Spectral invariants in very high spatial resolution hyperspectral images of vegetation

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Radiative transfer (RT) models are at the core of optical remote sensing of vegetation. Most current vegetation monitoring algorithms are designed for medium spatial resolution multispectral satellite data, where the pixel size ranges between 10 and 300 m. In the recent years, hyperspectral data with very high spatial resolution (VHR), where pixel size ranges between 0.1 and 10 m, has become more and more available from various platforms. However, the current algorithms cannot cope at such small scales where individual canopy elements, such as leaves and tree crowns are visible. This is because the algorithms treat vegetation as a continuous medium where the local illumination conditions of the canopy elements can be ignored. As it stands, no physically based algorithm designed VHR data exists yet.

In this talk, we discuss the applicability of the RT-based spectral invariant theory to VHR hyperspectral data. We also demonstrate that the theory can be used to accurately retrieve the local illumination conditions at leaf-level and introduce a method for the inversion of leaf chlorophyll content from synthetic data, generated using Monte Carlo ray tracing simulations.

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