Geophysical Research Abstracts
Vol. 21, EGU2019-16543, 2019
EGU General Assembly 2019

SOLSA HIMIP – A software for Hyperspectral Image Manipulation, Interpretation and Processing

Thanh Bui (1), Thomas Lefevre (2), Beate Orberger (3,4), Anas El Mendili (2), Ali Mohammad-Djafari (5), Sylvain Delchini (6), Henry Pilliere (2), Simon B. Blancher (1), Aisha Kanzari (1), Xavier Bourrat (6), Daneil Chateigner (7), Mike Buxton (8), and Monique Le Guen (9)

(1) Eramet IDEAS, Eramet Group, France, Trappes, France (thanh.bui@erametgroup.com), (2) ThermoFisher Scientific (TFS), Artenay, France, (3) Catura Geoprojects, Paris, France, (4) GEOPS-Université Paris Sud-Paris Saclay, Orsay, France (beate.orberger@u-psud.fr), (5) L2S, CNRS, Centrale Supélec, Université Paris-Saclay, France, (6) BRGM, Orléans, France, (7) CRISMAT-CNRS, Normandie Université, Caen, France; , (8) Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, The Netherlands, (9) Eramet Nickel Division, Eramet Group, Trappes, France

On-line-real-time combined mineralogical and chemical analysis on drill cores is highly demanded by mining and metallurgical companies to speed up exploration and mining, through more precise geomodels and optimal definition of metallurgical parameters. The EU-H2020 SOLSA project (www.solsa-mining.eu), targets to construct an expert system coupling sonic drilling with an on-line-real-time analytical system, combining for the first time systematic mineralogical and chemical analysis on drill cores using a profilometer, a high resolution RGB camera, VNIR (Visible Near Infrared)/SWIR (Shortwave Infrared) hyperspectral cameras, and a XRF spectrometer. This expert system should scan about 60 m drill cores per day to reach real-time decision.

Hyperspectral imaging or spectroscopy reflectance is a useful mineralogical analysis tool thanks to its non-destructive measurement, rapid data acquisition and simple instrumentation. The abstract presents the Hyperspectral Image Manipulation, Interpretation and Processing (HIMIP) software that is under active development. The software has a graphic user interface to facilitate its usage. HIMIP is developed mainly in Matlab that can be compiled to a standalone application with the supplementary Matlab compiler. The main functionalities of the software include: reflectance computation, hull correction computation, spectra manipulation, spectral library management, hyperspectral image registration and sparse hyperspectral unmixing associated with superpixel algorithms.

In practice, geoscientists interpret separate spectra to identify minerals using the commercial software ENVI and the Spectral Interpretation Field Manual GMEX. HIMIP offers the same functionalities that allow users to select and manipulate spectra from a hyperspectral image. The reflectance and its continuum removal are displayed together with associated diagnostic absorption features for mineral determination. Users are able to reduce noise using Savitzky-Golay filter and enhance false color image by selecting appropriate spectral bands (wavelengths) as well as adjusting image intensities. In addition, users can extract appropriate spectra and enlarge the existing spectral library thanks to the spectral library management of HIMIP.

For automatic mineral identification, HIMIP implemented three sparse unmixing techniques [1], [2] based on the under extension spectral library [3]. The novelty of the software lies in its incorporation of spatial information using superpixel algorithms into sparse unmixing techniques, which significantly improves its accuracy and efficiency. In addition to applying unmixing computation on reflectance data, HIMIP implements the unmixing computation on two other kinds of data including logarithm of reflectance and continuum removal. The software also provides users necessary tools to explore the unmixing results.

As our analytical system consists of several sensors with different angles of view and resolutions, HIMIP implements a registration technique based on control points with different geometric transformations for registering VNIR and SWIR hyperspectral data. The software enables using existing control points or selecting new control points. Furthermore, we have been developing other registration method based geometry-optic models to register all different kinds of data in our system. The integration of this method and the fusion of registered data are ongoing.

Other functionalities including spectral angle mapper and machine learning techniques such as support vector machines and random forest classification are going to be implemented.