Optimized multicore implementation and benchmarks for on-board image compression algorithm - on dedicated space HW

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The necessity for performing multispectral and hyperspectral image compression on multicore systems capable of running on-board satellites has increased as multispectral and hyperspectral sensors generate a very large amount of data correlated with the fact the storage space and the bandwidth used for transmitting images are scarce resources on satellites.

The lossless compression algorithm offers outstanding effectiveness for compressing three-dimensional images produced by multispectral and hyperspectral images and sounders. Hyperspectral images typically include hundreds of spectral band covering contiguous range of the spectrum, with each band having fairly narrow spectral resolution while a multispectral image might have tens of bands that might not be contiguous, and each band would generally cover a wider portion of the spectrum. By parallelizing it, we can efficiently distribute the computational effort to all available cores and maximize the throughput. It will allow us to reduce the volume of data required to store the images and to send more data to the ground station.

The purpose of this project is to optimize and parallelize the compression algorithm with the intention that it will eventually be used in future satellite missions. The developed software runs on both RTEMS and Linux operating system.

The parallelized version of the compression algorithm uses the MTAPI library because it allows implementation for resource-constrained systems, such as those with a small memory footprint, deterministic behavior, and hardware-specific optimizations. The master-worker design paradigm (also referred to as master-slave model) was selected because the compression of the multispectral/hyperspectral images blocks can be done independently without communication between processing nodes."