Abstract

The main objective of this work is to present an analysis of performance for remote sensing compressors that takes into account the energy consumption of them. Knowing that the energy consumption of an algorithm is dependent of the hardware, two processing platforms with different characteristics will be used for a first kind of analysis. The first one make exclusive use of a CPU, performing all the processing serially. With the help of a GPU, the second platform will perform part of the job with parallel operations. The compression algorithm used for the analysis is the recommended by the CCSDS to perform the image compression for remote sensing satellites (CCSDS 122.0-B-1). In that context, the energy cost of each platform can be measured and a three-dimensional curve involving rate-distortion-energy can be plotted. Another analysis can be made using a power measurement hardware. Thus, the main remote sensing image compression algorithms can be run on several different computers, where energy consumption can be analyzed using a three-dimensional curve too. Finally it is possible to analyze some interesting points in the context of energy restriction involving: platforms, processing time and rate-distortion theory.
How much time represents the transform process?

Nebraska CCSDS algorithm implementation

How much time is possible to gain doing the transform with a GPU?

Results 2 - RDC curve (rate-distortion-cost)

Simulation parameters
- Cost: Amount of encoded images using 60% of laptop battery range (85% → 25%).
- Information font: 100 images of 4096^2 pixels (CBERS-2B).
- External hardware: Developed to turn on/off the battery charger (helping the simulator).
- Laptop S.O.: Windows 8 64 bits.

CPU: Intel(R) Core(TM) i7-3610QM (4 cores)
Third generation Intel(R) Core(TM) i7-3610QM (clock of 2241003 KHz).

GPU: NVIDIA GeForce GT 630M (96 cores)
Streaming Multiprocessor Capability 2.1 with 2 multiprocessors (MP) of 48 cores each one (clock of 950000 KHz).

Results
In some cases 30% more codification using the GPU.

[energy saved] 24% < 29, 1% [time saved]

Published:
Results 3 - Using an external metering hardware (under work)

![Diagram showing energy consumption of remote sensing image compressors in different processing platforms.](image)

- **Computer (Master)**
- **Computer (Slave)**
- **Serial cable**
- **Ethernet cable**
- **Energy cable**

**Antennas**:
- CCSDS-Nebraska
- SPIHT CODETREE
- SPIHT FASTCODE
- JPEG2000 OPENJPEG

### Energy [Joules]
- 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8

### PSNR [dB]
- 55 50 45 40

### BPP
- 40 0.2 0.4 0.6 0.8 1