Abstract

Current research investigations using remotely sensed images are offered with a plethora of sources to explore land cover/ land use applicability. In the last two decades, various techniques have been developed for classification of satellite imageries. A vast majority of them are supervised/ semi-supervised approaches that require manual selection of samples for each class. Some of the unsupervised approaches are based on hard thresholds which are particular to image acquisition modules. In this study, unsupervised classification techniques have been proposed to classify land cover in multi-spectral and hybrid polarimetric SAR imageries. A set of rules has been defined using the properties of spectral slopes for selecting training samples from multi-spectral imageries, which are used for training a machine learning algorithm to classify the land cover into three/ five classes. Then, using hybrid polarimetric SAR images, the scatter values from land surface are clustered into three primary scattering mechanisms. In this case, pseudo-power components from Stokes parameters based decompositions of SAR data are used. These pseudo-power components are clustered into latent classes (scatter components) using finite mixture models with multivariate Gaussian distribution priors. Through multi-spectral images, land features are characterized by their spectral reflectance. SAR images would give an idea of the land cover with reference to scattering characteristics. These two modalities of images, i.e., multi-spectral and hybrid polarimetric SAR imageries, are used to form their combined features to classify land cover. Two different kinds of perceptions of land cover by these two modes of imageries are semantically bridged to infer seven distinguishable land cover classes in an unsupervised framework. Such multi-modal pipeline imbibes advantages of both spectral and scattering properties in analyzing the land cover classes. The defined land cover classes in each of the classification schemes are generic in existence which are commonly found in majority of inhabited regions of globe, leading to generalization of the proposed classification techniques. Experiments show robustness of the proposed classification pipelines across different imagery products and study regions. The adaptability of such generic classification technique in application to specific target detection algorithm is also demonstrated through a case study on open-cast coal mine detection problem. Classification maps are assessed by validating them with manually collected ground truths that are in sync with temporal stamps of imagery products.

Keywords: *Unsupervised land cover classification, polarimetric SAR data, hybrid polarized SAR images, multi-spectral images, multi-modal image analysis.*