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NOVEL EDGE DATA PROCESSION SYSTEM FOR EO APPLICATIONS

Abstract

Earth Observation data processing have traditionally been done in terrestrial data centers and lately in the so-called cloud. This requires that all data produced within the satellite payload is downlinked to ground, or into the cloud. Certain data reduction has been done on-board to improve the value of the downlinked data somewhat. However, sensors produce more and more data, and the downlink capacity is not evolving at the same pace, thus the downlink is becoming a critical bottleneck. Therefore, more data processing needs to be done close to the sensors, at the edge, to reduce the data to be downlinked but also to shorten the time for decision-making. Edge processing also allows combining data from several sensors (satellites) through inter-satellite links before downlinking the combined result.

RUAG Space is developing high-performance processing modules and systems. Lynx provides an unprecedented amount of processing power, 30000 DMIPS, still fulfilling the tough requirements for a long lifetime in the harsh space environment. Development and engineering models are available together with evaluation kit for potential customers. Flight model is in development and environment qualification is planned for this year. In the paper we will present the system in more detail as well as performance measurements and compare with other systems for a very demanding processing intensive application.

Data processing frameworks for image and signal processing with or without AI is also included in our plans for a complete ecosystem around the processing system. Furthermore, Klepsydra Technologies has developed a novel approach to on-board artificial intelligence (AI) based on cutting-edge academic research on parallelization of data processing. This high-performance AI algorithm, based on the so-called pipeline parallelization approach, combined with the Lynx module enable AI onboard with low power consumption and high throughput.

We also foresee to be able to emulate our processing system in the cloud with the same processing frameworks as in space such that the application developers can try out and possibly train their applications in the cloud and by the switch of a button deploy their application in the operational environment at the edge in space.

The proposed combined solution has been validated with several Deep Neural Network (DNN) models including standard object detection and classification algorithms as well as Space specific algorithms for Earth Observation. The results show that the data processing rate and power saving increase substantially with respect to state-of-the-art solutions for Space onboard AI applications.