

Recognition of Handwritten Characters from Trend Codes

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Abstract

A procedure to recognize handwritten characters is proposed. Trend codes encoding the major changes in the shape of the character are used as features. Experiments have shown the procedure to give good results.

KEYWORDS: Optical character recognition, features, compass codes, trend codes.

1. Introduction

Optical character recognition (OCR) of handwritten characters has been an area of active research for many years. In this, binary images of alphanumeric characters are fed into a computer, which then follows some procedure to recognize the character classes of the patterns fed in. Different researchers have adopted different procedures for OCR. Berthod and Maroy [1] encoded a character into a string of five primitives using angular segmentation for on-line recognition. Granlund [4] used Fourier transformation to extract features for classifying a pattern. Lam and Suen [6] extracted convex polygons and line segments as geometric primitives for a decision tree. Loy and Landau [7] employed segmentation in feature extraction for on-line recognition. Mantas and Heaton [8], and Pavlidis and Ali [10] analysed the pattern's shape by polygonal approximation. Persoon and Fu [11] developed a distance measure based on Fourier descriptors. Sarvarayudu and Sethi [12] described a boundary scalar transformation technique. Shen-Pei Wang [13] discussed concepts of recognizability, learnability and ambiguity, and used Freeman's [3] chain code for on-line handwritten character

recognition. Shridhar and Badreldin [14] described a two-stage OCR, which first converted the contour points of a character's shape into a Fourier series, and then used topological descriptors to resolve the ambiguity of rotational invariance. Toussaint and Donaldson [15] based their recognition on Mason and Clemens [9] extremum points in the contour of a pattern.

In this paper, we describe a technique of extracting compass codes from the contour of a pattern. The compass codes are condensed into trend codes, which give the major directional trends in the shape of a character. These trend codes are then used as features to classify a pattern. In Section 2, we describe our feature extraction scheme. Section 3 describes the recognizer, which uses the features extracted. Our experiment results are given in Section 4. Concluding remarks are given in Section 5.

2. Feature Extraction

A. Locating Paramount Pixels

The pattern is enclosed in a rectangle called the characteristic rectangle such that neither the topmost row, the bottom-most row, the leftmost column, nor the rightmost column in the characteristic rectangle is entirely blank. Thus the characteristic rectangle is the smallest rectangle that encloses the pattern, there being no blank rows or columns surrounding the pattern.

The rows in the characteristic rectangle are numbered from top to bottom as 1 to H , and the columns are numbered from left to right as 1 to W , where H is called the height, and W the width of the characteristic rectangle. Thus, for example, H is 23, and W is 20 in Figure 1.

