IAF EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM (IP)

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HARDWARE DESIGN FOR DEEP LEARNING IN MICRO SATELLITE SYSTEMS: A PARALLEL EDGE COMPUTING APPROACH

Abstract

This study introduces a state-of-the-art GPU-based hardware design meticulously tailored for on-board deep learning applications within micro satellite systems, employing a Parallel Edge Computing Approach. Addressing intricate challenges in Earth Observation, lunar, Martian, and other extraterrestrial data processing systems, the research encompasses both training and deployment aspects of deep learning models. The proposed methodology outpaces conventional FPGA-based solutions in computational performance, energy efficiency, and integration simplicity. The intricately designed printed circuit board (PCB) layout strategically minimizes signal interference, optimizes power distribution, and ensures thermal reliability, aligning seamlessly with emerging information technologies in the realm of deep learning. Extensive testing validates a successful implementation, spotlighting notable advancements over traditional FPGA alternatives. The study underscores the advantages of contemporary GPU technologies, providing insights into achieving superior computational efficiency and streamlined integration for both training and deployment of advanced deep learning applications in micro satellite environments across diverse celestial bodies. This research aspires to contribute to the evolving landscape of Earth Observation and space exploration, embodying a steadfast commitment to excellence and innovation in advancing hardware solutions for deep learning in micro satellite systems, particularly through the implementation of parallel edge computing techniques.

Keywords: Hardware Design, Deep Learning, Micro Satellite Systems, Parallel Edge Computing, GPU-based Architecture, FPGA Alternatives, Computational Efficiency, On-board Applications, Earth Observation, Space Exploration.