World Academy of Science, Engineering and Technology
International Journal of Industrial and Systems Engineering
Vol:15, No:09, 2021

Gaits Stability Analysis for a Pneumatic Quadruped Robot Using Reinforcement Learning

Authors : Soofiyan Atar, Adil Shaikh, Sahil Rajpurkar, Pragnesh Bhalala, Aniket Desai, Irfan Siddavatam

Abstract : Deep reinforcement learning (deep RL) algorithms leverage the symbolic power of complex controllers by automating it by mapping sensory inputs to low-level actions. Deep RL eliminates the complex robot dynamics with minimal engineering. Deep RL provides high-risk involvement by directly implementing it in real-world scenarios and also high sensitivity towards hyperparameters. Tuning of hyperparameters on a pneumatic quadruped robot becomes very expensive through trial-and-error learning. This paper presents an automated learning control for a pneumatic quadruped robot using sample efficient deep Q learning, enabling minimal tuning and very few trials to learn the neural network. Long training hours may degrade the pneumatic cylinder due to jerk actions originated through stochastic weights. We applied this method to the pneumatic quadruped robot, which resulted in a hopping gait. In our process, we eliminated the use of a simulator and acquired a stable gait. This approach evolves so that the resultant gait matures more sturdy towards any stochastic changes in the environment. We further show that our algorithm performed very well as compared to programmed gait using robot dynamics.

Keywords : model-based reinforcement learning, gait stability, supervised learning, pneumatic quadruped
Conference Title : ICIRA 2021 : International Conference on Industrial Robots and Automation
Conference Location : London, United Kingdom
Conference Dates : September 23-24, 2021