CCIT REPORT #755 February 2010

2D Object Description and Recognition Based on Contour Matching by Implicit Polynomials

Zoya Landa, David Malah, and Meir Barzohar

E-mail: zrybak@yahoo.com, malah@ee.technion.ac.il, meirb@visionsense.com.

Abstract

This work deals with 2D object description and recognition based on coefficients of implicit polynomials (IP). We first improve the description abilities of recently published Min-Max and Min-Var algorithms by replacing algebraic distances by geometric ones in the relevant cost function. We show that a recognizer based on a full set of recently published linear, quadrature, and angular rotation invariants, derived from a polynomial of a predetermined degree, has difficulties in distinguishing among objects which are either too complicated to be modeled by a polynomial of that degree or are simple and can be successfully modeled by a polynomial of a lower degree. We propose a recognition approach that is based on deriving linear rotation invariants from several polynomials of different degrees, fitted to the object shape, as well as on their fitting errors. This approach is found to considerably improve the recognition and is denoted as Multi Order (degree) and Fitting Errors Technique (MOFET). We also propose a Shape Transform, based on the Scatter Matrix of the objects' shape, which transforms each object to its "Mother Shape". The Mother Shape is unique, up to rotation, for all the objects that are related to the original shape via an Affine transform. Thus, we are able to handle affine transformed objects as well. Finally, we compare the performance of our approach with the Curvature Scale Space (CSS) method and find that it has an advantage over CSS, at about the same complexity.

Index Terms

Implicit polynomials, object recognition, zero-set sensitivity, curve fitting, stable fitting, affine transform.