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USING AI FOR PREDICTIVE MAINTENANCE IN HUMAN SPACEFLIGHT: CHALLENGES,
OPPORTUNITIES, AND SOLUTIONS

Abstract

This paper argues that Artificial Intelligence can be a valuable asset for enhancing safety and innovation in human space exploration. We see predictive maintenance as one of the key applications of AI when it comes to space exploration. Predictive maintenance is the process of using data and algorithms to monitor the condition and performance of equipment, and to anticipate and prevent failures before they occur. Predictive maintenance can help reduce operational costs, improve reliability, and ensure astronaut safety by avoiding critical malfunctions and accidents. In this presentation, we provide an overview of how AI models can be used for predictive maintenance in the context of human spaceflight. We discuss the main challenges and opportunities of applying AI to complex and dynamic systems, such as spacecraft, astronaut suites, and habitats. We also review some of the existing and emerging AI technologies and solutions that can support predictive maintenance, such as anomaly detection, fault diagnosis, prognostics, and optimization. For practical demonstrations we rely on the power of Microsoft Azure AI capabilities, which help build intelligent applications without deep AI or data science skills or knowledge. We specifically provide examples of how predictive maintenance can be achieved with AI-based capabilities such as computer vision and anomaly detection. We conclude by outlining some of the future directions and possibilities in advancing responsible use of AI for predictive maintenance in human spaceflight.