Evaluating Signal-to-noise Ratios in Hyperspectral Imagery Summed During versus Post Acquisition

Natalie Cornish
Department of Geography, McGill University, Montreal (Quebec) Canada
2014
Supervisors: Dr. Margaret Kalacska & Raymond Soffer

Signal-to-Noise Ratios (SNRs) indicate the level of useful information versus interference collected in an image. The SNR found in hyperspectral images acquired using the Compact Airborne Spectrographic Imager 1500 (CASI-1500) can be improved by making use of the imager's programming capabilities, and instructing the device to add two or more individual signals from adjacent spectral channels together during image acquisition (summing on-chip). A similar amplification is achieved when using post-processing software (summing off-chip), but results in lower SNR relative to the image summed on-chip. I hypothesized that the discrepancy resulting from summing an image on-chip versus off-chip would be negligible due to the low noise floor advertised for the CASI-1500. In order to test this hypothesis, this thesis compares SNR found in images summed during acquisition to those summed post acquisition. Results show low discrepancies in SNR between summation techniques when summing few channels together (low levels of summation), and increasing discrepancies with increasing levels of summation. As a result, off-chip summation provides a viable alternative to on-chip summation when an imaging device is well-designed, and where low levels of summation are required.

CASI-1500 Signal-to-noise ratios (SNR) by summation configuration and varying signal strengths (1,000 DN: low, 8,000 DN: medium, 16,000 DN: high).