

IRLM: AN IMAGING SYSTEM FOR  
OBJECT RECOGNITION, LOCALIZATION, AND MOTION RECOVERY

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Abstract

In this paper, a system (called IRLM) is presented for object recognition, localization, and motion recovery using grey level images. The simplicity of IRLM is achieved by the mathematical formulation of perspective projections of features. The generic features used here are conic sections which are projected into easily detectable conic sections in images, and the matching process is tuned to conform to specific model constraints and projection equations.

To locate the object and recover its motion, coarse-to-fine algorithms (including closed-form and iterative solutions) are used. The recovered location and motion are used to predict other features' visibilities and attributes of the image. The predicted attributes are then used to direct the interpretation process and to verify the consistency of interpretation.

During interpretation, either top-down or bottom-up matching processes are used, depending on how much information is gathered at the time by the system. This allows IRLM to search the most needed information in identifying and locating the object in any given frame.

1. Introduction: Overview of IRLM

In this paper we present an efficient approach to object recognition and motion recovery based upon the projected properties of features and transformations of rigidly moving object features. In our implementation, object features such as conic sections are used to construct our models and other features that have known projection

properties. The analysis of such feature transformations enable us to recover objects' identities and transfunctional states. The recovered motion states are then used to verify object recognition since features on a same rigid object should undergo the same transformation and it is this consistency algorithm and the hypothesis-and-test components which form the basis of the IRLM algorithm. Here the inputs of IRLM are intensity images, in contrast to range data used in most recent research (Faugarus, 1986; Pentland, 1986; Bolles & Horaud, 1984; Grimson & Thomas, 1984, 1985). Our IRLM has 4 basic dynamically interesting components:

1.1 Feature Finder.

The feature finder extracts conic sections from edge images and computes their attributes. Detected features of the same kind are organized according to their attributes for each retrieval.

1.2 The Locator.

The locator takes the matches of the model and image features as input and calculates the orientation and position of the object in space regardless of whether the matches are consistent or not.

1.3 Motion Recoverer.

The motion recoverer estimates the motion parameters so as to minimize the predicted and measured attributes of features on images.

