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Part-Based Methods for Character Recognition

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論　文　内　容　の　要　旨

The conventional character recognition methods have many limitations when applied to the new recognition tasks, such as the recognition of handwritten characters, scene characters and the document of arbitrary fonts. For those tasks, there are many difficulties, such like the various character appearances, noise and distortion, segmentation problem, etc. Consequently, in this thesis, the part-based method is proposed. In the part-based method, only the parts of the character image are used for recognition and the global structure information is usually discarded. By only using the parts, the part-based method is supposed to have the advantages on overcoming the above difficulties. In this thesis, the applications of the part-based method are studied and tested on

various databases. The results showed that the part-based method is a good choice for those new character recognition tasks.

In Chapter 2, the part-based methods were introduced and in Chapter 3 the selection strategies of the parts were studied. The part-based methods were also tested on the MNIST (digits) as well as the CEDAR (alphabets) databases. The results showed that the performance of the part-based method was totally comparable with the state-of-the-art methods. On the MNIST, the part-based method of class distance achieved the recognition rate of 99.15% with a very simple classifier. On the CEDAR of alphabets, the class distance method had a recognition rate of 78.9% while the whole-based method was only 70.1%. Besides, the part-based methods are robust against the degradation of the image, which is proved by the experiments on cropped images generated from MNIST. When the cropped images were tested, the recognition rate of the whole-based method decreased from 92.8% to 44.9% while the part-based method only decreased from 93.6% to 81.3%. Moreover, by applying the parts selection strategy, the part-based method can achieve almost the same recognition rate with only a half of the reference parts.

In Chapter 4, the part-based method was extended to the handwritten character string recognition and compared with the BLSTM (a state-of-the-art method for character string recognition). From the experiment results, we can see that the part-based method has the robustness against the distortion of the image. For those severe cases, the part-based method is a powerful tool.

In Chapter 5, the part-based method was applied to arbitrary font recognition. The results showed that the part-based method was able to outperform the commercial OCR. The highest recognition rate of the part-based method was 73.5% while the commercial OCR was only 56.7%. This is a very important property for the scene character recognition. In the future, it is possible to apply the part-based method to scene character recognition and which will be able to recognize the characters in arbitrary fonts.

In Chapter 6, the part-based method was also tested on document image decoding. As shown in the experiments, it is possible to create a recognition system with the merits of robustness, preprocessing-free, segmentation-free, font-free or even language-free. It will be very useful when the prior knowledge (for example, the font and the language information) of a document is hard to obtain.

論 文 審 査 の 結 果 の 要 旨

本研究は，断片化に基づく文字認識について複数の手法を提案し，それらの有効性を評価実験により示し，さらに断片化が文字列認識や装飾文字認識にも有効であることを実証したものとして，価値ある業績であると認める