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A supervised technique for drill-core mineral mapping using Hyperspectral data

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Drilling is a key task in exploration campaigns to characterize mineral deposits at depth. Drillcores are first logged in the field by a geologist and with regards to, e.g., mineral assemblages, alteration patterns, and structural features. The core-logging information is then used to locate and target the important ore accumulations and select representative samples that are further analyzed by laboratory measurements (e.g., Scanning Electron Microscopy (SEM), Xray diffraction (XRD), X-ray Fluorescence (XRF)). However, core-logging is a laborious task and subject to the expertise of the geologist.
Hyperspectral imaging is a non-invasive and non-destructive technique that is increasingly being used to support the geologist in the analysis of drill-core samples. Nonetheless, the benefit and impact of using hyperspectral data depend on the applied methods. With this in mind, machine learning techniques, which have been applied in different research fields, provide useful tools for an advance and more automatic analysis of the data. Lately, machine learning frameworks are also being implemented for mapping minerals in drill-core hyperspectral data.
In this context, this work follows an approach to map minerals on drill-core hyperspectral data using supervised machine learning techniques, in which SEM data, integrated with the mineral liberation analysis (MLA) software, are used in training a classifier. More specifically, the highresolution
mineralogical data obtained by SEM-MLA analysis is resampled and co-registered to the hyperspectral data to generate a training set. Due to the large difference in spatial resolution between the SEM-MLA and hyperspectral images, a pre-labeling strategy is required to link these two images at the hyperspectral data spatial resolution. In this study, we use the SEM-MLA image to compute the abundances of minerals for each hyperspectral pixel in the corresponding SEM-MLA region. We then use the abundances as features in a clustering procedure to generate the training labels. In the final step, the generated training set is fed into a supervised classification technique for the mineral mapping over a large area of a drill-core. The experiments are carried out on a visible to near-infrared (VNIR) and shortwave infrared (SWIR) hyperspectral data set and based on preliminary tests the mineral mapping task improves significantly.