An Efficient Machine Learning Approach for Atmospheric Correction

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Abstract

The earth observation using remote sensing images is an inquisitive way to explore and evaluate the geo-resources of any specific area on the globe. In this regard, Indian Resourcesat-2A (R2A) remote sensing satellite plays an important role in monitoring the critical resources of our planet using its unique three tier imaging mechanism. Optical sensors on-board R2A have good spatial temporal resolution for diverse space borne applications. Most of these applications requires Surface Reflectance (SR) data product by removing the effects of intermittent atmospheric scattering and absorption. Radiative Transfer Models (RTM) are used to perform atmospheric correction which are computationally intensive, thus a Look-Up-Table (LUT) is utilized to interpolate intermediate values as a trade-off between accuracy and speed. However, the process of interpolation too becomes very compute intensive when a large enough LUT is used. The paper provides an approach to remove this trade-off by using multi-layered deep network to model interpolation as a regression problem. The proposed method generates highly accurate Deep SR product with a significant reduction in turn-around time. The experimental result shows that a speedup of 5x is achieved with the developed framework as compared to conventional interpolation-based approach for generation of R2A LISS-3 Deep SR scene data product. The Deep SR product is compared with pure 6SV generated product and R2 value found to be 0.97 (Green), 0.97 (Red), 0.98 (NIR) and 0.98 (SWIR) respectively. To check the efficacy of the framework, the LISS-3 Deep SR product is also compared with closest acquisition Landsat-8 SR product and ground truth values obtained through vicarious calibration. The maximum relative deviation error found to be 1.34%, 1.82%, 3.25% and 2.16% for Green, Red, NIR and SWIR channels respectively.

Keywords radiative transfer, atmospheric correction, LUT interpolation, remote sensing, neural networks, surface reflectance

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