

A Combinatorial Methodology for Visual Mobile Robot Navigation through a New Color Detection Algorithm

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Abstract

The navigation approaches of mobile robots are divided into three major categories including hierarchical, behavioral, and combinatorial paradigms. In this paper, a visual mobile robot with combinatorial navigation paradigm is proposed which takes advantages of five reactionary and three goal-directed behaviors (GDBs). All GDBs and one reactionary behavior (visual goal seeking) employ the high-level visual information while the remaining ones use the data of infra-red and touch sensors. A proportional-differential-proportional (PDP) controller with a visual feedback supports GDBs. Besides, we provide color features through the new color match filter algorithm in order to detect the desired objects in the scene. It consists of two phases: designing and inspection. In the former step, the coefficients of the filter are optimized by genetic algorithms while in the later; the optimal filter is used to detect objects. Experimental results provided remarkable performance for color matched filters in non-stationary environmental conditions with varying illumination. Besides, the robot motion was reliably stable because of the visual PDP controller. In experiments, the robot frequently hunted all objects in the scene and moved each one to the corresponding basket.

Key Words

Mobile Robots, Combinatorial Navigation Paradigm, Visual Controller, Color Detection, Genetic Algorithms