11 September 2001

Minimal-Number DSS and DPS Segmentations

Azriel Rosenfeld* and Reinhard Klette+

* Center for Automation Research
University of Maryland, College Park, Maryland, USA
email: ar@cfar.umd.edu

+ CITR Tamaki, University of Auckland
Morrin Road, Glen Innes, Auckland, New Zealand
email: r.klette@auckland.ac.nz

There have been many publications on segmentation of digital arcs or curves into maximum-length digital straight segments (DSSs). (For a review of the literature on digital straight lines and DSSs see [1].) There are also several publications (e.g., [2]) on segmentation of digital surfaces into maximum-size digital plane segments (DPSs), where size is measured in numbers of surface elements.

Figure 1 shows two different segmentations of a digital curve (boundary of the region). Segmentation 1 divides the curve into n segments a_1a_2, a_2a_3, ..., a_na_1. Segmentation 2 is assumed to start somewhere in segment a_1a_2 at point b_1. Then b_2 cannot precede a_2 or follow a_3. Repeated application of this argument shows that the number of segments in segmentation 2 must be $n-1, n$, or $n+1$, i.e. the numbers of segments in a minimal-number DSS segmentation can only vary by one. Can an analogous result be obtained for minimal-number DSP segmentations?

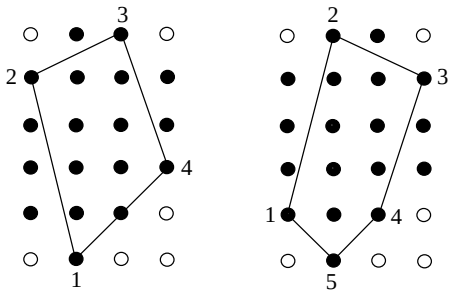

Figure 1: Examples of curve segmentations into 4 and 5 segments.

Does there exist a linear-time on-line algorithm for segmenting a digital curve into a minimal number of DSSs? Does there exist a linear-time (off-line)

algorithm for segmenting a digital surface into a minimal number of DPSs? Does there exist such an algorithm for the surfaces of digitized convex solids?

References

[1] A. Rosenfeld and R. Klette. Digital straightness. In *Electronic Notes in Theoretical Computer Science*, **46** (S. Fourey, G. T. Herman and T. Y. Kong, eds.), Elsevier Science Publishers, Amsterdam, 2001.

[2] J. Vittone and J.-M. Chassery. Recognition of digital naive planes and polyhedrization. In *Discrete Geometry for Computer Imagery* (G. Borgefors, I. Nyström, and G. Sanniti di Baja, eds.), LNCS 1953, Springer, Berlin, 2001, 296–310.