

THE DEMPSTER-SHAFER THEORY COMBINED WITH NEURAL NETWORK IN HANDWRITTEN CHARACTER RECOGNITION

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Received March 2008; revised August 2008

ABSTRACT. A novel character recognition method, called the Dempster-Shafer theory combined with Neural Network in Handwritten Character Recognition (DSNNHCR), is proposed in this paper. The DSNNHCR integrates a Recurrent Neural Network (RNN) and the Dempster-Shafer theory (D-S) to recognize handwritten characters. It first employs an RNN to effectively extract oriented features of a handwritten character. Subsequently, the method creates 3 feature variables using extracted oriented features. Finally, 3 feature variables are applied to the Dempster-Shafer theory which can powerfully estimate the similarity ratings between a recognized character and sampling characters in the character database. Experimental results demonstrate that the DSNNHCR system achieves a satisfying recognition performance.

Keywords: Dempster-Shafer theory, Recurrent neural network, Mass functions, Belief measures, Plausibility measures, Handwritten character recognition

1. **Introduction.** The recognition of handwritten characters plays an important role in the issue of development and research in image processing [1-3,6-10,12-14,16-18,22-25,27,30,32,33]. Visual recognition process usually starts with extraction of some features from an input image. For example, oriented strokes are such features. Oriented features of different types are popularly employed for character recognition in OCR [5,17,18,25,30]. Actually, a character can be considered as a construction of several parts at different orientations, lengths, and positions [5-10,12,23,25,30]. Therefore, a method for extracting these oriented parts from an input image is definitely required. Recurrent neural network (RNN) efficiently provides a solution to this problem [6-10,25].

Many kinds of recognition systems have been developed based on various feature representations [6-8,22,25]. Especially, in [22] Liou's method compares an unknown input character with each of all standard characters in the character database and measures the similarity degree between them according to a certain similarity measurement. The method proposes a self-organization matching approach to achieve the recognition of handwritten characters with thick strokes. These extracted features which are used in the self-organization matching are center loci, orientation, and major axes of ellipses. It employs a modified SOM network to perform the matching of characters. This system