

Algorithms and Architectures for Robot Vision

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The author has previously conducted research in vision devices, algorithms, and architectures. Most of this work has addressed problems in scene perception and object recognition in support of autonomous robotics. A number of novel algorithms have resulted, including pyramid image analysis using contrast-normalized feature extraction [1], scale-rotation-aspect invariant image analysis using polar-exponential-grid representation [2,3], and high-speed image segmentation using multi-resolution stochastic search techniques [4]. Other efforts have included development of a multi-sensor fusion approach to scene analysis, and the development of a real-time VLSI machine vision architecture [5,6].

The scope of our current work is to develop practical sensing implementations for robots operating in complex, partially unstructured environments [7,8]. A focus in this work is to develop object models and estimation techniques which are specific to requirements of robot locomotion, approach and avoidance, and grasp and manipulation. Such problems have to date received limited attention in either computer or human vision—in essence, asking not only how perception is in general modeled, but also what is the functional purpose of its underlying representations [9]. As in the past [1,2], we are drawing on ideas from both the psychological and machine vision literature. Of particular interest to us is developing 3-D shape and motion estimates for complex objects when given only partial and uncertain information and when such information is incrementally accrued over time. Our current studies consider the use of surface motion, contour, and texture information, with the longer range goal of developing a fused sensing strategy based on these sources and others.

References

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