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Orbiting Intelligence: A Comprehensive Survey of AI Applications and Advancements in Space Exploration

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Abstract : Space exploration has always been at the forefront of technological innovation, pushing the boundaries of human knowledge and capabilities. In recent years, the integration of Artificial Intelligence (AI) has revolutionized the field, offering unprecedented opportunities to enhance the efficiency, autonomy and intelligence of space missions. This survey paper aims to provide a comprehensive overview of the multifaceted applications of AI in space exploration, exploring the evolution of this synergy and its impact on mission success, scientific discovery, and the future of space endeavors. Indian Space Research Organization (ISRO) has achieved great feats in the recent moon mission (Chandrayaan-3) and sun mission (Aditya L1) by using artificial intelligence to enhance moon navigation as well as help young scientists to study the Sun even before the launch by creating AI-generated image visualizations. Throughout this survey, we will review key advancements, challenges and prospects in the intersection of AI and space exploration. As humanity continues its quest to explore the cosmos, the integration of AI promises to unlock new frontiers, reshape mission architectures, and redefine our understanding of the universe. This survey aims to serve as a comprehensive resource for researchers, engineers and enthusiasts interested in the dynamic and evolving landscape of AI applications in space exploration.

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