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# AI-AUGMENTED MULTI-SENSOR SYSTEM FOR LUNAR SURFACE DEBRIS MAPPING AND MITIGATION

**Abstract**

The proliferation of space debris on the Moon's surface poses risks to landing zones, scientific instrumentation, and future lunar infrastructure. This study introduces an AI-enhanced hybrid detection framework, integrating LiDAR-based topographic mapping, SAR imaging, and hyperspectral optical analysis to accurately detect, classify, and track lunar debris. The system employs machine learning algorithms for material differentiation and real-time collision risk assessment, enabling autonomous debris retrieval strategies. Findings contribute to the development of lunar space traffic management protocols, impact risk mitigation models, and AI-assisted planetary debris monitoring systems.