Journal of Geology & Geophysics
ISSN: 2381-8719
OPEN ACCESS Freely available online
Commentary

Hyperspectral Remote Sensing (HRS)

Komal Rai*

Department of Psychology, Lovely Professional University, Phagwara, Punjab, India

DESCRIPTION

Hyperspectral Remote Sensing is an advanced tool that provides high spatial/spectral resolution data from a distance, with the aim of providing near-laboratory-quality radiance (and subsequent related information) for each picture element (pixel) from a distance. This information enables the identification of targets based on the spectral behavior of the material in question (mainly absorption features of chromophores-see further on). This approach has been found to be very useful in many terrestrial, atmospheric and marine applications. The classical definition for HRS given by Goetz and his colleagues in 1985 remains valid today.

"The acquisition of images in hundreds of contiguous registered spectral bands such that for each pixel a radiant spectrum can be derived." This definition covers all spectral regions (i.e. VIS (Visible), NIR (Near Infrared), SWIR (Shortwave In-Frared), MWIR (Midwave Infrared) and LWIR (Longwave Infrared)), all spatial domains and platforms (microscopic to macroscopic; ground, air and space platforms) and all targets (solid, liquid and gas). Although not mentioned in Goetz's definition, not only are a "high number of bands" needed for this technology, but also high spectral resolution, i.e., a narrow bandwidth (FWHM), and an appropriately large sampling interval across the spectrum. The accepted bandwidth for HRS technology was set to approx. 10 nm 25 years ago. However, today, narrower bandwidths are available and desirable in order to broaden HRS's capability. The former spectral resolution of 10 nm was proposed mainly for the first HRS application (geology); new issues, such as assessing vegetation fluorescence, are now, requiring band-widths of less than 1 nm. The idea is to collect near-laboratory-quality radiation from a far distance and apply spectral-based analytical tools to interpret the data. Using this approach, HRS provides information in addition to the traditional cognitive remote sensing mapping and increases our ability to sense Earth remotely. HRS can thus be defined as "spatial spectrometry from afar" which adopts spectral routines, models and methodology and merges them with spatial information. Whereas in the laboratory, conditions are constant, optimal and well-controlled, in the acquisition of high-quality spectral data in airborne/ spaceborne cases, significant interference is encountered, such as the short dwell time of data acquisition over a given pixel, and hence a lower SNR, atmospheric attenuation of gases and aerosols and the uncontrolled illumination conditions of the source and objects. This makes HRS a very challenging technology that involves many disciplines, including: atmospheric science, electro-optical engineering, aviation, computer science, statistics and applied mathematics and more. The major aim of HRS is to extract physical information from raw HRS data across the spectrum (radiance) which can be easily converted to describe inherent properties of the targets in question, such as reflectance and emissivity. Under laboratory conditions, the spectral information across the VIS-NIR-SWIR-MWIR-LWIR spectral regions can be quantitatively analyzed for all Earth materials, natural and artificial, such as vegetation, water, gases, artificial material, soils and rocks, with many already available in spectral libraries. It was shown that if a HRS sensor with high SNR is used, an analytical spectral approach can be incorporated to yield new products never before sensed by other remote sensing means. The high spectral resolution of HRS technology combined with temporal coverage enables better recognition of targets, a quantitative analysis of phenomena and extracting information.

Allocating spectral information temporally in a spatial domain provides a new dimension that neither the traditional point spectroscopy nor air photography can provide separately. HRS can thus be described as an "expert" Geographic Information System (GIS) in which surface layers are built on a pixel-by-pixel basis rather than a selected group of points with direct and indirect chemical and physical information. Spatial recognition of the phenomenon in question is better performed in the HRS domain than by traditional GIS technique. HRS consists of many points (actually the number of pixels in the image) that are used to generate thematic layers, whereas in GIS, only a few points are used for this purpose. The concept of the HRS technology, where every pixel is characterized by a complete spectrum of ground targets (and their mixtures) that can be quantitatively analyzed within the spatial view. The capability of acquiring quantitative information from many points on the ground at almost the same time provides another innovative

Correspondence to: Komal Rai, Department of Psychology, Lovely Professional University, Phagwara, Punjab, India, E-mail: komalresearch7@gmail.com

Received: 04-Feb-2022; Manuscript No. JGG-21-13872; **Editor assigned:** 07-Feb-2022; PreQC. No. JGG-21-13872 (PQ); **Reviewed:** 18-Feb-2022; QC. No. JGG-21-13872; **Revised:** 22-Feb-2022; Manuscript No. JGG-21-13872 (R); **Published:** 1-Mar-2022, DOI: 10.35248/2381-8719.22.11.1019.

Citation: Rai K (2022) Hyperspectral Remote Sensing (HRS). J Geol Geophys. 11:1019.

Copyright: © 2022 Rai K. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

aspect of HRS technology: it freezes time for all spatial pixels at almost the same point, subsequently permitting adequate temporal analysis. HRS technology is thus a promising tool that adds many new aspects to the existing mapping technology and improves our capability to remote-sense materials from far distances.