EGU24-5443, updated on 27 Mar 2025
https://doi.org/10.5194/egusphere-egu24-5443
EGU General Assembly 2024

Comparing the Capability of Multi- and Hyperspectral Remote Sensing Data in Lithological Mapping Using Machine Learning Algorithms: A Case Study from Sudan

Abdelmajeed A. Elrasheed[1,2] and Szilárd Szabó[1]
[1]University of Debrecen, Department of Physical Geography and Geoinformatics, Hungary
(ali.abdelmajeed.adam.elrasheed@science.unideb.hu)
[2]University of Khartoum, Department of Geology, Khartoum, Sudan

Lithological mapping is vital approach in a variety of geological applications such as mineral exploration, study and understand the origin and tectonic setting for the area under investigation. However, it's challenging to conduct this task in the traditional way mainly in remote areas characterised by rugged topography such as Red Sea. Recently, the integration of remote sensing and machine learning provide an effective quick and low-cost approach in lithological mapping. The aim of this research was to compare the potentiality of Landsat 9 multi-spectral and PRISMA hyperspectral remote sensing data in lithological mapping in Red Sea Area, N-E Sudan. We employed Random Forest (RF) and Naïve Bayes (NB) machine learning algorithms. The study area is covered mainly by; Ophiolite, Meta-volcanic, Marble, Granitoids, Altered rocks and superficial deposits. The results showed that, PRISMA hyperspectral data obtained better classification result compare to the Landsat 9 multi-spectral data using both classifiers. Also, our finding proved that, RF out performance NB in the multi- and hyperspectral datasets. E.g. NB classifier gave Kappa 0.90 and 0.80 while RF provided 0.95 and 0.90 for PRISMA and Landsat 9 respectively. Moreover, the OA was 0.96 and 0.92 for PRISMA and 0.92 and 0.83 for Landsat 9. We firmly recommend this approach as an effective method for mapping lithology in the area where the rocks are cropped out and free vegetation cover regions.

Abdelmajeed A. Elrasheed is funded by the Stipendium Hungaricum scholarship under the joint executive program between Hungary and Sudan.

The study was elaborated under the research project NKFI K138079.