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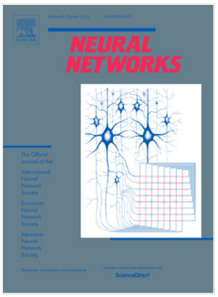

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PII: S0893-6080(16)30098-3
DOI: http://dx.doi.org/10.1016/j.neunet.2016.08.003
Reference: NN 3651

To appear in: *Neural Networks*

Received date: 26 June 2015
Revised date: 26 June 2016
Accepted date: 8 August 2016

Please cite this article as: Shahbazi, H., Parandeh, R., & Jamshidi, K. Implementation of imitation learning using natural learner central pattern generator neural networks. *Neural Networks* (2016), http://dx.doi.org/10.1016/j.neunet.2016.08.003

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Implementation of Imitation Learning using Natural Learner Central Pattern Generator Neural Networks

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Abstract

In this paper a new design of neural networks is introduced, which is able to generate oscillatory patterns. The fundamental building block of the neural network is O-neurons that can generate an oscillation in its transfer functions. Since the natural policy gradient learning has been used in training a central pattern generator paradigm, it is called Natural Learner CPG Neural Networks (NLCPGNN). O-neurons are connected and coupled to each other in order to shape a network and their unknown parameters are found by a natural policy gradient learning algorithm. The main contribution of this paper is design of this learning algorithm which is able to simultaneously search for the weights and topology of the network. This system is capable to obtain any complex motion and rhythmic trajectory via first layer and learn rhythmic trajectories in the second layer and converge towards all these movements. Moreover this two layers system is able to provide various features of a learner model for instance resistance against perturbations, modulation of trajectories amplitude and frequency. Simulation of the learning system in the robot simulator (WEBOTS) that is linked with MATLAB software has been done. Implementation on a real NAO robot demonstrates that the robot has learned desired motion with high accuracy.These results show proposed system produces high convergence rate and low test errors.

Keywords: Imitation learning, Neural Networks, Oscillatory neurons,

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