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ALGORITHMIC ROADMAP BETWEEN SPACEFLIGHT ACTIVITIES AND ARTIFICIAL INTELLIGENCE

Abstract

The landscape of space exploration enabling technologies is increasingly fluid, and the presence of artificial intelligence (AI) has continued to grow. Fundamentally, AI is a class of algorithms that aims to mimic human decision logic at solving complex tasks. Due to this characteristic, AI applications in spaceflight may largely focus on automating processes, both onboard and on the ground, in a way that alleviates human burden. However, doing so raises a plethora of questions that may be difficult to address, such as real-time assurance, trust between the human user and AI system, and possibly even a lack of widespread standards for AI applications in spaceflight. Mitigating these worries may also increasingly require the designer to have technical knowledge in the realms of both spaceflight and ML/AI concepts, which may not be extensively afforded. Furthermore, it may be possible that a singular spaceflight problem can have multiple AI formulations, leading to confusion on the best approach. To alleviate such concerns, we propose the development of an algorithmic roadmap between standard spaceflight activities and processes, and potential AI technologies/algorithms that can best automate them. We primarily focus on general classes of algorithms that can be best applied to specific use cases, as well as their data requirements and performance drawbacks. We also address new and emerging AI technologies, and their potential roles within this evolving ecosystem. We aim for this roadmap to serve as an initial resource for design decisions related to AI enabled spaceflight.