BEP 인공지능을 이용한 속기문자영상 디자인문체 인식에 관한 연구

A Study on the Recognition of the Stenographic Character Design Image by using BEP AI

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1. Introduction

As we are living in the information age in which much information is deluged, we need to develop the ability to process much information quickly.

Here, the media which are able to record, keep, and process every information are essential to the information age, however media held in common by both human and machine are not numerous so much. So operative work input by keyboard may be an obstacle to promote informationalization, but it must be essential work. In selecting the way held in common by both human and machine, if it is obviously impossible to make human read disks or tapes which are exclusive for machine, it will be far easy and appropriate to make machine read printing media exclusive for human. In this meaning, it is very important task to make a computer recognize character automatically.

2. The Purpose of Research and Expected Effect

In this paper we would study the applicability of neural networks to the recognition process of steno -graphic character image, applying the classification function, which is the greatest merit of those of neural networks applied to the various parts so far, to the stenographic character recognition, relatively simple classification work.

Korean stenographic recognition algorithms, which recognize the characters by using some methods, have a quantitative problem that despite the simplicity of the structure a lot of basic characters are impossible to classify into a type. They also have qualitative one that it is not easy to classify characters for the delicacy of the character forms. In this paper, it performs a recognition of basic 126 characters and after preprocessing to the steno -graphic character input first, it performs learning, extracting 104 DC component and inputting them to the neural networks. The character learning outputs the character whose degree of the similarity is the highest of all, compared with the standard pattern.

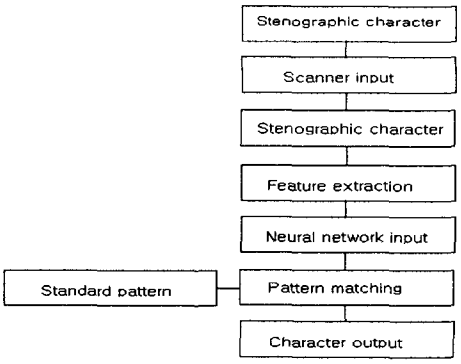
3. An Outline of Recognition System

The whole process of character recognition is shown as the Figure 1. Character image input by scanner is represented as 26 X 26 character image through binary process. A 26 X 26 character image deletes a noise and an isolated pixel due to the fallacy of input system, performing smoothing procedure.

3-1. The Procedure of Processing

The binary character image input by scanner is not able to extract feature correctly for an isolated pixel and a noise of hole or convex. It is because neural networks would be disturbed in case of such a data being made to learn a neural network as it is. Therefore it performs smoothing as a preprocess -ing procedure.

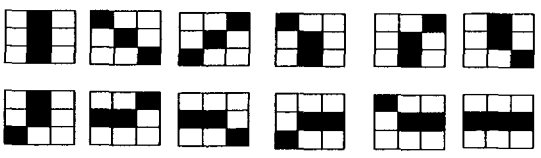
[Fig. 1] Processing Procedure of Character Recognition



The original purpose of neural networks is to make neural networks recognize in the environment identical with visual data of human, so we make it a rule to preprocess input data as little as possible. Therefore thinning procedure is skipped because it is considered not to affect the recognized rate or the decrease of general data number.

We use 12 masks of thin-line preservation to prevent the thin lines are not preserved, which is the problem of multi-logical smoothing as mentioned above. The following figure 2 shows the mask for a thin-line pattern confirming.

[Fig. 2] The Line Preservation Masks



This filter is very effective to preserve the change of intensity observed in the end of the character, deleting noise, not losing the sharpness of original image at the same time.

3-2. The Procedure of Extracting Feature

Character image data performing preprocessing procedure perform a feature extraction appropriate to the neural networks learning. That is, it exacts total 104 input DC elements considered to include data of stenographic character to some extent not to use binary data of 26 X 26 pixel into input directly.

This algorithms, which had been ever applied to dynamic character like *Hangul*, is considered to have more powerful effect in recognizing stenographic characters, than in the dynamic characters, to represent the core of recognition as only DC elements being extracted in the angle of four direction.

[Fig. 3] The Example of DC Element Extraction for Korean Stenographic Character " RU"

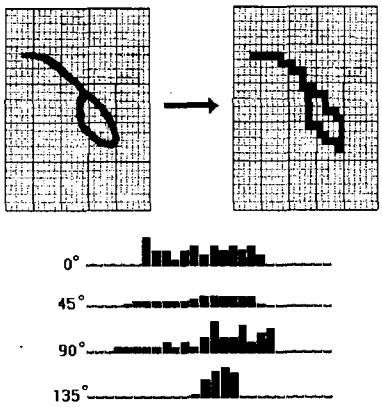


Figure 3, one of 104 DC element extraction proce -dures, shows the relative size of 104 DC elements for stenographic character RU .

104 data produced thus extract DC elements of 0, 45, 90, 135 direction, if actually we try to do a second-dimension FFT with special characters, we confirm DC elements to form a feature of that character.

3-3. Neural Network(AI)

Neural Networks used in this paper is Feed-forward style network as a structure of multi-layer networks with one hidden-layer including input and output layer and the signal in each layer is toward only to the upper layer. Each node is set by the product sum of the output and the weight in the lower node, which is output to the upper layer by sigmoid function with the characteristic of non-linear asymmetric increase.

$$\triangle Wji(n+1) = \eta\, \delta\, pj\ ipi + \alpha\, \triangle Wji(n) \quad (1)$$

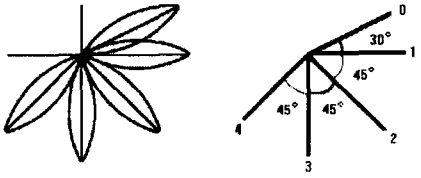
$$\triangle bias\ j(n+1) = \eta\, \delta\, j + \alpha\, \triangle bias\ j(n) \quad (2)$$

Hereupon, the parameter η is the learning rate and α is the momentum. Controlling learning rate and momen-tum, we could reach the global minima effectively, reduc-ing learning time. Also bias formula is changed as formula (2).

3-4. Stenographic Character

Stenography was studied first in *Rome* in about BC 63, and in the country Korean style stenographic way called the stenographic way of *Cho-sun* langu -age originated first in 1909. But the research of stenography had been almost discontinued by the Korean-Japanese annexation, after Liberation, it has been developed and pervaded as various steno -graphic rule, passing by the transformation of various pattern.

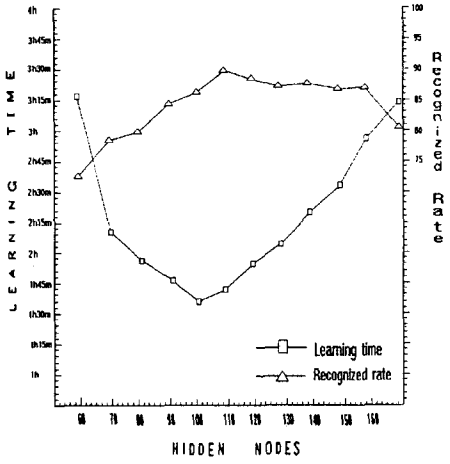
[Fig. 4] The Basic Design Form of Korean Stenographic Character



4. The Result and Analysis of Experiment

Data of input character are distributed and input in 104 input layer nodes and hidden layer node is made to obtain optimum node number, being changed and experimented many times. Figure 5 shows the relation of recognized rate and the learning time when we make hidden layer number increase.

[Fig. 5] The Recognized Rate and Learning Time in Accordance with Node Number of Hidden Layer



5. Conclusions

In this paper, after scanning the present situation of the general research in the characters recognition by neural networks and the background of stenographic character recognition, we present the recognition system of stenographic characters by using BEP neural networks which is one of representative neural network modes. Even though this experiment was performed under the limited environment of the basic characters, its result shows the possibility that the stenographic characters can be recognized effectively by neural network system.

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