Accuracy of Radiative Transfer in Hyperspectral Remote Sensing

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Objectives

- To understand how Hyperspectral data collection is conducted
- To determine the accuracy of the AC models (ELM, ATCOR, QUAC) as compared to the ground truth measured reflectance
- To determine the advantages / robustness of various models / disadvantage of models (i.e. how prone to error) and when to use them

Main research ideas

- Atmospheric correction (AC) is used to remove solar illumination and atmospheric effects from the measured spectral data to obtain accurate surface reflectance
- HSI data of target panels (radiance spectral) are collected from Airborne sensor
- Ground truth measurements of targets taken (reflectance spectral)
- Use Euclidean Distance to estimated accuracy and compare the various methods

Research results

- ATCOR with ground calibration offers best accuracy, followed by QUAC and ELM.
- Further study on AC methods and its impact on different materials analysed

Benefits/potential applications of the research

- By understanding the level of accuracy as compared to ground truth / actual spectral profile of a material, target recognition systems could be designed, configured and fine-tuned to increase its detection performance
- Target spectral could be collected by using the most appropriate AC methods in that scenario and stored in a library for analysis
- Spectral profile of materials have different signatures and once the target and its associate materials could be determined, the spectral profile could be used to search and locate camouflaged targets in HSI imagery

Follow-up research activities

- Study other advanced AC methods (e.g. FLAASH) and conduct regional trials
- Automatic Target Detection using HSI
- Machine Learning with HSI Data

References: Yuen, Peter & Richardson, Mark. (2010). An introduction to hyperspectral imaging and its application for security, surveillance and target acquisition. Imaging Science Journal. 58. 241-253.