Paper ID: 53485
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student

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Technologies to Enable Space Systems (3)

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DEEP LEARNING AND REINFORCEMENT LEARNING FOR THE CREATION OF AN AGENT-BASED INTELLIGENT SATELLITE SYSTEM

Abstract

With the growing demands of the space industry, there is an increasing need for an intelligent remote agent that can operate a spacecraft without the input of on-ground engineers, thereby freeing up resources and bypassing the issue of communication delays for long interplanetary missions. Intelligent control, active health monitoring maintenance and autonomous navigation are three key fields that need to be integrated to create this agent. The present work explores the application of a deep learning framework to aid in autonomous orbit and attitude correction of a satellite following an impact from a foreign object or orbital decay. A back-propagation neural network is trained and tested. The input for the neural network as defined in the training set consists of orbit and attitude position residues generated with reference to a predefined orbit as provided by an orbit propagator, containing the simulated orbital perturbation following an impact. The output is the thrust and control values needed to correct the perturbations.

The algorithm performance is evaluated based on a result comparison to a fine tuned traditional dynamic control system. After training, the neural network is computationally more efficient than the control system. For predicting correct attitude control values, an accuracy of 87