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

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A NOVEL PANSHARPENING APPROACH FOR SATELLITE THERMAL IMAGERY SEGMENTATION FOR THE ASSIGNMENT OF HEAT SIGNATURES TO MODULE GROUPS WITHIN SOLAR PARKS

Abstract

The current development of new satellite constellations is promising easier access to higher resolution satellite imagery in the visual spectrum and beyond. Evidence of this trend can be found in the fundraising race between NewSpace startups to develop systems to provide higher resolution imagery with shorter revisit periods than presently available. This future state of the art will allow many societal challenges to be addressed using satellite data, such as improving the monitoring of renewable energy infrastructure. New algorithms should be developed using existing resources to prepare for this opportunity.

Thermal imagery as available from Landsat 8-9 has a resolution limited to 100m, preventing the heat signature of specific structures such as strings of modules within solar parks or individual buildings from being clearly distinguished. This paper aims to present an approach for pansharpening satellite thermal imagery, using higher resolution panchromatic imagery to segment pixel data from the thermal imagery onto specific structures in the panchromatic imagery.

This approach is tested with the application use case of identification of thermal variations between groups of modules within a solar park. Landsat 8-9 Band 10/11 Thermal Infrared Sensor (TIRS) imagery is pansharpened using panchromatic imagery from Landsat 8-9 Band 8 and is validated against in-situ data collected by a thermal camera. This allows for more precise segmentation of the thermal signature of specific structures, in this case groups of modules within the solar park.

The algorithms presented in this paper could help to facilitate growth in global solar park infrastructure by decreasing operations and maintenance costs, thereby reducing the global reliance on fossil fuels and aiding a transition to renewable energy. This research will also help to prepare for a future scenario with higher resolution satellite imagery from both the visual and infrared spectra, with which automatic anomaly detection could be enabled using the proposed segmentation algorithms.