The Research of Thangka Buddha Gesture Detection Algorithm

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ABSTRACT

This paper describes both the meaning of split Thangka Buddha gesture and steps, then choice the Canny operator method of edge detection on the thangka Buddha's gesture.Through a simple way of human-computer interaction,the Buddha's gesture will be cut off from Thangka Buddha,and then make simulation experiments by software of Matlab.Finally,through analysis and comparison,expounds the advantages and disadvantages of the algorithm.

Keywords

Thangka;Gesture;ImageSegmentation;Edge Detection Introduction.

INTRODUCTION

Thangka is the Tibetan art treasures, it is a kind of unique painting art form in Tibetan culture.The Research of Thangka Buddha Gesture Detection Algorithm which have a profound effect on whole of thangka image segmentation region.Thangka image is different from the natural images.The natural images of color distribution, shape and texture characteristics have a certain regularity.However,Thangka images because of thousands of years opreservation,it texture are more or less shaken,the edges characteristics and gray distribution are too difficult to find its own rules.So this paper through the human-computer interaction,cut out the Buddha gestures in a rectangular area first,then split from the shape of the gesture area.

Algorithm Description

2.1 Image Segmen[1]tation

Image segmentation divided the image into each has its own features and non-overlapping area.Assuming that collection represents the whole image area,the image segmentation issue is to determine the subset R_k need to meet the following conditions:

(1) $I = \bigcup\limits_{k=1}^{K} R_k$

(2) $R_k \bigcap R_j = \phi, k \neq j$

(3) In a certain standard, each subset   of inner pixels must similar, but the pixel to the differences between different subsets.

(4) Each R_k is connected.

Image segmentation often use the target similarity and the difference between background and target to be achieved.Image segmentation need to find some similar characteristics, in this characteristic, the target interior is similar.

2.2 Edge Detection

At the junction of two large difference between two grayscale is usually the edges of the image,and the edges contain a wealth of information.Edge is detected, the image of the interested regions can be divided,so the algorithm is very important to detect edges.Edge detection methods can be divided based on the first derivative of the edge detection and second derivative-based edge detection.Based on the first derivative of the edge detection operators have gradient operator, the direction operator, Canny operator, etc.Second derivative-based edge detection operators have pull-operator, LOG operator, etc.This paper uses the Canny operator of Thangka image edge detection.

The simulation

3.1 Image acquisition and artificial shear

Thangka Buddha images are variety,morphological complexity,search for Buddha gesture in any images is very difficult.So choose the number of gestures which is obvious in the study of the images,and then use the appropriate software cut off Buddha gesture.The result is showed in Figure 1 and Figure2.
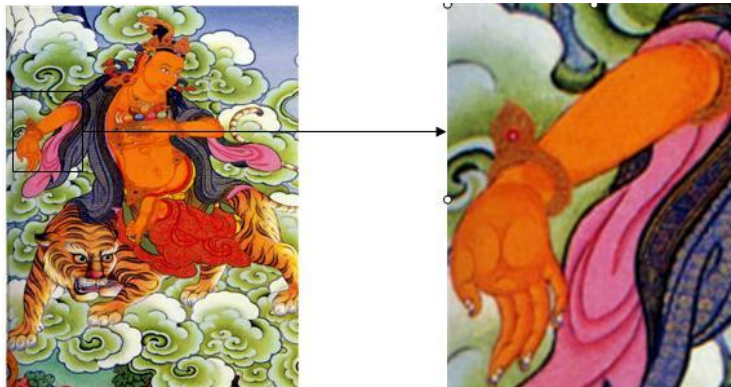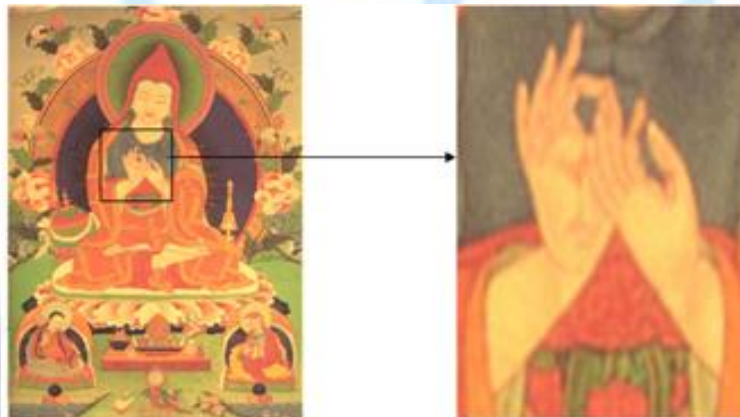
Figure 1:Gestures Cut

Figure 2:Gestures Cu

3.2 Canny operator method for image segmentation

Mablab is a language which based on matrix and array,and it also a simpler grammar rules programing language.It is closed to the human way of thinking used to program.Matlab has now become the world's most widely used software development,so in this paper, the software as a simulation tool.Canny operator is the optimum edge detection operator[4].Suppose that the function:

$$G(x, y) = \frac{1}{2\pi\sigma^2} \exp(-\frac{x^2 + y^2}{2\sigma^2})$$

(1)

Assuming gradient vector is:

$$\nabla G = [\frac{\partial G / \partial X}{\partial G / \partial Y}]$$

(2)

We can use the decomposition method to increase speed,that is let the ∇G two-dimensional filtering convolution template decomposed into two one-dimension of filter.

$$\frac{\partial G(x, y)}{\partial x} = kxe^{-\frac{x^2}{2\sigma^2}} e^{-\frac{y^2}{2\sigma^2}} = h_1(x)h_2(y)$$

(3)

$$\frac{\partial G(x, y)}{\partial y} = kye^{-\frac{y^2}{2\sigma^2}} e^{-\frac{x^2}{2\sigma^2}} = h_1(y)h_2(x)$$

(4)

In this formula,

$$h_1(x) = \sqrt{k}\, x e^{-\frac{x^2}{2\sigma^2}}, \quad h_2(y) = \sqrt{k}\, e^{-\frac{y^2}{2\sigma^2}} \tag{5}$$

$$h_1(y) = \sqrt{k}\, y e^{-\frac{y^2}{2\sigma^2}}, \quad h_2(x) = \sqrt{k}\, e^{-\frac{x^2}{2\sigma^2}} \tag{6}$$

Therefor,

$$h_1(x) = x h_2(x), \quad h_1(y) = y h_2(y) \tag{7}$$

Finally, we use these two templates respectively convolution with f(x,y),to obtain:

$$E_x = \frac{\partial G(x, y)}{\partial x} * f ; \quad E_y = \frac{\partial G(x, y)}{\partial y} * f \tag{8}$$

And,

$$A(i, j) = \sqrt{E_x^{\,2} + E_y^{\,2}}, \quad a(i, j) = \arctan \frac{E_y(i, j)}{E_x(i, j)} \tag{9}$$

In this situation,A(i,j) represents edge strength,a(I,j) represents the vertical direction of the edge[4].

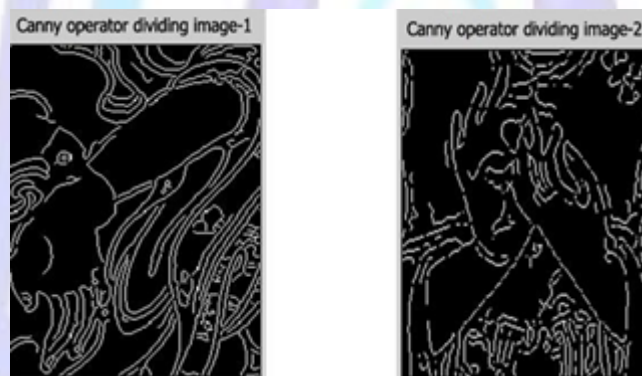Using Canny operator cut off Thangka Buddha image,the result image is showed in Figure 3.

Figure 3:Canny operator dividing image-1, image-2 gesture

CONCLUSION

Through Matlab simulation experiment shows that, Canny operator for edge information of the image have a good ability to identify.Using the Canny operator cut off image,its notable feature is accurate in edge positioning,good continuity,less false edges and have single pixel width.That is two-dimensional case has a good direction.However in this experiment,not only the Canny operator for Buddha gestures on the edge can be detected very good,but also put other non-gestures regions of border be detected too.Therefore,the algorithm requires further improvement.

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