

## HANDWRITTEN CHARACTER RECOGNITION BASED ON RELATIVE POSITION OF LOCAL FEATURES EXTRACTED BY SELF-ORGANIZING MAPS

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*ABSTRACT.* This paper describes a new pattern recognition method which is based on relative position of local features. We use a self-organizing map to detect a position of features, thus the relative position of them are automatically defined based on arrangement of the competing units. The local features are detected using filter constructed by adaptive subspace self-organizing maps.

**Keywords:** Pattern recognition, Self-organizing map, Local feature, Relative position

1. **Introduction.** Many researchers have reported various pattern recognition methods so far, and recently machine learning techniques such as neural networks, support vector methods, convolutional nets and so on have become important roles in the field of handwritten character recognition [1]-[4]. Elastic matching (EM), which is also called deformable template, flexible matching or nonlinear template matching, has been gathering attention [5]. In EM, one character image ‘A’ is treated like a “rubber sheet” and fitted to another character image ‘B’, which is usually template, as close as possible. Thus EM is defined as an optimization problem with respect to a linear or nonlinear pixel-to-pixel mapping from ‘A’ to ‘B’. Recognition by EM is robust to deformations of handwritten characters. However, EM requires high computational cost, because optimization problem, which is to find an ideal transformation of character image ‘A’, should be solved.

On the other hand, a visual system of a human has advantages concerning robustness and adaptability. In the human visual system, simple features in local areas, i.e. line orientation, are extracted in V1, and extracted features are integrated in higher brain [6]-[8]. A neocognitron which is one of the most famous neural network models was proposed in accordance with this biological knowledge [9]. But it is known that the neocognitron includes complex network structure and difficulty in tuning parameters.

In this paper, we propose a new handwritten character recognition method in which a concept of EM and the biological knowledge of the human visual system are adopted. Here, the concept of EM means that the character image ‘A’ is transformed to match it with the template image ‘B’ with keeping its topology. To realize such transformation, a self-organizing map (SOM) [10] is employed. Some gazing points in the image and their relative position can be extracted using SOM. Then an essential feature around each gazing point, which is a universal feature such as a line orientation, is extracted using