Optics

Progressive Band Selection for Hyperspectral Images

An innovation in the area of hyperspectral image processing

Space-borne hyperspectral imagers collect enough information to positively identify materials and substances on the ground. Scientists often use hyperspectral data to investigate land use, mineral deposits, or signs of climate change. However, the same data is also useful during disasters or other emergencies, when detection and mapping of fires, chemical agents, or flooded areas can provide critical information to first-responders. The latter application relies on the ability to identify materials quickly and accurately. The sheer volume of data in the image causes many applications to run slowly and produce poor results, as they search the full image dataset for the information they need. This innovation develops a system that creates reduced datasets tailored for each potential application.

BENEFITS

➲ Tailorable: can tailor datasets for specific applications

➲ Suitable for space: May be adapted to run on-board an observing spacecraft, allowing in-flight decisions based on the data it collects, without having to transmit the full image to the ground or wait for instructions from human controllers

technology solution

THE TECHNOLOGY

Only a small portion of a hyperspectral image is useful to identify any given material. The sheer volume of data in the image causes many material classification programs to run slowly and produce poor results, as they search the full image dataset for the information they need. The same algorithm can produce more accurate results in less time if it is given a reduced dataset that contains only the information most useful for detecting the target material.

This technology is a system that creates reduced datasets tailored for each potential application. The system can operate on archived hyperspectral imagery from NASA's EO-1 Hyperion instrument or on data from future missions, such as the Hyperspectral Infrared Imager (HyspIRI), as they become operational. Other agencies with hyperspectral imagers, including the defense and intelligence communities, can also use the system in their applications. Additionally, the system can operate on-board these spacecraft, allowing them to quickly and autonomously analyze the imagery they collect. Spacecraft with this capability could detect emerging situations and then intelligently re-task themselves to collect more data, or alert scientists or emergency personnel on the ground.

This innovation includes an algorithm to convert hyperspectral images to a progressive format, along with another algorithm to quickly analyze hyperspectral images in this progressive format and select the most important bands for a given science application.

APPLICATIONS

The technology has several potential applications:

- ➲ Fast analysis of hyperspectral images (i.e. disaster response or target detection scenarios)

PUBLICATIONS

Patent No: 8406469

Fisher, K., & Chang, C. (2009). Progressive band selection. Imaging Spectrometry XIV.