# Parametric approximations of contours of digitized characters

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**Abstract**

Contours of digitized characters are segmented by detection of sufficiently curved arcs. The resulting reference points are closely related to the structural features of characters (such as endpoints, cavities...). Piecewise approximation is done with parametric cubics and quartics and results are compared. Very good quality approximations are obtained at relatively low cost.

KEYWORDS: Contour segmentation, contour approximation, parametric curves, digitized characters.

## 1. Introduction

The goal of the present work is to find an efficient way to approximate contours in a piecewise manner. The analytic representation of contour pieces could then be used to derive information (such as curvature, areas etc...) related to the detection of features for character recognition. Such approximations could also be of use in many other applications.

We can identify the following desirable properties for our contour approximation scheme:

**Simplicity**. The partitioning of the contour should yield a *small number* of pieces, to be approximated by *low order* polynomials.

**Goodness of approximation**. Since digitization tends to yield wiggly contours, it is counter-productive to follow them exactly. However the approximation should be good enough to capture all features which play a useful role in recognition.

**Invariance**. Contour segmentation and quality of fit should be relatively independant of the resolution used for digitization.

It is also desirable that the contour partition itself bears a close relationship to the features to be subsequently detected.

Many approaches have been developed for contour approximation. The most common is probably polygonal approximation [2,5,9]. But parametric cubics have also been used [4,7]. Because the contours of handwritten characters normally present fairly long curved portions, we have opted for parametric cubics and quartics.

The initial problem to be solved is contour partitioning. We would like to obtain a limited number of reference points along the contour, which are related to the structural features of the character, and between which the selected curves will produce good approximations.

Several techniques exist for curve partitioning [6], detecting corners [1,3] or critical points [8]. But spurious corners are often obtained, while some true corners may go undetected. And critical points tend to occur in clusters. The more sophisticated corner detection algorithms reduce these defects but lose significantly in efficiency. Another difficulty is that corners — defined as points where we have a significant enough discontinuity in the mean curvature — are not the only points of interest here: we would also like to obtain "middle points" of large cavities for example. A new technique is developed to meet these needs.

After contour partitioning, each contour piece must be approximated. Optimal approximations are time consuming. Our approach instead is to find heuristics yielding generally good approximations.