Research on Target Detection based on moving Image

Feiyan Wu [1], Xianwen Liao [2]

[1]Guangxi Colleges and Universities Key Laboratory of Professional Software Technology, Wuzhou University, Wuzhou 543002, China

[2]The Beihai campus of the Guilin University of Electronic Technology Department of Computer Science, Beihai 536000, China

Abstract

In the process of image processing, we will use a lot of techniques. This paper discusses and studies the following technologies: video capture and digital image conversion technology, image enhancement gray transformation, image smoothing, image sharpening, edge detection and extraction in image recognition. The research and application of these technologies is very important to realize the research goal of this paper.

Keywords

Optical flow; background model; digital image processing.

1. Introduction

Most of the images we encounter in our daily lives are constantly changing, and there are so many moving goals that should be the focus of our attention. Moving target detection is an important current research object for scholars. The purpose of moving target detection is to detect the moving target accurately and quickly, and extract it.

2. Moving Target Detection in dynamic background

This article is based on the optical flow method to detect; optical flow is an image motion expression. Its definition is an image sequence in the image brightness mode of apparent motion. If an object is moving, the brightness pattern of the corresponding object must change from the image. The basic idea of optical flow detection is the use of the optical flow characteristics of the target over time. From our point of view, movement in our eyes is nothing more than a simple geometric change. The intuitive manifestation is that the image pixels are changing.

The concept of entropy comes from thermodynamics. The definition of entropy in thermodynamics is the logarithm of the number of possible states of the system, called thermal entropy. The source uses the information entropy to count its own statistics, which is actually a physical quantity that represents the mean uncertainty of the source. From the perspective of statistics, it is to describe a source. We can use entropy to find the threshold S we want to distinguish between the target and the background. In this way, the amount of information on the target and the background can easily reach the maximum value.

Here, we generally use the Kalman filter method to update the background image to deal with changes in the environment of the department, thereby preventing external factors from affecting motion detection.

The update formula for the background image is:

$$B_{k+1}(p)=B_k(p)+g(I_k(p)-B_k(p)) \tag{1}$$

Increase the value as:

$$g=a_1(1-M(p))+a_2M_k(p) \tag{2}$$

I mean the current frame image B is a very small background image so we can segment the moving target from the background sequence image. Here a_1=0.1 , a_2=0.01.

In order to detect the moving target, we need to find a threshold S to make the binary image closer to the moving target. Generally speaking, it is difficult to determine an appropriate threshold, so we can express information by probability distribution. The gray distribution of target and background can be represented by information entropy.

$$\text{Exu+Eyv+Et} = 0 \quad \Phi(s) = -\sum_{i=1}^{s} \frac{p_i}{z_s} \ln \frac{p_i}{z_s} - \sum_{j=s+1}^{M} \frac{p_j}{1-z_j} \ln \frac{p_j}{1-z_j} \tag{3}$$

3. Application of Digital Image processing Technology

3.1 Image grayscale change

In the process of image imaging, there are many external factors, such as the sensitivity of photosensitive components, the instability of electronic components and so on. In gray level correction, we use the image acquisition system to correct the image pixels point by point.

Set the original image to f(x,y), the actual noise-containing images obtained areg(x,y).

$$g(x,y)=e(x,y)\cdot f(x,y) \tag{4}$$

In the above formula, e(x,y) is a function with reduced properties. For the degradation function of the system, an image with a gray level of constant C can be simply calibrated.

If the actual output is：

$$g_c(x,y)=C\cdot e(x,y) \tag{5}$$

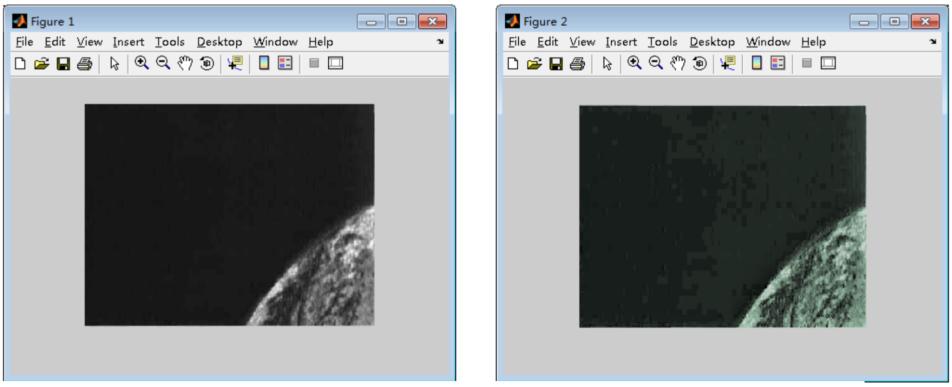
According to the above formula, we can get it：

$$e(x,y)\text{为 } e(x,y)=\frac{g_c(x,y)}{C} \tag{6}$$

Then we can get the original image of the real image, which has been corrected f(x,y).

$$f(x,y)=C\cdot \frac{g(x,y)}{g_c(x,y)} \tag{7}$$

The result is shown in figure 1.



(a) Background image of moving target (b) Grayscale corrected images

Fig. 1 Gray level correction of pictures

3.2 Image smoothing

We select a sliding window with odd points, scan the window on the image, arrange its pixels according to the gray level and take the middle gray value Med, instead of the gray value of the change point. That is,

$$g(m,n)=Med\{f(m-k,n-l),(k,l)\in W\}$$

m-2	m-1	m	m+1	m+2

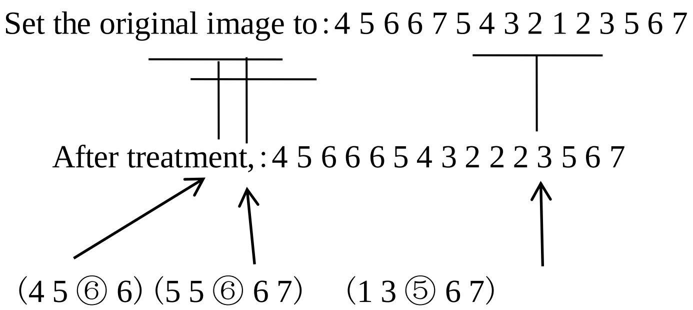


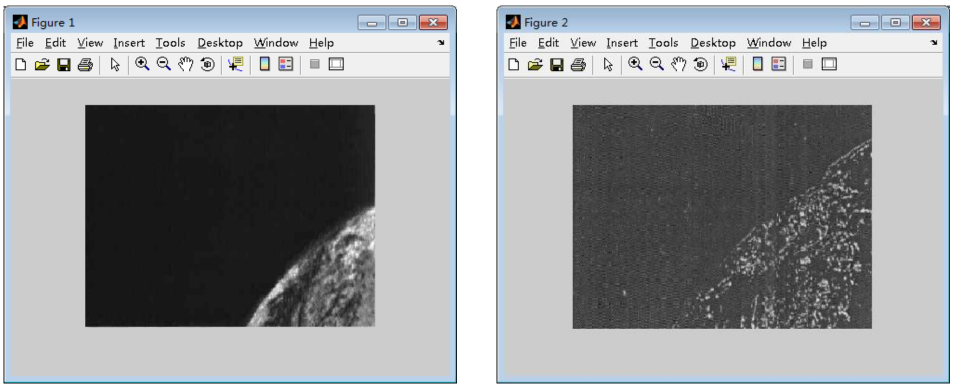
Figure 2 Filtering process schematic diagram

The expression of two dimensional median filter function MATLAB is J=medfilt2(I)

The program looks like this：

```
I=imread(‘eight,tif’);
Imshow(I);
J=imnoise(i,’salt&pepper’,0.04);
Figure,imshow(J);
K=medfilt2(J);
Figure,imshow(K);
```

The result is shown in figure 3：



Original picture (b)Image after median filtering

Fig. 3 Median filtering of original image

3.3 . Image sharpening

Definition of gradient:

$$\nabla f=\begin{bmatrix} G_X \\ G_Y \end{bmatrix}=\begin{bmatrix} \frac{\partial f}{\partial x} \\ \frac{\partial f}{\partial y} \end{bmatrix} \tag{8}$$

Phase angle Ang and the amplitude Mags show as follows：

$$\mathrm{Ang}(\nabla f)=\arctan\left(\frac{\partial f}{\partial y} \Big/ \frac{\partial f}{\partial x} \right) \tag{9}$$

$$\mathrm{Mag}(\nabla)=|\nabla f|=\left[G_x^2+G_y^2\right]^{\frac{1}{2}}=\left[\left(\frac{\partial f}{\partial x}\right)^2+\left(\frac{\partial f}{\partial y}\right)^2\right]^{\frac{1}{2}} \quad (10)$$

So the gradient value must be proportional to the gray difference between the adjacent pixels, so there is a large gradient value at the contour. The methods for image sharpening by gradient are as follows.

For output images g(i,j), the points at which the point is equal to the gradient.

$$g(i,j)=|\nabla f(i,j)| \quad (11)$$

Select a gradient value for pixels whose gradient value exceeds a threshold T, while preserving the pixel value of the original image when the threshold value is lower.

$$g(i,j)=\begin{cases}|\nabla f(i,j)|, & |\nabla f(i,j)|\geq T\\ f(i,j) & \text{other}\end{cases} \quad (12)$$

For pixels whose gradient value exceeds the threshold T, the fixed gray level LG is used, while the pixel value of the original image is kept when the threshold value is less than the threshold value.

$$g(i,j)=\begin{cases}L_{G,}\ |\nabla f(i,j)\geq T\,|\\ f(i,j), \quad \text{other}\end{cases} \quad (13)$$

When the gradient value exceeds the threshold T, the gradient value is used, while the fixed gray level LB is used when the threshold value is smaller.

$$g(i,j)=\begin{cases}|\nabla f(i,j)|,|\nabla f(i,j)\geq T|\\ L_B, \text{other}\end{cases} \quad (14)$$

The pixel whose gradient value exceeds the threshold T is represented by a fixed gray level LG, and

$$g(i,j)=\begin{cases}L_G,|\nabla f(i,j)\geq T\,|\\ L_B, \text{other}\end{cases} \quad (15)$$

when it is less than the threshold, a fixed gray scale LB is used.

The template is as follows:

$$G_X=\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix} \qquad G_y=\begin{bmatrix}0 & 1\\ -1 & 0\end{bmatrix}$$

The procedure is as follows

```
I=imread('rice.tif');
Imshow(I);
BW=edge(I,'roberts',0.1);
Figure,imshoe(BW);
```

3.4 Extract the contour of the target

The principle of contour extraction: we suppose there is a little bit in the original image, its color is black. When it has 8 black adjacent points, we delete the point.

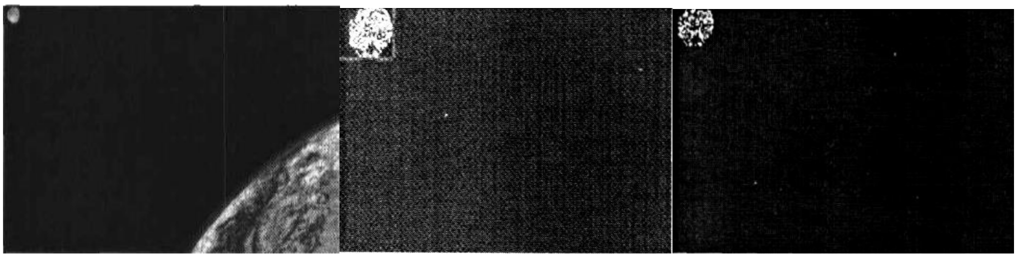
Contour extraction program

```
im=imread(filepath);
figure,imshow(im,[]);title('Raw');
（Extract original image）
im=im2bw(im);
figure,imshow(im,[]),title('BW');
```

(binaryzation)

```
im2=imfill(im,'holes');
im3=bwperim(im2);
figure,imshow(im2,[]); title('')
figure,imshow(im3,[]);
```

The final result of the run is shown in figure 4.



(a)The original image (b) The image extracted from the moving object (c)The expanded image

Fig. 4 Contour extraction of moving objects

4. Summary

In this paper, moving images are studied. Because the background is dynamic, the background is always changing. If we want to get a precise background, we must overcome a lot of difficulties. By taking the optical flow vector field as the basis, we can separate the object from the background on an image, detect the moving target and make the track of the moving object through the professional research methods of optical flow model, background model and soil moisture. Through digital image processing technology, we can process and improve the resulting image.

Acknowledgents

The Basic Ability Improvement Project of Young and Middle-aged Teachers in Guangxi University in 2017: The Research on the Interface Design of Automobile Multi-channel Display and Control System based on Human-Computer interaction, Subject No.: 2017KY0628, Project manager: Wu Feiyan; Wuzhou University 2016 School-level Scientific Research Project: The Research on Human-Computer Interface Design of Vehicle Display and Control System based on Visual Expression, Project No.: 2016B009, Project manager: Wu Feiyan.

References

[1] Giachetti A,Campani M,Torre V. The use of optical flow for road navigation[J].IEEE Transactions on Robotics and Automation，2008,14(1):34～48.

[2] Batavia PH, Pomerleau DE, Thorpe CE, Overtaking vehicle detection using implicit opticalflow[C]. In:proc. of the IEEE Conference on Intelligent Transportation System. Boston, Massachusetts,2007,720～740.

[3] Dubuisson M-P ,Jain A K. Contour extraction of moving objects in complex outdoor scenes[J].International Journal of Computer Vision，2005,14(1):79～125.

[4] A. M. Tekalp. Digital Video Processing. Rochester, NY, 2005.

[5] Joachim Denzler and Heinirich Niemann “Combination of Simple Vision Modules for Robust Real-Time Motion Tracking”, European Transactions Telecommunications，2005.