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CURRENT CHALLENGES FACING SPACEBORNE HYPERSPECTRAL REMOTE SENSING TECHNOLOGY AND THEIR POTENTIAL SOLUTIONS

Abstract

Hyperspectral remote sensing technology has advanced significantly in the past two decades. Current sensors onboard airborne and spaceborne platforms cover large areas of the Earth surface with unprecedented spectral, spatial, and temporal resolutions (Bioucas-Dias 2013). These characteristics provide useful applications in various fields of study utilizing spaceborne platforms including geology, astronomy, agriculture, mineral exploration, and surveillance. Current challenges facing hyperspectral remote sensing development are cost and complexity. Faster computers, higher sensitivity detectors, data downlink capabilities, and larger data storage capacity are needed to further develop hyperspectral imaging systems (Singh Dowerah 2010). The source of these high requirements is namely driven by the high dimensionality and size of the hyperspectral imagery data (Bioucas-Dias 2013). Hyperspectral imagery is collected in the form of a hyperspectral 'cube', with the spatial information arranged in the X & Y plane and spectral information arranged in the Z axis. Because hyperspectral remote sensing is taken over hundreds of discrete, contiguously spaced spectral bands, each dataset exceeds hundreds of megabytes, and demands large storage capacity for data accumulation, faster computers for large data processing, and high data downlink capabilities for large data relocation. Several concepts to mitigate large data issues are discussed, such as deploying the technology on several spacecraft, and utilizing existing orbital infrastructure. This paper aims to provide an analysis of current challenges spaceborne hyperspectral remote sensing development faces, investigate potential solutions in addition to identifying future challenges and direction of future development.