Advanced Science and Technology Letters
Vol.29 (SIP 2013), pp.88-91
http://dx.doi.org/10.14257/astl.2013.29.18

Rearranged Hough transform based on image retrieval technique

Youngeun An[1,1], Jongan Park[1], Younghun Lee[1], Gukjeong Kim[1] and Jonghun Chun[1],

[1] Chosun College of Science & Technology, Pilmundaero 309-1, Dong-gu, Gwang-ju, South Korea
{Youngeun An, Jongan Park, Younghun Lee, Gukjeong Kim, Jonghun Chun, yean}@cst.ac.kr

Abstract. Content features include information on colors, shapes, textures, and movement. In particular, as human eyesight is sensitive to shape information as well as illumination or color in early judgments on objects, there have been a number of studies on the detection of objects. This study proposed a new algorithm where noise invariability is added to the existing standard Hough transform which is applied for recognition of shape. In the simulation of the image retrieval system using a rearranged Hough transform, a variety of images with different sizes were analyzed. As a result of the analysis, it was discovered that the weak point was that this transform was sensitive to rotation, expansion, and reduction.

Keywords: Hough transform, Voting number, SBIR, Rearranged

1 Introduction

As visual systems have been combined with areas of intelligence in moving robots [1, 2], intelligent traffic system [3, 4], and medicine [5, 6], the importance of visual systems has been raised as a central technology which will contribute to human welfare and business directly. The fundamental work of a visual based system is to detect lines, corners, and curves as geometric traits in images. A. Rosenfeld and R. Gonzalez introduced the Radon and Hough transforms as representative analytic instruments to detect geometric traits in images [7, 8].

The Hough transform can efficiently detect straight or transformed lines which exist partially in images, even in images with noise. In particular, it simplified the complex problem of detecting straight lines in images into finding the maximum local value from the two-dimensional Hough arrangement through conversion of the parameter coordinate system planes. So the Hough transform has been used as a

[1] Please note that the LNCS Editorial assumes that all authors have used the western naming convention, with given names preceding surnames. This determines the structure of the names in the running heads and the author index.

ISSN: 2287-1233 ASTL

central technology to detect straight lines in diverse vision based systems [9-11]. There has been a lot of national and international research on the Hough transform and related fields [12]. However, the Hough transform has a problem when identical straight lines are overlapped in finding coordinates of maximum local values and detecting straight lines in images in the two dimensional Hough arrangement acquired by converting all the feature points which exist in binary images into parameter coordinate planes [9-11, 13].

Therefore, this study proposed an image retrieval system using a rearranged Hough transform to overcome the problem of detection precision. For the proposed image retrieval system using rearranged Hough transform is able to cope with rotation, expansion, and reduction giving good detection performance.

2 Design of the rearranged Hough transform algorithm

A common Hough transform in shape searches for the recognition of objects has a problem with overlapped detection of geometric features. Therefore, an algorithm designed to overcome this problem extracts feature points crossed after the standard Hough transform. Then as the number of the lines which pass the feature points are voted on, rearranged, and normalized, the rearranged Hough transform in which the features are reinforced is created.

The movement order is presented as follows:

First, a binary image is acquired through a pre-treatment process on the query image in a Cartesian coordinate plane. Second, through the Hough arrangement of all the feature points of the acquired binary image, the 2-dimensional Hough arrangements are acquired. After extraction of the cell coordinates a certain threshold value or as many of the coordinates of the local maximum values are acquired as needed, with the use of the coordinates extracted, straight lines or feature points crossed are detected from the Cartesian coordinate images. Third, the numbers of the lines passing the checked feature points in each angle are voted on and the voting results are rearranged according to size as in Table 1. Fourth, after the voting the level numbers are clustered and normalized as in Table 1.

Table 1. Feature table

Voting number	Level
1	125
2	303
3	669
4	737
5	579
6	441
7	491

3 Simulation and analyzed

With respect to the algorithms proposed in this study, diverse images were tested using MATLAB 2012 software. For this test, query images were analyzed under the same conditions. First of all, the query images used for each algorithm were the same. To explain the image retrieval method: a database of 3000 images was collected and of those 20 was chosen for to be query images for comparison. Then similar images to the 20 query images were decided on according to the algorithms. For the simulation of the algorithms, common chain code method targeting diverse images and feature points of the proposed algorithm were saved as data in advance. For the data that was saved, when new query images were entered, only newly entered query images had to have their feature points calculated, and measurements of similarity were compared with the use of feature points in the data and the resulting similar images extracted.

Figure 1 and 2 are results of the simulation for the query image.

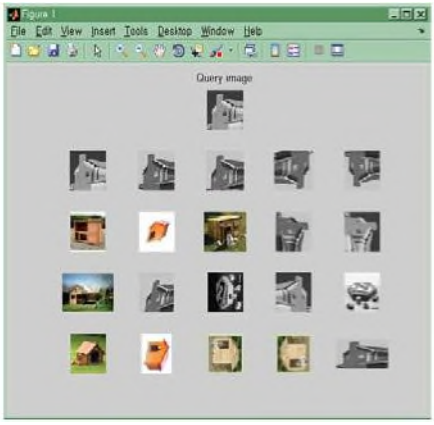

Fig. 1. The results of the retrieval using the standard Hough transform algorithm

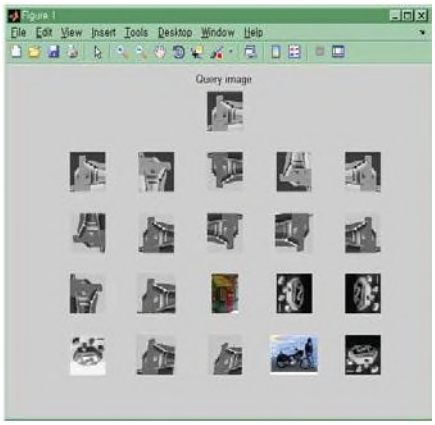

Fig. 2. The results of the retrieval using the rearrangement Hough transform algorithm

As a result, it was discovered that the Hough transform proposed detected reduced and expanded images as well as rotated ones as being similar. That is, as in Figure 1, the retrieval results using the standard Hough transform found similar images to the queries, but for images with different orientations or sizes the retrieval results were not satisfactory. However, it was discovered that the retrieval system using the rearranged Hough transform had a relatively higher rate in detecting similar images with different orientations and sizes.

4 Conclusion

This study proposed an algorithm to retrieve images using a retrieval system using a rearranged Hough transform for detection of new shape information which reinforces

noise invariability of the standard Hough transform used for SBIR (Shape Based Image Retrieval). For composition of the algorithm, the standard Hough transform was used on query images for pre-treatment to retrieve feature points and the number of lines which passed each feature point was voted on. Then, the voting numbers were rearranged according to size and the levels of the voting number were clustered and normalized to compose a descriptor table.

The system proposed based on the results above can be effectively used to recognize and detect diverse shaped images in multi-media data. Also, it is suggested that for development of optimized image featuring systems, an optimized retrieval engine and efficient image databases are needed.

References

1. G. Capi, A Vision-based Approach for Intelligent Robot Navigation. In: Intelligent Systems Technologies and Applications, 9, 2, 97--107 (2010)
2. A. Chatterjee, O. Ray, A. Chatterjee, and A. Rakshit, Development of a Real-life EKF based SLAM System for Mobile Robots employing Vision Sensing. In: Expert Systems with Applications, 37, 7, 8266--8274 (2011)
3. B. Fishbain and M. Mehrubeoglu, Guest Editorial of the Special Issue on Real-time Vision-based Motion Analysis and Intelligent Transportation Systems. In: Real-Time Image Processing, 5, 4, 213--214 (2010)
4. Y. Fang, Fusion-layer-based Machine Vision for Intelligent Transportation Systems, MIT Thesis, (2010)
5. R. G. Brown, C. E. Hann, and J. G. Chase, Vision-based 3D Surface Motion Capture for the DIET Breast Cancer Screening System. In: Computer Applications in Technology, 39, 1-3, 72--78 (2010)
6. M. Patel, S. Lal, D. Kavanagh, and P. Rossiter, Fatigue Detection Using Computer Vision. In: Electronics and Telecommunications, 56, 4, 457--461 (2010)
7. A. Rosenfeld, Picture Processing by Computer, Academic Press, San Diego (1969)
8. R. C. Gonzalez and Richard E. Woods, Digital Image Processing, Prentice Hall, Third Edition, Berlin (2008)
9. B. H. Cho and S. H. Jung, Line Detection in the Images of a Wireless Mobile Robot using an Efficient Preprocessing and Improved Hough Transform. In: Journal of Korea Multimedia Society(KMMS), 14, 6, 719--729 (2011)
10. B. H. Cho and S. H. Jung, Preprocessing and Mask Design for Efficient Line Detection in the Transmitted Image from a Mobile Robot. In: Proceedings of The Korea Computer Congress, 37, 1, 252--253 (2010)
11. B. H. Cho and S. H. Jung, Hough Transform using Gradient Direction Information and Mask. In: Proceeding of The KMMS Fall Conference, 12, 2, 5--7 (2009)
12. S. Du, B. J. van Wyk, C. Tu, and X. Zhang, An Improved Hough Transform Neighborhood Map for Straight Line Segments. In: IEEE Transactions on Image Processing, 19, 3, 573-585 (2010)
13. A. Großmann and R. Poli, Robust Mobile Robot Localisation from Sparse and Noisy Proximity Readings using Hough Transform and Probability Grids. In: Robotics and Autonomous Systems, 37, 1, 1--18 (2001)

