How machine learning work on hyperspectral data for rock mapping

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The rock discrimination is often implemented by field geological investigation or lab geochemical analysis which are time-consuming, expensive and laborious. Hyperspectral remote sensing provides an economic, fast and nondestructive means for lithological mapping. The availability of reliable data and usable samples constrain the spread of hyperspectral technique into geologic applications. Furthermore, the cutting-edge techniques for data processing are lagged in geologic community. As the technique of Machine Learning (ML) prevails in a variety of applications for big data, it is imperative to explore how this powerful technique can be more readily utilized in hyperspectral analyses. This study used a scanned hyperspectral image of rock samples from the Ni-Cu-PGE mineral deposit in Cape Smith Belt, Canada to discriminate six similar types of mafic and ultramafic rocks; the traditional mapping method of Spectral Angle Mapper (SAM) and ML technique of Random Forest (RF) were both applied. Classification results show that RF outperforms SAM in mapping accuracy. The RF model also generated a set of important bands that can facilitate the band selection in the airborne image and reduce the effort in gathering geologic expert knowledge for future lithologic mapping. The study proves that RF is a robust tool to analyze the spectral data for rock discrimination, although only a small number of samples are provided.