19th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Interactive Presentations - 19th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (IP)

Author: Mr. Rohaan Ahmed
Ryerson University, Canada, rohaan.ahmed@ryerson.ca

Prof. Nariman Farsad
Ryerson University, Canada, nfarsad@ryerson.ca

APPLICATIONS FOR ARTIFICIAL INTELLIGENCE IN NEXT GENERATION DEEP SPACE EXPLORATION ROBOTICS

Abstract

Space robotics will be absolutely vital to enabling deep space exploration, as we look to return to the moon, step foot on Mars, mine asteroids, assemble satellites in space, and explore beyond. To achieve this, future robotic systems will be required to achieve unprecedented levels of autonomy while facing several challenges associated with the deep space environment.

Key challenges will include, but are not limited to:

- Risk and costs associated with the development and launch of autonomous robotics
- Greater communication delays with infrequent communication windows
- Restrictive bandwidth usage
- Limited power generation capabilities
- Minimizing hardware mass and volume while offering greater operational capabilities and situational awareness than presently available

Recent advancements in Artificial Intelligence, particularly in the areas of Machine Learning, Computer Vision, Mixed Reality, and Deep Reinforcement Learning, offer tremendous opportunities to help solve many of these challenges. This paper will focus on the key areas of robotics that can benefit from applications of State-of-the-Art AI for Lunar and Martian exploration. This will be done by leveraging lessons learned from the successful operation of Low Earth Orbit robotics, such as Canadarm2 and Dextre manipulators, and Martian surface rovers, such as the Curiosity rover.

Key application areas that will be studied include:

- Autonomous robotic operations, including self-assembly and proximity operations
- Self-maintenance
- Swarm surface robotics
- Configurable hardware and Mixed Reality for robotic workstations design
- Artificially intelligent algorithm
- Resource sharing between several robotic elements