Chapter 41

Wavelet-Based Recognition of Handwritten Characters Using Artificial Neural Network

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ABSTRACT

In the present chapter, the widely common problem of handwritten character recognition has been tackled with multiresolution technique using discrete wavelet transform and artificial neural networks. The technique has been tested and found to be more accurate and economic in respect of the recognition process time of the system. Features of the handwritten character images are extracted by discrete wavelet transform used with appropriate level of multiresolution technique, then the artificial neural networks is trained by extracted features. The unknown input handwritten character images are recognized by trained artificial neural networks system. The proposed method provides good recognition accuracy for handwritten characters with less training time, less no. of samples and less no. of iterations.

INTRODUCTION

Handwritten character recognition (HCR) is an area of pattern recognition process that has been the subject of considerable research during the last few decades. The ultimate objective of any HCR system is to simulate the human reading capabilities so that the computer can read, understand, edit and do similar activities as human do with the text.

Mostly, English language is used all over the world for the communication purpose, also in many Indian offices such as railways, passport, income tax, sales tax, defense and public sector undertakings.
such as bank, insurance, court, economic centers, and educational institutions etc. A lot of works on handwritten English character recognition have been published but still minimum training time and high recognition accuracy of handwritten English character recognition is an open problem. Therefore, it is of great importance to develop automatic handwritten character recognition system for English language.

In this chapter, efforts have been made to develop automatic handwritten character recognition system for English language with high recognition accuracy and minimum training and classification time. HCR is a challenging problem in the pattern recognition area. The difficulty is mainly caused due to the large variations of individual writing style. To get high recognition accuracy and minimum training and classification time for the HCR system, we have applied multiresolution technique using discrete wavelet transform (DWT) and artificial neural network (ANN). Experimental results show that the proposed method used in this chapter for handwritten English character recognition is giving high recognition accuracy and minimum training time. In what follows we briefly describe the different techniques used in our chapter.

The research problem is to develop a HCR system which recognizes the handwritten characters successfully. Often, the shape variations of handwritten characters cause the misclassification, therefore the multiresolution of handwritten characters plays an important role in the correct recognition process. Using the multiresolution, we can reduce the size of characters without losing the basic characteristics of characters, therefore more accuracy and better recognition rate can be achieved. The technique has been tested and found to be more accurate and faster.

This chapter is divided into seven parts and organized as follows: first part i.e. the introduction in which the problem of HCR is discussed with sufficient background information. Second part i.e. the background, which describes the brief review of literature. Third part gives the flowchart view of recognition methodology. Fourth part gives the details of preprocessing of handwritten characters including noise removal, slant angle correction, and also deals with the feature extraction using multiresolution technique. Fifth part describes the recognition and classification methods. Sixth part briefly reports the experimental results of implementation of the proposed approach. Seventh part outlines the conclusions and also provides suggestions for future work.

BACKGROUND

The history of HCR systems is incomplete without mentioning the OCR systems, which preceded them. OCR is a problem recognized as being as old as the computer itself. Simon (1992) and Suen et al. (1993). The researchers in the field of pattern recognition are referred to survey papers and text books for good exposure of the HCR system. In the earlier works, the automatic recognition of characters has been classified into two categories: recognition of the machine-printed characters and the recognition of handwritten characters. Arica et al. (2001). Machine-printed character recognition systems generally used template matching, in which an image is compared to a library of images. Handwritten characters used low-level image processing techniques on the binary image to extract the feature vectors, which are then fed to statistical classifiers. Arica et al. (2001). Now, writing has been the most natural mode of collecting, storing, and transmitting information in this world, it is used for communication among humans and also for communication of humans and computer systems. Arica et al. (2001).

Lee et al. (1996) proposed two stages of character recognition system: a feature extraction stage for extracting the multiresolution features with wavelet transform and a classification stage for classifying