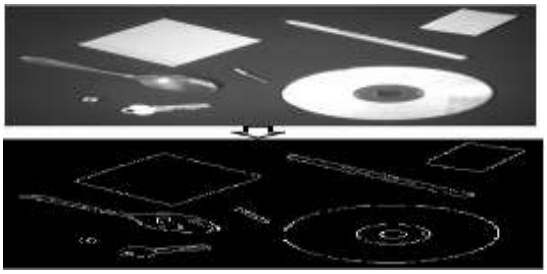

Figure 1 Edge detection

1.2 Principal component analysis (PCA)

PCA [2] is really a statistical method that uses the orthogonal change to transform some interpretations of probably interrelated variables into some principles of linearly uncorrelated variables named principal components. The amount of principal components is fewer than or corresponding to how many real variables. This conversion is well-defined in this way that the initial PCA gets the leading potential variance (i.e., accounts for the maximum amount of the variability in the information as possible), and each following module subsequently has the most variance possible beneath the restriction so it be orthogonal to (i.e., uncorrelated with) the sooner mechanisms. PCA are guaranteed to be autonomous if the information set is mutually generally disseminated. PCA is sensitive to the comparative scaling of the inventive variables.

1.3 Edge detection using PCA

Initially all the input image may be taken; then PCA transformation may be applied. Now any edge detector operator can be utilized to detect the edge in the PCA.

Figure 1.2: PCA based edge detection

Figure 1.2 has shown the results of the edge detected using the PCA.

1.4 Edge detection for hue component

From color image to grey-scale image, results in the effect that some edges are misused. Moreover, a lot of the missing edges be a consequence of hue changes.

Consequently, we are able to present an improved edge detection model for color image once the issue of edge detection of hue component.

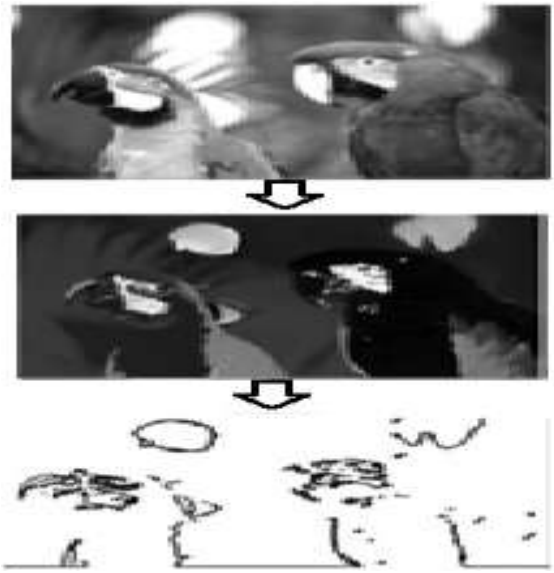

Figure 1.3: Edge detection using Hue components

1.5 Edge Fusion

Fusion is the method of merging significant information i.e. edges inside our case from several images right into a single final edge detected image. The resulting image may well be more informative than some of the input images.

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1.6 Morphological Thinning

Thinning is really a morphological operation that's utilised to eliminate selected foreground pixels from binary images. It's commonly used to tidy up the output of edge detectors by reducing all lines to single pixel thickness. Thinning is generally only placed on binary images, and produces another binary image as output. It is going to be used to get rid of unwanted points on the edges in an image.

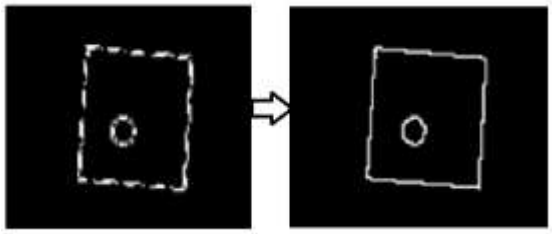


Figure 1.4: conversion of binary image into output image i.e. using thinning

2.LITERATURE SURVEY

Chen et al. (2010) [1] improved the efficiency and the performance of the color edge detection, a novel color edge detection algorithm has proposed. A better Kuwahara filter can be used to smooth the original image first. After edge detection with each channel independently in RGB color space, an adaptive threshold selection method is put on predict the optimum threshold value and an edge thinning algorithm is employed to extract accurate edge

XIAO et al. (2011) [2] has proposed a multi-scale edge detection algorithm which took soft threshold approach to implement detail improvement and noise reduced amount of the actual color image. Initially, obtaining the actual color images at different scales through wavelet multi-scale edge detection algorithm, then on the basis of the enhanced soft threshold filter function, selecting appropriate threshold of the obtained image edges to execute noise reduction while improve the edge information on the reservation; and finally, carrying out the weighted 2-norm fusion of edges of various-scale-image.

Wang and Yan (2012) [3] has presented a brand new edge detection approach centred on vector morphological operators in color image processing. A new vector ordering in RGB color space has proposed. And then by analysing the features of the noise contaminating image, vector morphological operators has proposed and these operators are applied in color edge detection.

Xu et al. (2012) [4] has proposed a novel approach of edge detection for color image to be able to efficiently preserve edge in noise appearance. Initially, multi-structure elements were created to be able to construct morphological gradient operators with performance of noise suppressing. After that, the color image is transformed from RGB to HSV color space because of the latter is reliable with human vision perception. At last, morphological edge detection operators in HIS color space centred on multi-structure elements has been presented.

Xin and Ki (2012) [5] has proposed a better Canny algorithm to detect edges in color image. Algorithm consists of these steps: quaternion weighted average filter, vector Sobel gradient computation, non-maxima suppression predicated on interpolation, edge detection and connection. Algorithm can also be applied to manage color images of transmission line icing.

Hao et al. (2013) [6] has studied that the premise of acquiring the clear object contour in traditional Canny operator is to create suitable parameters, does not need the adaptive ability. An adaptive Canny edge-detection technique is proposed which Cantered on Canny theory. Adopt the 3*3 neighbourhoods rather than canny algorithm in neighbourhood to calculate the calculation gradient. After that, the most between-class variance (Otsu) technique is employed to acquire the high and low thresholds.

Wang et al. (2013) [7] has discussed the issues that the standard edge detection algorithms are sensitive to noise and the surroundings of plate scene is complex, plate image is smoothed with Gaussian filter, and in contrast of edge images from non-subsampled contour let edge detection algorithm and multi-scale wavelet edge detection algorithm, a fresh algorithm, pulse coupled neural network edge detection algorithm centred on multi-scale wavelet

transform is proposed. Initially, multi-scale wavelet is employed to detect edge of smoothed plate image, and then pulse coupled neural network is employed to debar the fake edge, accompanied by binary calculation with K-means clustering algorithm.

Fu et al. (2013) [8] has compared both improved methods, which are improved Sobel operator and improved wavelet transform utilizing the multi-scale morphological filtering, subjective visual have achieved better results. However they will find benefits and disadvantages in objective evaluations. So improvement is further done by utilizing two improved techniques with the wavelet transform fusion technology. The experimental results indicates that the fused image has increased significantly in information entropy and the common gradient set alongside the improved SoBel operator, and it even offers improved the peak signal to noise ratio and the distortion degree set alongside the improved wavelet edge detection technique. The fused image can concentrate the benefits of both improved techniques together and make complementary benefits. Eventually, the great de-noising effect and complete edge are achieved

Ju et al. (2012) [9] has proposed a novel image segmentation algorithm on the basis of the adaptive edge detection and a better mean shift. Based on the ostu technique, an adaptive threshold algorithm has been placed on improve canny operator in edge detection. The edge detection technique has better performance and strong adaptability. Then resulting edge information is incorporated into the key two steps of image segmentation centered on mean shift. Considering that the discontinuity and homogeneity information are combined flexibly, the proposed algorithm takes the most effective of local and global image information.

Abid et al. (2013) [10] has proposed a fresh technique for image edge detection centred on multilayer perceptron (MLP). The technique is depends on updating a MLP to understand some contours drawn on a 3×3 grid and then make the most of the network generalization capacity to detect different edge details even for very noisy images. The technique is applied initial to Gray scale images and may be easily extended to color ones. The technique is effective even for surprisingly low contrast images which is why other edge operators fail.

Lei and Fan (2014) [11] has proposed a novel color edge detection technique on the basis of the fusion of hue component and principal component analysis to resolve the problems. Initial, a novel computational approach to hue difference is defined, and then it's put on classical gradient operators to acquire accurate edges for hue component. Moreover, complete object edges could be obtained utilizing the edge fusion of the initial principal component and hue part of color image with low-computational complexity. The proposed gradient operators are located to be very efficient to acquire better edge results for color images.

3.RESULTS

3.1 EXPERIMENTAL SETUP

3.2 SIMULATION RESULTS

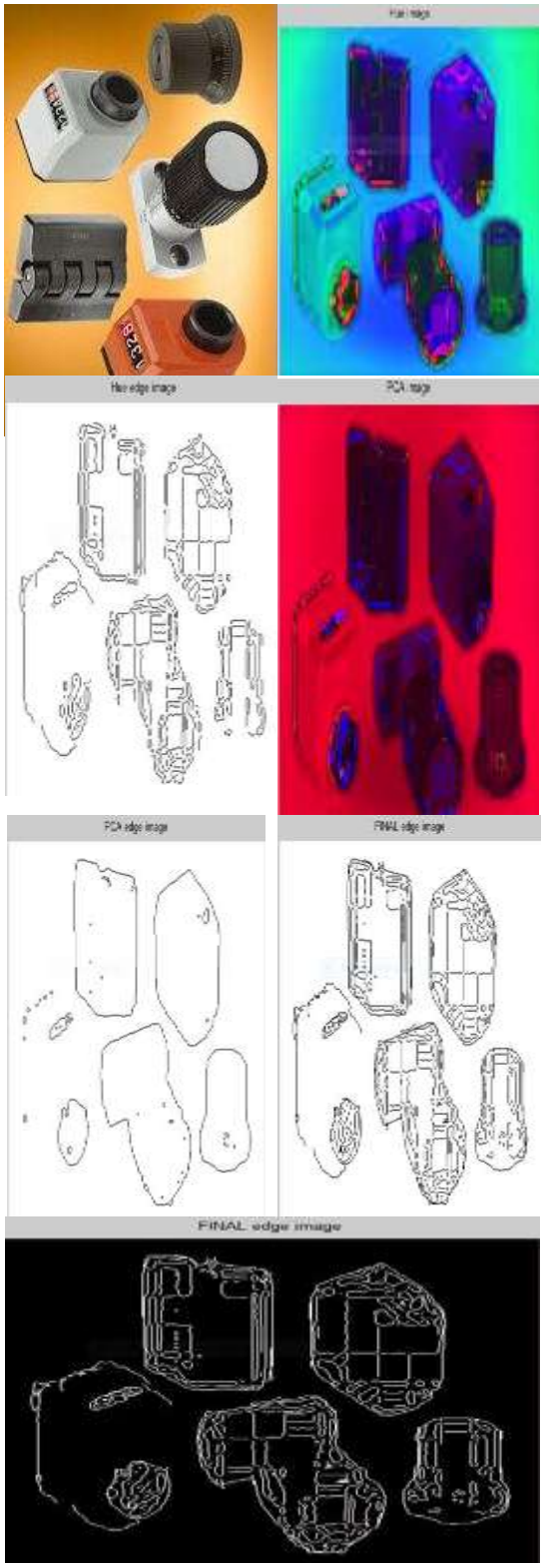
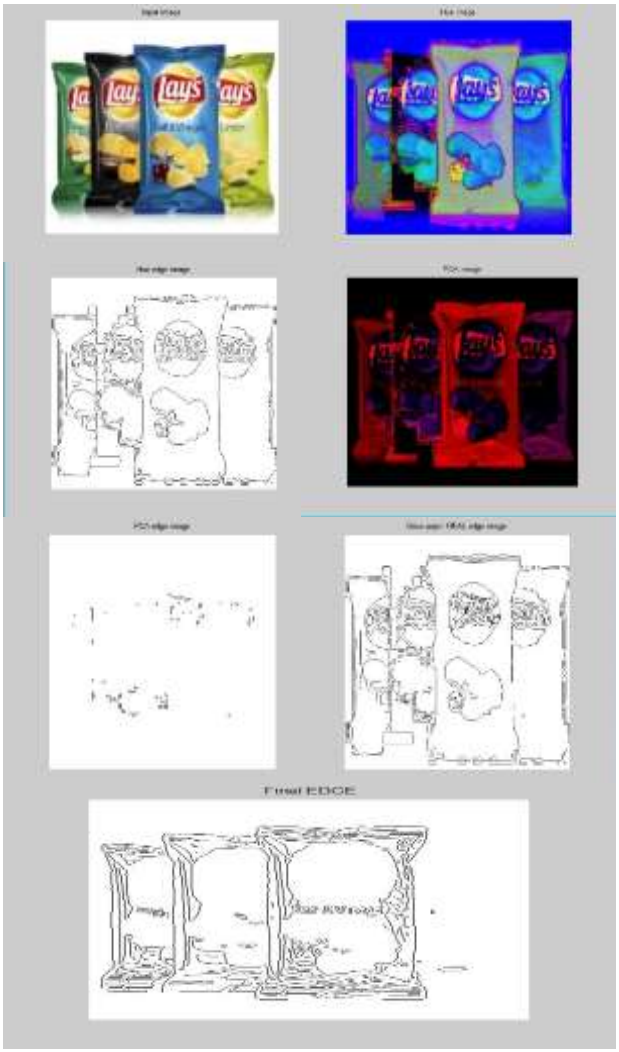


FIG: Input image ,hue image, hue edge image ,pca image, pca edge image, final edge image.

3.3 RESULTS EVALUATION:

S. No	MSE	PSNR	BER	PRATT	RMSE
1	36916	4.9173	0.2034	0.6408	139.21
2	19337	10.5338	0.0949	0.6532	139.0575
3	49888	2.3017	0.4344	0.6608	223.3562
4	46641	2.8863	0.3465	0.6763	215.9653
5	30719	6.51351	0.1535	0.6330	175.2684
6	32676	5.9770	0.1673	0.4495	180.7650
7	22988	9.0316	0.1107	0.4367	151.6179
8	4307	3.5765	0.279	0.462	207.552
9	46166	2.9752	0.3361	0.6672	214.8627
10	38993	4.4419	0.2251	0.4371	197.4665

4.COMPARISON BETWEEN PREVIOUS AND EXISTING TECHNIQUES



4.1 Comparison Results

Techniques	MSE	PSNR	F-MEASURE	ACCURACY	PRATT

Detection using hue component	**0.9046**	**48.5661**	**8.0479**	**8.0480**	**0.0943**
Detection using PCA component	**0.9273**	**48.4589**	**2.8688**	**2.8688**	**0.0920**
Detection using Existing technique based on the fusion	**0.1289**	**57.0289**	**94.7490**	**93.4117**	**0.8344**
Detection using fuzzy logic	**0.0749**	**59.3849**	**96.0454**	**95.3811**	**0.7980**

5. Conclusion& Future work

This paper has shown the performance of fusion of HUE and PCA based color edge detection techniques. This paper has centered on detecting the edges for the Hue aspect in Human visual system. Hue is generally represented by position importance, so the prevailing edge detection methods are incapable to correctly perceive edges of hue aspect in HSV color plane. As a consequence, the most used approaches of color edge detection typically neglect the role of hue factor, thus misplaced some edges set off by hue variations. This work has not considered any improvement in the existing technique. In near future we will propose a new color edge detection technique on the basis of the combination of hue factor and principal component analysis to eliminate the issues with existing methods

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