Dimensional Reduction of Rock Hyperspectral Signatures and Classification Based on a NCA Method used in developing a UAV Multispectral Imaging System

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The adoption of hyperspectral imaging has had positive feedback in multiple industries, especially those heavily reliant on the visual analysis of subjects. Reasons for such are primarily due to the high accuracies achievable from processing high dimensional data. Nevertheless, hyperspectral data is said to possess a 'dimensionality curse'. This phenomenon, deems it computationally demanding and difficult to employ in rapid field investigations such as the use of drone-mounted spectral cameras to distinguish rocks. To counter this, this study proposes the employment of a method of reducing the number of dimensions used to highlight the most characteristic feature bands referred to as Neighbourhood Component Analysis(NCA). NCA aided in disregarding redundant bands from 204 dimensionalities, to a still highly capable 5 bands dimensionality, which coincides with the current production of 5-band detection drones. To process this data, several machine learning(ML) algorithms were run in order to perform spectral classification of rocks based on the 5 NCA defined bands. This study's novel findings show that one is able to acquire with NCA and ML, 5 bands, with a post-optimization average global accuracy of 95.4%. Such capabilities are highly sufficient considering the magnitude of the dimensionality reduction combined with the potential field drone applicability.

Keywords : Multispectral imaging, Dimensionality reduction, Machine learning