GECCO-2011

Submissions

My Submissions

pap795s1 Details

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Submission Form Data | Related Data

print

Acknowledgement

Acknowledgement: yes

Requested Track

Requested Track: Artificial Life/Robotics/Evolvable Hardware

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Paper

Paper:

pdf

Keywords

General methodology:

Evolutionary robotics
Evolvable hardware
Local search
Local search

Others:

Machine learning

Abstract

Abstract (Maximum 200 words):

Creating gaits for legged robots is an important task to enable robots to access rugged terrain, yet designing such gaits by hand is a challenging and time-consuming process. In this paper we investigate various algorithms for automating the creation of quadruped gaits. Because many robots do not have accurate simulators, we test gait learning algorithms entirely on a physical robot. We compare the performance of two classes of learning gaits: locally searching parameterized motion models and evolving artificial neural networks with the HyperNEAT generative encoding. Specifically, we test six different parameterized learning strategies: uniform and Gaussian random hill climbing, policy gradient reinforcement learning, Nelder-Mead simplex, a random baseline, and a new method that builds a model of the fitness landscape with linear regression to guide further exploration. While all parameter search methods outperform a manually-

designed gait, only the linear regression and Nelder-Mead simplex strategies outperform a random baseline strategy. Gaits evolved with HyperNEAT perform considerably better than all parameterized local search methods and produce gaits nearly 9 times faster than a hand-designed gait. The best HyperNEAT gaits exhibit complex motion patterns that contain multiple frequencies, yet are regular in that the leg movements are coordinated.

Title

Title:
Generating Gaits for Physical Quadruped Robots: Evolved Neural Networks vs. Local Parameterized Search