Genetic Network Programming with Fuzzy Reinforcement Learning Nodes for Multi-Behaviour Robot Control

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Abstract

This research explores a new approach for building a complex intelligent robot multi-behaviour comprising of a variety of intelligent subsystems that are fused together into one hybrid system. The work mainly focuses on integrating reinforcement learning and fuzzy logic with genetic network programming, examining the different architectures, and aims to achieve multi-objective behaviours and alleviate the problem of learning and calibration by repeated interaction with the environment. Different components of the learning algorithm are studied separately and also in combination. They are developed systematically using an increasing level of complexity for robot behaviours. As a test bed, the work investigates how to achieve ball pursuit and wall avoidance behaviours simultaneously, in the realm of the robot soccer game. The training procedure and test environment is designed, as well as a variety of fitness functions are experimented for the multi-behaviour objectives. Furthermore, the novel evolutionary architecture is combined with hill-climbing to accelerate the search for the best individual.

Keywords—robot soccer; multi-behaviour; multi-objectives; genetic network programming; fuzzy logic; reinforcement learning;

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