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Transmission of hyperspectral data collected from unmanned aerial platforms in real time

ULPGC Universidad de Las Palmas de Gran Canaria | Fundación Parque Científico Tecnológico
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TYPE OF R+D RESULT
- **New technology**
- New product
- New service
- New knowledge or skill

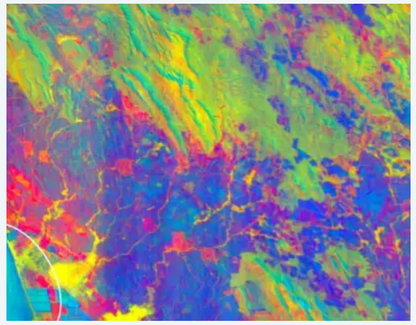
COMMERCIAL MATURITY LEVEL
- Model or conceptual idea
- Proof of concept (design)
- **Validated in a controlled environment**
- Validated in a real environment
- Successfully implanted

PROTECTION LEVEL
- **Non- applicable**
- Patent
- Software
- Know - how
- Utility model

Description of the solution. Problem solved

Hyperspectral images enable to collect information of a wide range of the electromagnetic spectrum, which makes easier to identify materials by the emitted or absorbed spectrum by said materials. One of the biggest challenges facing the hyperspectral technology is to analyse information in real time. For such task, different solutions in the market can be found, all of them have a common objective: distinguish and separate the different components of the analysed image.

One of the main difficulties involved in transmission of hyperspectral data is compressing the massive amount of information obtained by the captured image for its transmission in real time, without affecting its quality.



The proposed solution is a system based on a lossy compression algorithm for hyperspectral images (HyperLCA) characterised by high compression ratio, high performance and a reduced compression burden. This system is executed on a computer installed in an unmanned aerial vehicle platform (UAV), using the images captured by a hyperspectral push broom camera, which is also installed on the platform.

The method used by this system for compressing and decompressing images consists of dividing the image into much smaller images in order to be able to transfer them easily and, subsequently, bring them back together, obtaining, thus, the original image.

Fields of commercial application

This solution has numerous practical applications since it provides data collected from an UAV in real time for visualisation and analysis. It may be applied to the following fields:

- Agriculture: early detection of possible pests, facilitating timely action to save crops.
- Marine field: detection of uncontrolled spills; monitoring of large fish shoals; control of red tides caused by algal blooms; monitoring of ocean pollution caused by plastics and microplastics; etc.
- Security: search and rescue assistance; monitoring of road-traffic; fighting against forest fire; border control; etc.
- Other: mineralogy, archaeology, geology, and so on.

Market opportunity

Nowadays, only high-resolution satellite systems have sensors able to capture hyperspectral images. They provide high spatial resolutions, in the order of a few meters/pixels or even less, but they are very expensive and they fail to solve inconveniences resulting of temporal resolution (the amount of time needed to revisit and acquire data for the exact same location on Earth), which usually takes a few days or even more due to persistent meteorological conditions. This means that data is not provided in real time.

Another possibility of application may be installation of these systems on High Altitude Pseudo-Satellites (HAPS), which are unmanned airships that operate in the atmosphere at high altitudes, between 20 to 50 km approximately. They are mainly used for communications, teledetection and/or surveillance and offer lower costs compared to satellites. They also provide longer missions and optimal data collection since they can fly over the area to be monitored.

However, systems based on hyperspectral technology installed on drones (UAV) are motorised solutions offering valuable results when immediacy, mobility and high-quality data are essential.

Competitive advantage

The state of art does not observe the use of hyperspectral technology in applications where complex analysis of the collected data is needed, or even in those cases when it is simply necessary to observe the captured information instantaneously. Thus, this result replaces those deficiencies, since it allows the transmission of hyperspectral data to a ground station, where it is processed instantaneously. Also, there are not calculation or visualisation restrictions for the operator.

The used technology has relevant advantages such as failure tolerance, that means that if an error occurs during the compression of a macroblock, the remaining macroblocks would not be affected by this error. In addition to this, compression can be executed before the image is totally captured, since each macroblock is able to be compressed as it is collected.

Unlike traditional systems, compression process is very simple, while decompression is done by the selected data fusion algorithms, which is the more complex part of the process. Since decompression is done in the ground station, there are not so many limitations in terms of area, power and time. Therefore, the complexity of the data fusion process used does not affect the quality of the process. Finally, this solution is able to achieve high compression ratios with reasonably good quality of the decompressed image.

AUTHOR
José María Melián Álamo; Sebastián López Suárez

CONTACT
Oficina Transferencia de Resultados de Investigación (OTRI)
arivero@fpct.ulpgc.es
928 45 99 56 / 43
https://otri.ulpgc.es/

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