Deformed and Touched Characters Recogntion

Tadashi Hyuga, Hirotaka Wada, Tomoyoshi Aizawa, Yoshihisa Ijiri and Masato Kawade
OMRON Corporation
Kyoto, Japan
Email: {hyuga, wada, aizawa, joyport, kawade}@ari.ncl.omron.co.jp

***Abstract*—In this demonstration, we will show our Optical Character Recognition(OCR) technique. Character deformation and touching problems often occur during high-speed printing process in the machine vision industry. As a result, it is difficult for OCR system to segment and recognize characters properly.**

To solve these problems, we propose a novel OCR technique which is robust against deformation and touching. It splits regions of characters simply and excessively, recognizes all segments and merged regions, and obtains optimal segments using graph theory.

I. Introduction

In the machine vision industry, character deformations in printing have increased by the speed-up process of the factory. It is important to recognize these deformations such as touched characters shown in Fig. 1, distortion and slant. We propose the real-time OCR technique which can recognize various deformation types of characters with high stability under various conditions. The proposed method consists of four steps: binarization, line extraction, segmentation and recognition(Fig. 2). The details are described as follows.

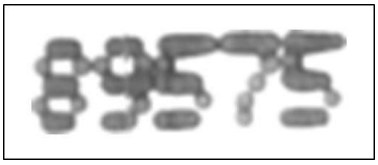

Figure 1. Touched Characters

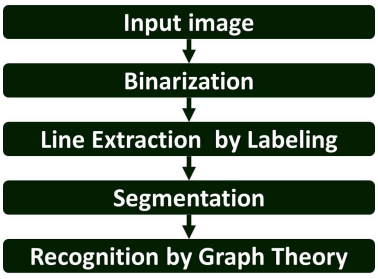

Figure 2. Flow chart of our technique

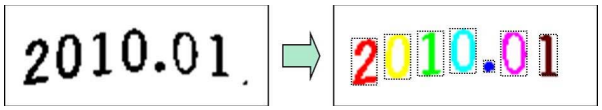

Figure 3. Labeling by binarization

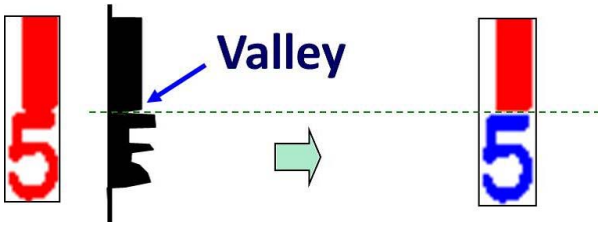

Figure 4. Dividing a large label using projection

II. Character Recognition using Graph Thoery

A. Binarization

At first, an input image is binarized by thresholding method. Then labels that consist of individual connected components in the binarized image are obtained(Fig. 3). The label that is relatively large can be divided at valley points of the projection(Fig. 4).

B. Line Extraction

Lines are then extracted in the image by connecting labels according to simple rules(Fig. 5). Following processes, i.e. segmentation and recognition, are performed for each line.

C. Segmentation

In order to obtain the correct segments of characters, candidate segments are generated excessively for each line

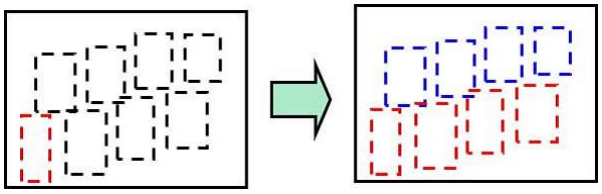

Figure 5. Line extraction: choosing the left labels and creating lines in connecting labels according to simple rules repeatedly.

978-1-4799-2190-4/13 $31.00 © 2013 IEEE
DOI 10.1109/ACPR.2013.193

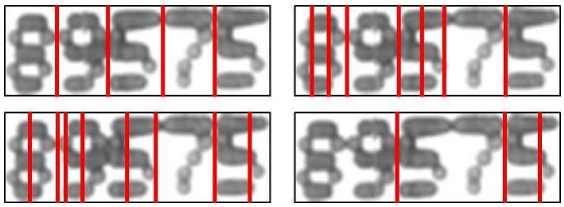

Figure 6. Candidates of segments

Figure 7. Results of our technique. left: input images, right: results.

by simple procedures[1], e.g. extracting valley points of the projection and the changing points of curvatures of the labels. Fig. 6 shows candidates of segments separated by red lines. With the following recognition process, the best candidate can be determined.

D. Recognition

Using the graph theory, optimal segments and recognition results of the whole lines can be obtained[2]. Each segment in a candidate segments is evaluated regarding various features such as similarities to the characters, the aspect rate, the position in the image, the distance between other segments and so on. Then, each edge's cost in the graph is set by the evaluation result. Each node is regarded as a segment point, each edge is regarded as a segment. Furthermore, each edge's cost is regarded as a likelihood of the two segment points connected the edge. Then, a path's cost is regarded as a likelihood of a candidate segments corresponded to the edges in the path. Finally, with an optimization process, it is determined which combination of the segments is the most likely. The results of examples are shown in Fig. 7 which shows that our technique can recognize deformed and touched characters robustly.

III. Conclusion

We have proposed a novel OCR technique with robustness against deformation and touching. In addition with the graph theory, deformed and touched characters can be obtained properly. Furthermore, our technique processes in real time, so it is utilizable in the machine vision industry.

References

[1] Lukas Neumann and Jiri Matas, A Method for Text Localization and Recognition in Real-World Images, In Proceedings of the 10th Asian Conference on Computer Vision, Vol.3, 770-783, 2010

[2] Cheng-Lin Liu, Masashi Koga and Hiromichi Fujisawa, Lexicon-Driven Segmentation and Recognition of Handwritten Character Strings for Japanese Address Reading, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol.24, No.11, 1425-1437, 2002