ABSTRACT

This chapter presents a technique which uses the sum of height square as a measure to define the deflection associated with a pseudo high curvature points on the digital planar curve. The proposed technique iteratively removes the pseudo high curvature points whose deflection is minimal, and recalculates the deflection associated with its neighbouring pseudo high curvature points. The experimental results of the proposed technique are compared with recent state of the art iterative point elimination methods. The comparative results show that the proposed technique produces the output polygon in a better way than others for most of the input digital curve.

INTRODUCTION

There had been significant interest in polygonal approximation of digital planar curve in the last two decades and it resulted in a large number of published papers. Another reason for its popularity is its application to a large number of problems viz. identifying registration number on cars (2002), for portrayal of geographical information (1998), recognizing handwritten forms (2016), in handling biological signal (electroocluography) (1990), in exploration of image (2002) and in matching similar images (1994, 1987, 1993). The technique polygonal approximation is classified as sequential, split and merge and heuristic search. The sequential algorithms use a linear probe to calculate error condition and if the condition is found to be false then the search for a new segment is started. Skalansky and Gonzalez (1980) and Ray and Ray (1994) presented sequential technique that performs a single pass along the digital curve and finds the vertices (pseudo high curvature vertices) of the closed curve. Skalansky and Gonzalez (1980)
use perpendicular distance as a measure to determine the vertices whereas Ray and Ray (1994), in an attempt to determine the longest promising line segment along a digital planar curve with minimum possible error optimize an objective function involving sum of squares of error and length of line segment. The output curve produced by Skalansky and Gonzalez (1980) depends upon the starting vertex of the input curve. Sequential techniques may not be able to retain features such as sharp corners and spikes. In contrast to sequential techniques, recursive splitting technique is based on divide-and-conquer method.

Pavlidis and Horowitz (1974) use split and merge technique which fits a line to an initial segmentation of the boundary vertices and computes the least squares error. It iteratively splits a curve if the error is too large and merges two segments if the error is too small. Dunham (1986) suggests an optimal algorithm (using dynamic programming), which instead of specifying the number of line segments specify the error and determine the minimum number of line segments. The recurrence relation used to determine the minimum number of line segments is simple. Sato (1992) also used dynamic programming to find the optimal approximating closed curve.

Yin (1998) presents a method for polygonal approximation that uses genetic algorithm. Yin (2003) presents Tabu search technique to reduce time and space complexity in polygonal approximation, but it is found to be computationally expensive.

The technique proposed in this chapter doesn’t fall into anyone of the categories described above. The main objective of this chapter is to introduce a new measure to define the deflection associated with pseudo high curvature vertex more precisely than the other recent iterative vertex elimination techniques. The technique proposed in this chapter obtains the pseudo high curvature vertex using chain code and deletes the duplicate vertices on the digital curve iteratively and produce output polygon retaining with real vertices.

BACKGROUND

Most of the iterative vertex elimination methods begin with a set of pseudo high curvature vertices. The technique used to remove the duplicate vertices on the input curve iteratively based on different measure. In Iterative vertex elimination, the following are the challenges in front of the researchers. How to find a starting set of vertices? Since the technique iteratively deleting the vertices the methods have to take decision on how many number of vertices can possibly deleted in iteration. There are cases there may more than vertex delivers similar contribution towards in retains the shape of the curve, in such case how to choose the real vertices. Most of the techniques go with the decision by selecting the vertex with a small curve key. Masood (2008) says by choosing any vertex randomly also will not show any wrong impact on the performance of the technique. Most of the polygonal approximation techniques will make a search to detect the real vertices through various measures, whereas the type of algorithms discussed in this chapter is making a search to detect duplicate vertices and because of this reason this category of techniques has been referred to as ‘reverse polygonization’.

Pikaz and Dinstein (1995) invented the concept of deleting duplicate vertices from the input curve iteratively. Authors choose three consecutive vertices of a curve and measure the of the middle vertex of these three vertices using two measures such as area of triangle and height of a triangle. Based on the data provided by these measures the method takes decision on the process of detecting duplicate vertices. Afterwards the technique removes the vertices whose contribution is less. Then the neighboring vertices
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