Evolutionary multi-objective optimization of autonomous mobile robots in neural-based cognition for behavioural robustness

Abstract

The utilization of a multi-objective approach for evolving artificial neural networks that act as the controllers for phototaxis and radio frequency (RF) localization behaviors of a virtual Khepera robot simulated in a 3D, physics-based environment is discussed in this chapter. It explains the comparison performances among the elitism without archive and elitism with archive used in the evolutionary multi-objective optimization (EMO) algorithm in an evolutionary robotics study. Furthermore, the controllers' moving performances, tracking ability and robustness also have been demonstrated and tested with four different levels of environments. The experimentation results showed the controllers allowed the robots to navigate successfully, hence demonstrating the EMO algorithm can be practically used to automatically generate controllers for phototaxis and RF-localization behaviors, respectively. Understanding the underlying assumptions and theoretical constructs through the utilization of EMO will allow the robotics researchers to better design autonomous robot controllers that require minimal levels of human-designed elements.