HANDWRITTEN ALPHABET AND DIGIT CHARACTER RECOGNITION USING SKELETON PATTERN MAPPING WITH STRUCTURAL CONSTRAINTS

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ABSTRACT

Handwritten character recognition is important application fields of neural networks. Many approaches, based on multilayer neural networks, modified back-propagation and self-organizing methods have been proposed [1]-[3]. However, rotation and high distortions, such as bold lines, non-uniform line width and blurred lines, prevent high recognition rates.

This paper presents a new character recognition method, which can be applied to handwritten alphabet and digit characters, having the above distortion. Basic strategy of the proposed follows human brain like processing, that is "mental distortion". Distorted patterns can be directly applied to the proposed system. The process is based on pattern mapping from standard to distorted patterns, while maintaining essential structure information. This process is similar to Kohonen's self-organizing feature map (SOM) [4]. However, several improvements are proposed in order to apply it to highly distorted pattern recognition.

Let the distorted pattern, standard pattern and its skeleton pattern be Q(m), P(n) and S(n), respectively. First, Q(m) is applied, and appropriate candidates for Q(m) are selected from P(n). Their skeleton pattern S(n) are mapped onto Q(m) following the modified SOM. A point of Q(m), q_i, is randomly selected. The point of S(n), s_j, which locates close to q_i, is selected. s_j is shifted toward q_i with the structure constraints. As the mapping makes progress, structural constraints are gradually relaxed. After the mapping, Q(m) is recognized based on consistency between Q(m) and the mapped S(n). The consistency is measured using line lengths of S(n), which stick out from Q(m), and line lengths of Q(m), which are not covered by S(n). In order to avoid one-stroke pattern mapping onto another one-stroke pattern, S(n) is restored to the standard pattern at some intervals. Furthermore, in order to compensate for line lengths of scaled and distorted patterns, redundant points are removed, and extra points are added in S(n) during the mapping process.

Computer simulation using so many kinds of distorted patterns have been done. High recognition rates are obtained. Figure 1 shows examples.

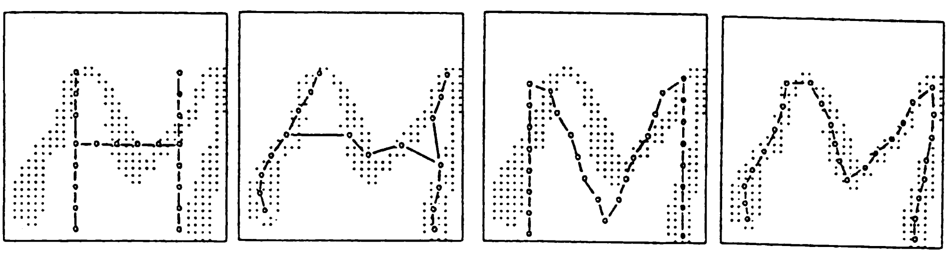

Fig.1 Examples of the mapping, using distorted 「M」, and standard 「H」 and 「M」.

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