PIPELINE PROCESSING OF LARGE VOLUMES OF HYPERSPECTRAL DRILL CORE IMAGERY

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1. SUMMARY

Hyperspectral imaging of geological core logs is now a routine technique in geological exploration and production. The CSIRO in Sydney developed a line-profiling system in 2003 and Frank Honey developed an whiskbroom imaging system for AngloGoldAshanti in 2005. The new Finnish SisuRock hyperspectral pushbroom camera imaging system has decreased image collection time and increased data volumes by an order of magnitude over these systems. We discuss the practical problems of producing a quantitative interpretation of 3500 SWIR core log images collected by the SisuRock system. Each image consists of 320x1000 240 band spectra, or over one billion 240-band spectra for the entire survey collected at a gold exploration target in Colombia. The processing pipeline consists of the following sequential steps:

1. Calibration of images against a white target and correction for dark current offsets;
2. Smoothing of spectra using polynomial fitting and a Fourier filtering technique;
3. Fit and remove a convex hull from each spectrum;
4. Extract diagnostic spectral features like absorption minima and maxima (depths and locations);
5. Mask out the background core tray;
6. Extract core segments from images using morphological segmentation;
7. Concatenate core segments into a continuous depth profile;
8. Register core segments to a depth scale with uniform spatial pixel size;
9. Generate summary statistics within a depth context;
10. Produce colour composite images of raw core and spectral features.

The various algorithms applied come from signal processing (spectral smoothing, convex hull removal, spectral feature extraction), image processing (separating drill core from core tray background, concatenation of core segments, resampling of core segments to a uniform spatial scale, colour-coding spectral features) and mathematical morphology (core segmentation and extraction). The various algorithms are well known and the aim of this presentation is to discuss ways of addressing data processing throughput issues posed by the task of interpreting over one billion image spectra in a reasonable amount of time. We discuss the various processing stages of the pipeline and present some results and show how they can be used to increase our geological and mineralogical knowledge of the prospect.