GSSL-2022-T3-S2/03

A FEASIBILITY STUDY FOR IDENTIFYING PROBABLE MINERAL DEPOSITS THROUGH HYPER-SPECTRAL IMAGING

R.L.M.S. Ramanayake[1]*, W.A.N.D. Wickramasinghe[1], K.A.S.T. Senarath[1], A. Senaratne[2], G.M.R.I. Godaliyadda[1], H.M.V.R. Herath[1], M.P.B. Ekanayake[1]

[1]Department of Electrical and Electronic Engineering, Faculty of Engineering, University of Peradeniya, Sri Lanka
[2]Department of Geology, University of Peradeniya, Peradeniya, Sri Lanka

Corresponding author email: ramanayake.laksitha1@gmail.com

The use of Hyper-Spectral Imaging (HSI) in conjunction with Digital Lithological Mapping (DLM) is becoming a crucial turning point in the area of Geological Science. As physical surveying is time-consuming, expensive, and limited by the environmental and social constraints of the location of interest, Lithological Mapping will benefit from the use of remotely sensed Hyper-Spectral Images (HSI). A pixel's reflectance spectrum varies depending on the surface composition of the region it covers. This factor can be used to derive probable abundances for macroscopic and microscopic components mixed in the surface of earth. Earth's soil can be considered as a mixture of different constituents. Existence of a mineral with a high concentration changes the composition of the soil which changes the reflectance spectrum. In this light we are proposing a methodology which fuse HSI, Signal/Image Processing, Statistics and Artificial Intelligence (AI). Initially, the pixels of the preprocessed HSI, which covers the soil is distinguished by classifying the pixel into macroscopical components. Pre classification can be done into classes soil, vegetation, water, or others depending on the actual terrain, using machine learning and AI. Once the soil pixels have been isolated the abundances of mineral deposits can be identified through computing the closeness between the pixel signatures and the reflectance spectrum of the mineral followed by a supervised learning classifier. This can be utilized in identifying probable mineral deposits such as ilmenite, limestone, nickel, iron etc. Validation of the algorithm was done by identifying ilmenite deposits of Pulmudai, Sri Lanka through a HSI from Hyperion sensor of Earth Observing-1 satellite which has 242 spectral channels ranging from 0.357 µm -2.576 µm and a spatial resolution of 30 meters. First, pre-classification was done using an Artificial Neural Network. Then, Ilmenite representative pixels were identified through a correlation factor analysis followed by a supervised learning classifier incorporating Fisher's Discriminant Analysis. The accuracy of the algorithm is proven by the laboratory test conducted on the soil samples collected form the locations discovered by the algorithm.

Keywords: *Digital lithological mapping, Hyper-Spectral Image, Reflectance Spectrum, Pixel Signature, Image Processing, Artificial Intelligence, Machine learning, Endmember*