19th International Computer Science and Engineering Conference (ICSEC)
Chiang Mai, Thailand, 23-26 November, 2015

Logo Recognition System

Chomtip Pornpanomchai
Passakorn Boonsripornchai
Pimchanok Puttong
Chonnipa Rattananirundorn

Faculty of Information and Communication Technology, Mahidol University, Bangkok Thailand
chomtip.por@mahidol.ac.th; {passakorn.boo, pimchanok.put, chonnipa.rat}@student.mahidol.ac.th

***Abstract*—the objective of this research is to develop computer software for recognizing a company logo. The system is called "Logo Recognition System or LRS". There are 2 parts of the LRS, namely: a client part and server part. The client part consists of common device, which is owned by the user, such as a mobile device, tablet and smart phone. On the client part, the LRS provides an easy graphic user interface for capturing a logo image. After that the device sends the logo image to the server part. The server part is a computer server, which does a process of recognizing with several algorithms and generates a result with a link of the logo's company website. The LRS consists of 4 components, namely: 1) Image Acquisition 2) Image Preprocessing 3) Image Recognition, and 4) Result Presentation. The system uses the python program to develop the logo recognition system on both client and server. The LRS can recognize the rotation image with any angle. The precision rate of the system is around 79.6 percent.**

Keywords—Pattern Recognition; Logo Recognition; Image processing

I. INTRODUCTION

These days, a lot of logos have been created and the growth rate is increasing, while the past few people knew a company's logo. Most of the people memorize companies' logos in order to classify which company they belong to, or use some information to search for the answer in the Internet. Furthermore, most of the companies are changing their logo to the new version to make a reliable image and create a new vision for customers to know where the logo comes from because a new version is based on the original one that has a similar thing. A logo is a common thing that every company should have because logos have a meaning and represent a characteristic of the company, which has an influence on its customers. This is the reason why the logo is quite an important thing for every company.

Fig. 1. The sample logo images

A company will get sued if it establishes a new logo which is very similar to the existing logos. Therefore, the first advantage of this research is to help a new company to survey a new logo without any similarity to the existing logos. The second advantage is to help people to find company information even though they have only a company's logo. The main objective of this research is to develop computer software, which is able to recognize a company's logo. Some samples of logo images are illustrated in Figure 1.

II. LITERATURE REVIEWS

There are many researchers who have applied various techniques to recognize a company logo. The brief summary of each technique is given below.

A. K-Nearest-Neighbor

Pourghassem, and Hassanzadeh 2011 applied the KNN to detect and recognize 40 logos, with a precision rate of 100 percent. Nejad, and Faez 2012 employed KNN to recognize 40 logos, with a precision rate of 100 percent. Bagheri, and Gao 2012 used KNN to recognize 20 logos, with a precision rate of 82.14 percent [1][2][3][4].

B. Neural Networks

Huang et al., 2014 used a convolutional neural network to recogonize 1500 logo images, with the precision of 99.07 percent. Zaga et al., 2000 applied generalized regression neural networks to recognize logos in a document. Gori et al., 2003 proposed edge back-propagation neural networks to recognize 134 company logos, with the precision rate of 99.04 percent [5][6][7].

C. Scale Invariant Feature Transform (SIFT)

Boia et al., 2014 applied SIFT to recognize FlickrLogos-32 database, holding 29 classes, each comprised 10 for training and 10 for testing, with the precision rate of 88.97 percent.
Zhang et al., 2014 selected 1,700 logos from 10,000-class logo dataset and FlickrLogos-27 and used SIFT to recognize them, with the precision rate of 94 percent. Kalaiyarasi and Karthikeyan employed SIFT to recognize 1,000 logos from MICC-Logos dataset, with the accuracy 75 percent. Le et al., 2013 presented logo recognition by SIFT. The system used 15 logos from Tobacco-800 dataset, with the precision of 95.86 percent. Skoczylas used molile device to capture 20 medical-logo images and recognized them with SIFT. Lipikorn et al., 2014 presented logo recognition by SIFT. They used 220

978-1-4673-7825-3/15/$31.00 ©2015 IEEE

automobile logos to test the system with, the accuracy of around 75 percent [8][9][10][11][12][13].

D. Template Matching

Alaei and Delalandre 2014 presented logo recognition by using template matching. They used 109 template models to match with Tobacco-800 dataset, with the precision of 97.22 percent. Yunqiong et al., 2008 used template matching to recognize 17 classified vehicle logos, with the precision of 90.23 percent. Zhao et al., 2014 applied template matching to recognize logo in YouTube video stream, with the precision of around 96 percent [14][15][16].

Based on the previous researches, the LRS adopts a histogram template matching to recognize logo images. The template matching is a simple technique, which is easy to implement and give an acceptable result. The LRS system design and implementation are presented in the next section.

III. METHODOLOGY

This section provides the details of the LRS analysis and design. The overview of the system and structure chart will be discussed.

A. System architecture overview

There are 2 parts of LRS, which are a user part and system part. The user should have his or her system on device, such as a mobile device, tablet and smart phone. The LRS consists of 4 main processes, as shown in Figure 2. Firstly, a user captures a logo image from his or her smart phone, which is an input for the system. Secondly, a device by the user will connect to the same network of servers. Thirdly, the system will receive logo images and get a result of matching input and data set in the system. The system uses library PYTHON for images to compute matrix calculations to get a result. Fourth, The LRS sends a result to the user and shows it on the user's smart phone. The results consist of logo name, logo website and logo details.

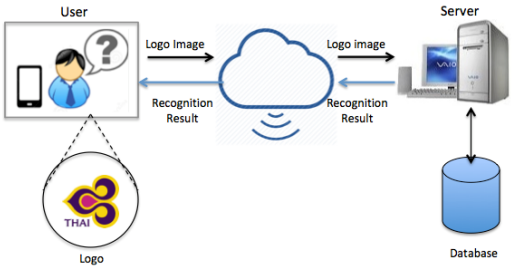

Fig. 2. Framework of Logo Recognition

B. System Structure Chart

The LRS system structure chart is illustrated in Figure 3, which consists of four subsystems, namely: image acquisition, image preprocessing, recognition and result presentation. Each subsystem has the following details.

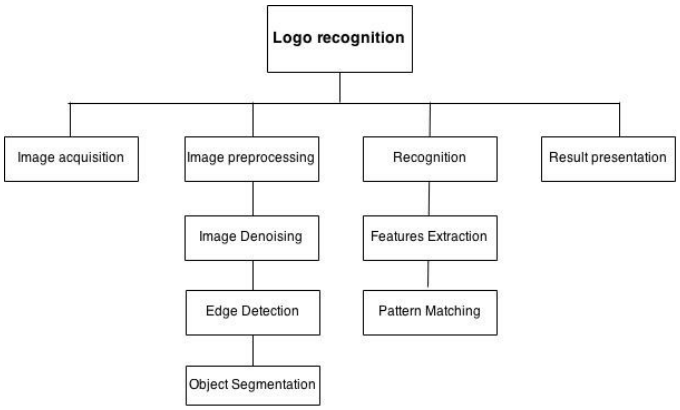

Fig. 3. Logo Recognition Structure Chart

1) Image acquisition

The input of the LRS is an image. The system prefers a logo image from a user by taking a picture or a captured logo image from the Internet. As shown in Figure 4(a), the input image can rotate and should be a complete logo. For background, it should not have too many details. Moreover, the image should contain no shadow.

2) Image Preprocessing

After a server gets a logo image, the Logo Recognition System will perform preprocessing through three subsystems. After that, the system can get the input logo image.

Image Denoising – To remove undesired objects in an image includes undesired background. That may add the accuracy of object segmentation.

Edge Detection – To identify logo boundaries, as shown in Figure 4 (b). The LRS uses edge value of the training image for detecting the object of the image.

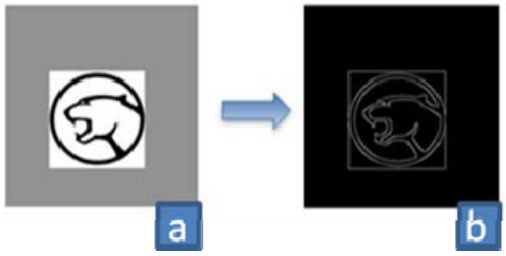

Fig. 4. Edge Detection Example

Object Segmentation – The system considers color by calculating the average of blue value for all pixels after the LRS gets the location of edge detection. The LRS uses position of the edge of the training image for detecting object from all images. The LRS gets the original image after the system detects an object, then the system will crop the original image and change the size of input images to 200 x 200 pixels. The size of the image should be the same size of an image in the database, as shown in Figure 5.

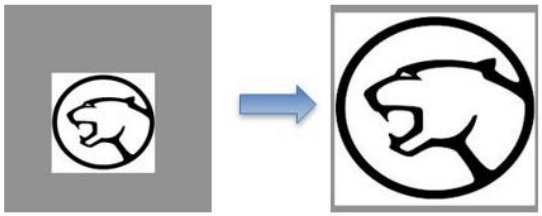

Fig. 5. Object Segmentation Example

3) Recognition

The training image was subsequently resized. The third system for recognition can be divided into two subsystems, which are feature extraction and pattern matching, which are described as follows.

Feature Extraction – The feature to recognize a logo image is two features extracted from an input image used in this project.

Histogram – We used the average RGB value to identify each logo different in the database. The system will find the RGB value, which has the approximately whole value as the input image.

Number of pixels in each degree – The system will determine the center of the image and draw a line from the center of the image every 10 degrees. We will get 36 lines per one image and get all locations of pixels that contain in line, as shown in Figure 6. After that, the LRS will bring the number of pixels that are on each line to newly rearrange by beginning with a position that has a maximum value.

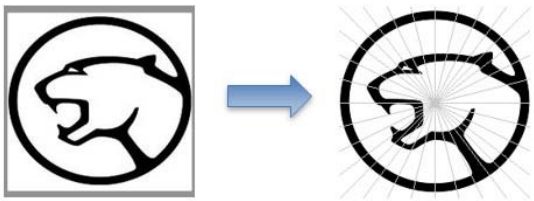

Fig. 6. Feature Extraction Example

Pattern Matching – This subsystem determines the matching result. From two feature extractions, we get the result value to compare with Equation 1.

$$\text{Distance (p, q)} = \frac{\sum_{i=1}^{n} |pi - qi|}{n} \qquad (1)$$

When distance (p, q) is the matching distance between p and q list;

The LRS uses this equation to find the distance of each image between the input image and data set. Thus, the matching result will be the data with the minimum distance. Moreover, if the minimum distance is greater than 70, the system will consider the input image as an unknown image.

4) Result Presentation

The LRS will get top three results that are nearest image in a database on the server and the first result will return information to the user. The information includes website of logo and name of logo will be shown on the system's interface automatically after finding the result.

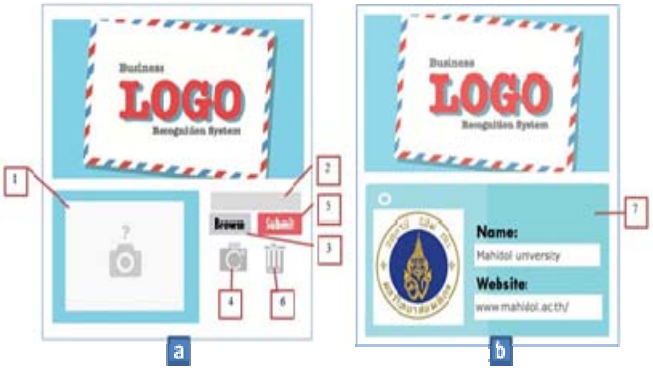

Fig. 7. Graphic User Interface Example

Figure 7 Graphic user interface example, as shown in Figure 7 (a), illustrates the display interface of the Logo Recognition System. Label 1 is the image panel for showing the input image. Label 2 is the location of the input file textbox. Labels 3 and 4 are the button to provide a user to choose the image or capture in the real time by using the camera on a smart phone. Label 5 is used to start the system. Label 6 will be used when the user wants to reset the system. The LRS provides the name of logo and website in the textboxes located as label 7 in Figure 7 (b).

IV. Experimental Results

The LRS conducted the experiment with the following software specifications. Operating System and Utilities Applications used 1) Macintosh, 2) MAMP and 3) SQLite Manager. Web Server Software used 1) MAMP and MAMP pro. Editor used 1) SublimeText and 2) Android Stdio. Database Management System (DBMS) used SQLite. Finally, Programming and Scripting Tools used 1) PYTHON, 2) PHP, 3) HTML, 4) Java script and 5) Android programming. Hardware Components used Galaxy Tab 3 Lite and Macbook Pro 15''.

The LRS conducted on 1,020 images for the training dataset and 30 images for the untrained dataset. The recognition precision rate of logo recognition of the training dataset was 79.6, 19.5 and 0.88% for match, mismatch and unknown logos, respectively. Moreover, the precision rate of the logo recognition of the untrained data set was 6.67, 0 and 93.33% for match, mismatch and unknown logo, respectively.

V. CONCLUSION

In this paper, the Logo Recognition system fulfilled the research objective by extracting two main logo features for the recognition of logos samples. The logo recognition used 9 categories of logo to test the system. The recognition precision

rate of logo recognition of the training dataset was 79.6, 19.5 and 0.88% for match, mismatch and unknown logos, respectively. Moreover, the precision rate of the logo recognition of the untrained data set was 6.67, 0 and 93.33% for match, mismatch, and unknown logo, respectively.

References

[1] S. Hassanzadeh, and H. Pourghassem, "A novel logo dectection and recognition framework for separated part logos in document images", Australian Journal of Basic and Applied Sciences, Vol. 5(9), pp. 936-946, 2011.

[2] H. Pourghassem, "A hierarchical logo detection and recognition algorithm using two-stage segmentation and multiple clssifiers", Proceedings of the International Conference on Computational Intelligence and Communication Networks, Uttar Pradesh, India, pp.227-231, 2012.

[3] A.A. Nejad, and K.Faez, "A novel method for extracting and recognizing logos", International Journal of Electrical and Computer Engineering, Vol 2, No.5, pp. 577-588, 2012.

[4] M.A.Bagheri, and Q. Gao, "Logo recognition based on a novel pairwise classification approach", Proceeding of the International Symposium on Artificial Intelligence and Signal Processing, Shiraz, Iran, pp. 316-321, 2012.

[5] Y.Huang, R.Wu, Y.Sun,W. Wang, and X. Ding, "Vehicle logo recognition system based on convolutional neural networks with a pretraining strategy", IEEE tranc. on Intelligent Transportation System, Issue 99, pp. 1-10, 2015.

[6] K.Zyga, R. Price, and B. Williams, "A generalized regression neural network for logo recognition", Proceeding of the International Conference on Knowledge-Based Intellinget Engineering System & Allied Technologies, Brighton, UK, pp.475-478, 2000.

[7] M.Gori, M.Maggini, S. Marinai, J.Q.Sheng, and G.Soda, "Edge-backpropagation for noisy logo recognition", Pattern Recognition, Vol. 36, pp. 103-110, 2003.

[8] R.Boia, A.Bandrabur and C. Florea, "Local description using multi-scale complete rank transform for improved logo recognition", Proceeding of the International Conference on Communication, Bucharest, Romania, pp. 1-4, 2014.

[9] Y. Zhang, S. Zhang, W. Liang, and Q. Guo, "Individualized matching based on logo density for scalable logo recognition", Proceeding of the International Conference on Acoustic, Speech and Signal Processing, Florence, Italy, pp.4324-4328, 2014.

[10] C.Kalaiyarasi, and S.Karthikeyan, "Enhancing logo matching and recognition using local features", Proceeding of the International Conference on Information Communication and Embedding System, Chennai, India, pp.1-6, 2014.

[11] V.P.Le, M.Visani, C.D.Tran, J.M.Ogier, "Improving logo spotting and matching for document categorization by a post-filter based on homography", Proceeding of International Conference on Document Analysis and Recognition, Washington DC, USA, pp. 270-274, 2013.

[12] M.Skoczylas, "Detection of positions and recogntion of brand logos visible on images captured using mobile devices", Poceeding of International Conference and Exposition on Electrical and Power Engineering, Iasi, Romania, pp. 863-868, 2014.

[13] R.Lipikorn, N.Cooharojananone, S.Kijsupapaisan, and T.Inchayanunth, "Vehicle logo recognition based on interior structure using SIFT descriptor and neural network", Proceeding of the International Conference on Information Science, Electronics and Electrical Engineering, Hokkaido, Japan, pp. 1595-1599, 2014.

[14] A.Alaei, and M.Delalandre, "A complete logo detection/rcognition system for document images", Proceeding of the International Conference on Document Analysis Systems, Loire Valley, France, pp. 324-328, 2014.

[15] W.Yunqiong, L.Zhifang, and X.Fei,"A fast coarse-to-fine vehicle logo detection and recognition method, Proceeding of the International Conference on Robotics and Biomimetics, Sanya, China, pp. 691-696, 2007.

[16] C.Zhao, J.Wang, C.Xie, and H.Lu, "A coarse-to-fine logo recognition method in video streams", Proceeding of the International Conference on Multimedia and Expo Workshop, Chengdu, China, pp.1-6, 2014.