Research on the Image Geometric Processing based on Mobile Device

Bing Xu[1,a], Fei Guo[2,b]

[1] GD LONG YUAN Electrical CO.,LTD, Beijing, 100039, China

[2] School of Information Engineering, Beijing Institute of Fashion Technology, Beijing 100029, China

[a]email:lunwen95@163.com, [b]email:iciclexu@sina.com

Keywords: Digital Image Processing; Mobile Devices; Geometric Transform

Abstract. Aiming at the problem of tilt, deformation, vibration and other issues when capturing image by mobile device, the image has been processed for scaling, rotation, mirror, shear based on mobile device, and the actual simulation experiment based on iOS platform has been done, and achieve better results. It lay a foundation for image retrieval and augmented reality based on mobile device.

Introduction

Digital image processing is methods and techniques done by the computer for image denoising, enhancement, restoration, segmentation, feature extraction[1][2]. Due to the rapid development of computer and digital image more and more used in agriculture, the military, education, medicine, and other fields [3][4], digital image processing technology rapid development in recent years. In recent years, mobile devices have been developing rapidly, and almost everyone has a Smartphone, one of the most important features of the Smartphone is taken photos. Smartphone has replaced the simple camera inside a certain range. People take pictures and conduct some processing. Similar to the "Mito" software came into being. The other hand, the image retrieval based on mobile devices has become a research topic in the field [5], and the image processing based on mobile devices is foundation.

This paper base on the mobile devices, focusing on geometric transform preprocessing for image skewing morphing. Image geometry transformation refers to changing the original image in accordance with the requirements for size, shape, location, and for two-dimensional referring to images shifting, mirror, rotate, etc. Paper based on mobile device for images processing such as zoom, Pan, rotate, vertical mirror, pretreatment, etc. Experiments that based on the iOS platform showed achieve better results, and laid the groundwork for image retrieval and complex processes.

Geometric Transforms based on Mobile Devices

Image Zoom. Image scaling is the original image scaled proportionally f_x times along the x axis, f_y times along the y axis, which produced a new image. After scaled the original image of the point $P_0(x_0, y_0)$ in the new image correspond to point $P(x, y)$, then the relationship between $P_0(x_0, y_0)$ and $P(x, y)$ as shown in Fig 1.

Scaling between two points represented by Eq.1:

$$\begin{bmatrix} x \\ y \\ 1 \end{bmatrix} = \begin{bmatrix} f_x & 0 & 0 \\ 0 & f_y & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_0 \\ y_0 \\ 1 \end{bmatrix} \quad (1)$$

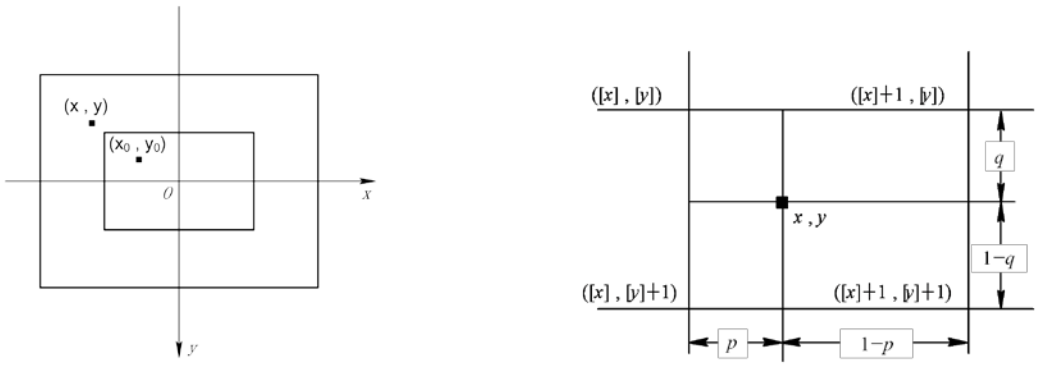


Fig.1. Image Zoom

If $f_x = f_y$, that is, in the direction of the x axis and y axis zoom ratios are the same, it is full scale and does not produce distortion. If $f_x \neq f_y$, the scaling of the image will change the relative positions between the pixels of the original image, resulting in distortion. Scaled pixels in an image may be not found to the corresponding pixels in the original image, so it is necessary to deal with, generally using nearest neighbor interpolation and pixel processing method. This paper uses the linear interpolation method for processing, schematic is shown in Fig 1.

The principle of this method is that when calculated score addresses is inconsistent with pixels, calculate surrounding distance ratios of the four pixels, and according to the ratios accomplish linear interpolation from four neighboring pixel values.

Image Mirror. Image Mirror transformation consists of a horizontally mirrored and vertically mirrored, without changing the shape. Horizontal mirroring operation is the left half or right half of the image mirroring transpositions central with image vertical axis; vertical mirror is upper part and lower part of the image in the horizontal central axis to mirror transpositions.

Mirror image transform can also be expressed as a matrix transformation. Set point $P_0(x_0, y_0)$is mirrored after the corresponding point $P(x, y)$, f_{Height} image height, width f_{Width}, in the original image $P_0(x_0, y_0)$ after a horizontally mirrored coordinates become $(f_{Width} - x_0, y_0)$, the matrix expression is:

$$\begin{bmatrix} x_0 \\ y_0 \\ 1 \end{bmatrix} = \begin{bmatrix} -1 & 0 & f_{Width} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \tag{2}$$

Similarly, $P_0(x_0, y_0)$ after a vertical mirror coordinates become $(x_0, f_{Height} - y_0)$.

Image Rotation and Shear. Image rotation is rotation image a certain angle with the center as the original point. Image rotation is the pixel position changes, image size will also change. Part which is out of the display area of the image can be cut off, or can expand the scope of images to display all of the images.

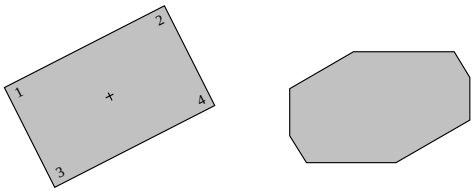


Fig.2 Image Rotation θ

Set point $P_0(x_0, y_0)$, original angle α, after the rotation angle θ of the corresponding point $P(x, y)$, the rotational radius is r, then after rotation is:

$$\begin{cases} x = r\cos(\alpha - \theta) = r\cos(\alpha)\cos(\theta) + r\sin(\alpha)\sin(\theta) = x_0\cos(\theta) + y_0\sin(\theta) \\ y = r\sin(\alpha - \theta) = r\sin(\alpha)\cos(\theta) - r\cos(\alpha)\sin(\theta) = -x_0\sin(\theta) + y_0\cos(\theta) \end{cases} \tag{3}$$

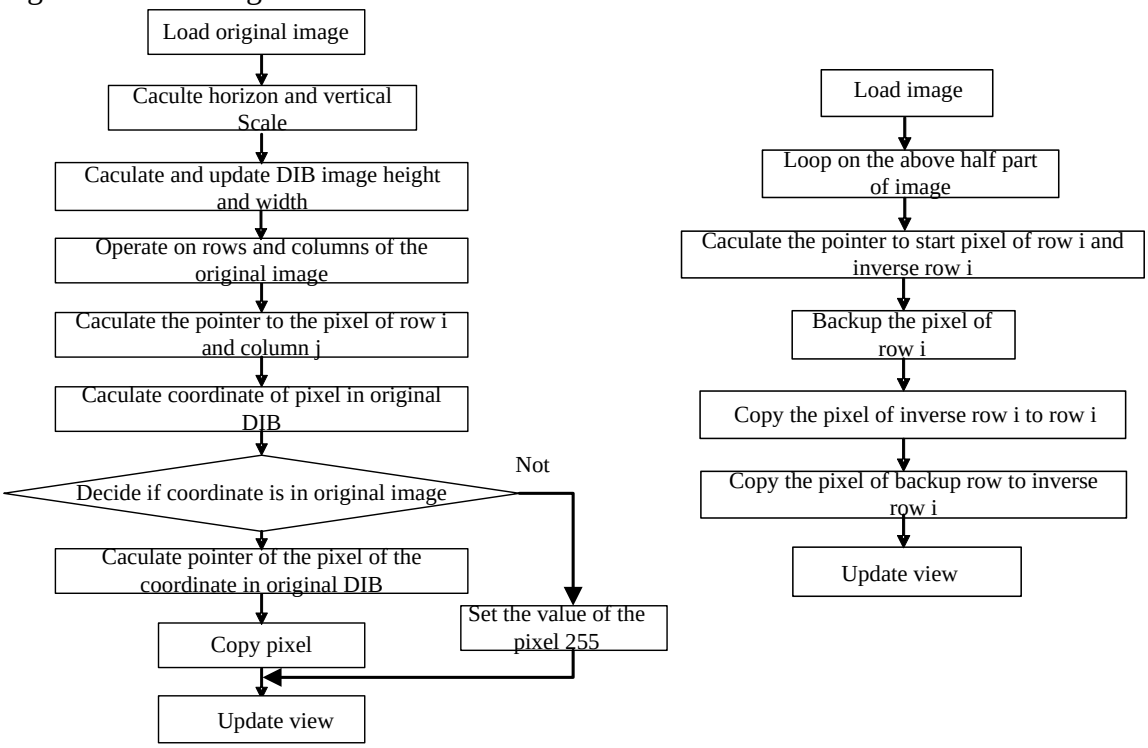
Image plane of shear is actually non-vertical projection of scenes in the projective plane. Shear causes graphic distortion in the image, including horizontal and vertical shear, shown as Eq.4:

$$\begin{cases} x = x_0 + by_0 \\ y = y_0 \end{cases} \quad \begin{cases} x = x_0 \\ y = bx_0 + y_0 \end{cases} \tag{4}$$

Experimental analysis

This paper based on iOS platform experimental analysis of image geometry transformation. Judging from the renderings to achieve better results, building a foundation for content-based image retrieval technology, augmented reality.

Image scaling pretreatment flow chart as shown in Fig 3, twice times magnification and narrow the image is shown in Fig 4:



(a) Image Zoom (b) Image Mirror

Fig.3 Image Zoom and Mirror Flow Chart

Fig.4 Diagram of image scaling

Diagram of the image mirrored vertically as shown in Fig 3. Horizontal mirroring process same with vertical mirror, only the operation on the left side of the image, and swapping is a column of information. This project mainly going to encounter the camera image, which is primarily vertically mirrored. Schematic diagram of horizontal and vertical mirrors, rotates the image 45 degree, horizontal shear of 30 degrees are as follows:

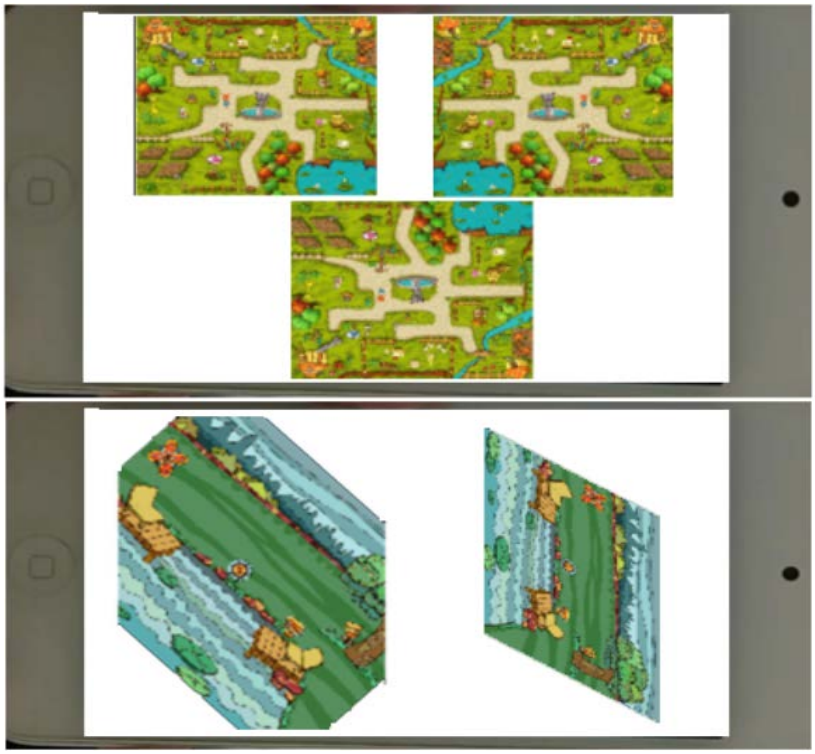


Fig.5 Diagram of image Rotation and shear and mirror

Conclusion

Aiming at the problems of tilt, deformation, mirror and others when capturing an image by mobile devices, geometric transformation of image based on mobile device in this paper, including translation, rotation, mirror, and shear and so on. Based on the iOS platform to carry out the experiment, from the experimental results achieve the better image processing results. It lay the foundation for the image retrieval, augmented reality based on mobile device.

Acknowledgement

In this paper, the research was sponsored by the General Program of Science and Technology Development Project of Beijing Municipal Commission of Education (Project No. KM201410012001) and Beijing Key Laboratory of Digital and Interactive Media Project (Project No. KF2013-13) and Youth Innovation Fund Project of science of Beijing Institute Of Fashion Technology (2014AL-29).

References

[1] Zheng Sun ET al. Digital image processing and recognition[M].Machinery Industry Press,2014.

[2]Wangming Tu, Youguo Wei, Shaomin Shi.Application of Matlab to Digital Image Processing[J].Microcomputer information,2007,23(3),299-300.

[3] Yunhua Jing, Yang Yang, Xiaoge Li. Application of Digital Image Processing in Automobile Automatic Recognition System[J].Computer Engineering,2003,9(9),100-102.

[4] YinYin Sun, RuruPan, Weidong Gao. Detection of yarn hairiness based on digital image processing[J].Journal of Textile Research,2013,34(6),102-106.

[5] Yawei Luo, Benchang Wei, Tao Guan ET al. Research on a fast feature match method for mobile devices[J].Application Research of computers,2013,30(02):591-594.