IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

Author: Mr. Nijanthan Vasudevan
Drexel University, United States, nijanthan.vasudevan@spacegeneration.org

Mr. Oudayl Massat
Space Generation Advisory Council (SGAC), United States, oudayl.massat@gmail.com
Ms. Alex Thach
University of Maryland, United States, alex.thach3@gmail.com
Mr. Arjuna Karthikeyan Senthilvel Kavitha
Drexel University, United States, as5788@drexel.edu
Ms. Cassandra Paoli
United States, cassie.paoli89@gmail.com

SYSTEM DESIGN AND ANALYSIS OF AN AI-ASSISTED MULTI-MODEL LOCOMOTION FOR MARS EXPLORATION

Abstract

The exploration of Mars is a top objective for space agencies worldwide, and developments in artificial intelligence (AI) are poised to be essential in improving the efficiency of these missions. In order to get the best performance on the red planet, this research proposes a novel method for the design and analysis of a multi-model locomotion system. The proposed design combines multimodal locomotion that can adjust to the many terrains the rover would encounter. A deep neural network is used to construct the reinforcement learning (RL) algorithm, which allows the system to learn from both its own experience and data collected from prior missions, to optimize the control rules for each locomotor mode. Several AI technologies can improve the rover's performance on Mars in addition to the RL algorithm. For instance, object recognition and navigation can be aided by computer vision, while mission control and the rover can communicate more effectively thanks to natural language processing. The system is made to function in a variety of Martian conditions, including rocky terrain, steep slopes, and flat plains. Using a dataset of the terrain on Mars, a series of simulations are run to assess the system's performance. The simulations show that the multi-model AI-assisted locomotion system performs better than conventional locomotion systems in terms of energy efficiency and traversability. Beyond improved mobility and operational range, the proposed technology for future Mars missions has several advantages. The rover can carry out more difficult scientific inquiries with the aid of advanced data analysis and decision-making procedures made possible by AI technologies. To help direct further exploration, machine learning algorithms can be employed to find patterns and abnormalities in the data 5the rover has acquired. With this proposed A.I model, and its deep RL algorithm the system's hardware and software capabilities will continue to progress. At this stage with unsupervised training on the AI, the more data that the model obtains from different environments the more the algorithm will optimize its own data processing capabilities. This research is further explained in our documentation. Overall, the proposed multi-model locomotion system with AI assistance represents a substantial advancement in the mission to explore Mars. This system has the potential to revolutionize space exploration and dramatically advance our knowledge of the red planet by utilizing AI technology for the best performance.

Keywords: Martin terrain, A.I assisted Locomotion, Rover, Multi-Model