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Estimation of Planar Curves, Surfaces, and Nonplanar Space Curves Defined by Implicit Equations with Applications to Edge and Range Image Segmentation.

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Summary: The author addresses the problem of parametric representation and estimation of complex planar curves in 2-D surfaces in 3-D, and nonplanar space curves in 3-D. Curves and surfaces can be defined either parametrically or implicitly, with the latter representation used here. A planar curve is the set of zeros of a smooth function of two variables x-y, a surface is the set of zeros of a smooth function of three variables x-y-z, and a space curve is the intersection of two surfaces, which are the set of zeros of two linearly independent smooth functions of three variables x-y-z For example, the surface of a complex object in 3-D can be represented as a subset of a single implicit surface, with similar results for planar and space curves. It is shown how this unified representation can be used for object recognition, object position estimation, and segmentation of objects into meaningful subobjects, that is, the detection of 'interest regions' that are more complex than high curvature regions and, hence, more useful as features for object recognition.

Keywords: pattern recognition; algebra; optimisation; edge segmentation; planar curves; surfaces; nonplanar space curves; implicit equations; range image segmentation; parametric representation; 2-D; 3-D; zeros; object recognition; object position estimation; curve fitting
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