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HIGHLY INTEGRATION OF HYPERSPECTRAL, THERMAL AND ARTIFICIAL INTELLIGENCE FOR THE ESA PHISAT-1 MISSION

Abstract

The European Space Agency (ESA) has contracted cosine Remote Sensing to highly integrate Thermal Infrared (TIR) technologies into a miniaturized Visible-Near-InfraRed (VNIR) hyperspectral imager able to fit a volume of less than two liters. The combination of hyperspectral VNIR and TIR in such a compact envelope is unprecedented. The imager is named HyperScout-2 as it will use the HyperScout-1 platform, that has flight heritage, as starting point to further integrate spectral channels. HyperScout-2 will be used as in-orbit test-bed to benchmark the performance of such a miniaturized class of systems as well as to perform hands-on investigations to forecast the benefits of combining frequent measurements in the VNIR and TIR from nanosatellites, with less frequent but very accurate measurements performed by institutional satellites such as the Copernicus fleet.

HyperScout-2 will enable experimental programs to investigate the use of Artificial Intelligence (AI) for a variety of applications ranging from cloud detection to ship detection with inline data inference, potentially beneficial also to the larger class satellites the Agency is developing as part of the Copernicus expansion element.

The first enabled data product is the fusion of TIR imaging with hyperspectral data fully co-registered. Applications that will be investigated are: evapotranspiration and agriculture applications, thermal inertia and soil moisture, Urban Heat Island, oil spill, fire monitoring, and water quality. The disruptive development makes use agile project management and risk mitigation approaches in order to catch the challenging schedule dictated by the main mission program. The project is targeting a flight window in August 2019, as part of the ESA PhiSat-1 mission.

This contribution reports on a general description of HyperScout-2 as well as of the fast track program in which is implemented. We will highlight the way machine learning is exploited for the first application

run in orbit as well as the potential of small systems deployed in constellations and integrated into ecosystems made of small and large systems.