

Demarcation of the Vibration Markers based on Gradient Information HT Method

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Abstract. *Purpose:* We do it for tracking the markers of experiments on vibration platform. *Method:* We recommended HT method which owns better robustness, then designed the programs by the way of MATLAB to demarcate the centers of vibration markers. *Result:* We have successfully demarcated the centers of vibration markers. *Conclusion:* Using the method described above can realize expectations.

I. Introduction.

Photo-grammetry[1] is a kind of global, non-contact method used in many fields[2], which is with the feature of high degree of automation and environmental adaptable. This method can also help get the data as speed, acceleration and trajectory while we are recording the time signal. Using markers to assist researching on building deformation for vibration platform is considered to be an important method to improve the accuracy and speed[3].

Hough Transform is an efficacious method to research on brink of figures[4], which owns good immunity and can work on several ones at the same time[5]. In this way, we'll easily mark the vibration platform for the following research.

II. The building of measuring system

We used digital camera (HDR-SR12, SONY) as the collector, which owns max sampling frequency of 800fm/s to satisfy technical requirements.

Form 1. The parameters of SONY HDR-SR12 digital camera

Parameters	Model/Data	Parameters	Model/Data
Sensor	CMOS	Camera Features	1920×1080
Size of image	96dpi	Speed of Shutter	1/25—1/800
Size of storage	MPEG, JPEG	Ram	120G

As fig.1 shows, you can notice vibration markers. In this experiment, we employed manual measurement method, which can meet the demand for its 0.5 pixel in accuracy[6]. The steps: first, we got the edge image of markers by using Grade edge detection operator, such as Fig.1(b) shows; and then, we used HT method to precisely mark the location of markers in each picture, which is the key step of the method.

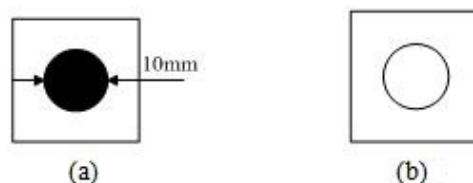


Fig.1. marker and edge image

The algorithm process of HT method is shown as Fig.2

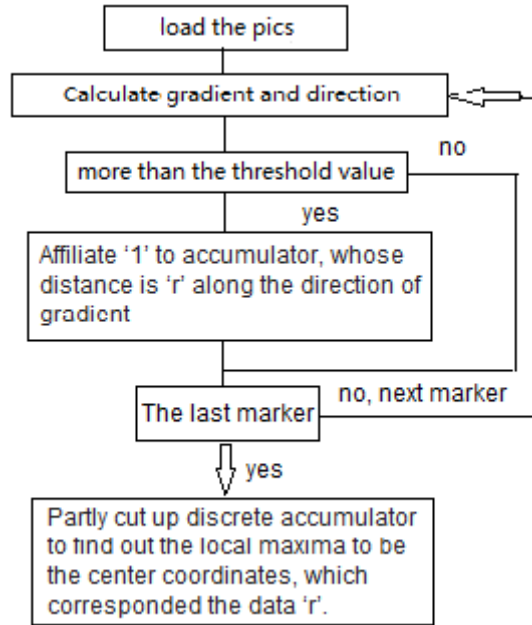


Fig.2. the algorithm process of HT method

We realized the algorithm above by using 'MATLAB', whose program is shown as following.

```

clc
close all;
clear
bw=imread('F:\ research.jpg');
f=rgb2gray(bw);
g=im2bw(f,.5);
bw=medfilt2(~g,[5 5]);
imshow(bw)
hold on;
[c,r]=imfindcircles(bw,[10,1000],'Method','PhaseCode','Sensitivity',.95,'EdgeThreshold',.96);
viscircles(c,r);
for i=1:length(r)
    plot(c(i,1),c(i,2),'ko');title('HT method to mark the center')%the center
end
  
```

III. Application and Analysis

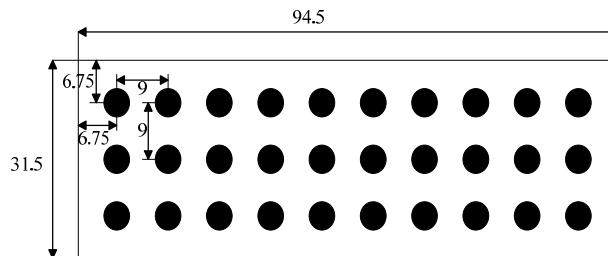


Fig.3. The original image with precise coordinate (Measurement: mm)

As you see above, Fig.3 shows the markers with precise coordinate. used HT method based on Gradient Information to mark the centers, then the result is shown in Fig.4 (below).

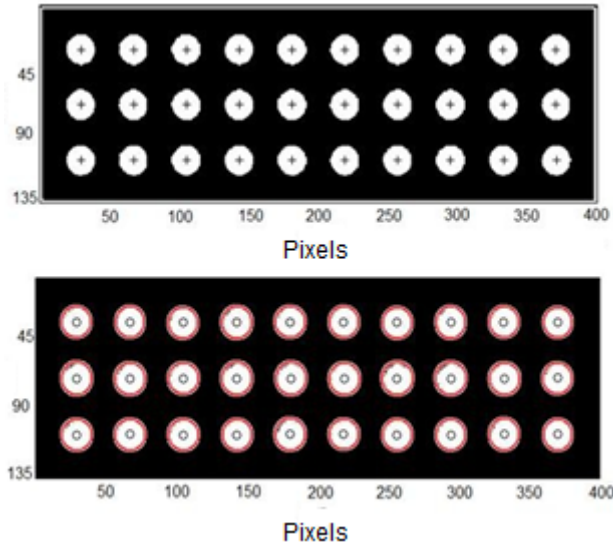


Fig.4. The actual centers (above) and the centers processed by HT method (below)

The coordinates of the markers shown in Fig.4 (above) were worked out by ‘MATLAB’ method. And the coordinates of the markers shown in Fig.4 (below) were worked out by HT method. Fig. 5 shows the result of the contradiction, which was programmed by ‘MATLAB’, to certify the accuracy of HT method.

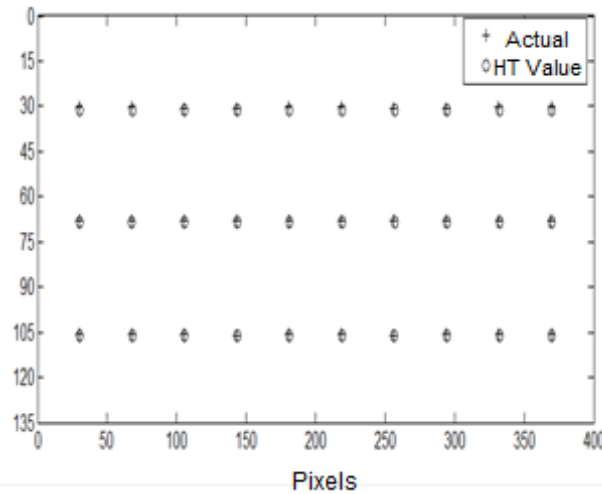


Fig.5. The comparison on result between HT method and the actual

In Fig.5, ‘+’ shown the actual coordinates as Fig.4 (above) and ‘o’ shown the coordinates worked out by HT method as Fig.4 (below). We noticed using HT method can help accurately mark the vibration markers by the comparison

IV. Conclusion

It is proved that, this method can realize the design we made before, apart from this, it owns good suitability and stability in dealing with the irregular markers, which can be great helpful in researching on the deformation of large equipment in future.

Reference

- [1] Yu Yonghua. The Analysis on Photogrammetry and Remote Sensing Technology[J]. Jiangxi Building Materials, 2014, 1: 217.
- [2] Li Guidong, Liu Zhixing. Direct Linear Transformation-Based Calibration Method and Accuracy Analysis[J], GEOMATICS & SPATIAL INFORMATION TECHNOLOGY ,2013.12,36(12): 227-228.

- [3] Song Limei, Chen Changman, Chen Zhuo. Detection and recognition of cyclic coded targets[J], Optics and Precision Engineering, 2013.12,21(12): 3239-3247.
- [4] Chen Si, Zhao Huichang. Scattering Center Extraction of UWB Radio Fuze's Target Based on Polar Hough Transform[J], Preparedness Technology: English, 2012,2: 74-78.
- [5] Xu hua, Li Tianbin, Wang Dong. STUDY OF SEISMIC RESPONSES OF MOUNTAIN TUNNELS WITH 3D SHAKING TABLE MODEL TEST[J], Chines Journal of Rock Mechanics and Engineering, 2013.9,32 (9) : 1762-1771
- [6] Zhang Yongsheng. Remote Imaging System[M]. Beijing: Science Press, 2000, vol.4:38-39,2005.