

Cubic approximation of curve-shaped objects in \mathbb{Z}^2 : a generalized approach based on discrete curvature *

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Abstract

Approximation of arbitrary curves and curve-shaped objects on the digital plane, \mathbb{Z}^2 , is a captivating problem with potential usages in many computer-aided applications, such as image processing and image analysis, pattern recognition, computer vision, etc. The simplest approximation is linear in nature, and for improving the quality of approximation, higher order curves are used. Hence, to obtain the desired approximation, we have used a set of cubic B-splines, which are constructed based on control points judiciously selected from the input digital curve based on estimated curvatures at the constituent points of the curve. For estimation of discrete curvature, several algorithms have been proposed so far, which are mostly based on the concepts of real geometry and hence are computationally expensive. The existing measure of k -curvature, although computationally attractive, is crippled with some unwanted syndromes, as revealed in this paper. Hence, an improved algorithm for estimating k -curvature is also proposed. Exhaustive testing and experimental results demonstrate the strength and elegance of our method.

Keywords : Discrete curvature, digital geometry, k -curvature.

I. Introduction

Opposed to the continuous nature of a curve in the real space, a digital curve is inherently discrete in nature, which requires special techniques for realization of an efficient approximation in the digital space. Thus, given a digital curve \mathcal{C} , defined as a sequence of integer points,

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