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Optical and SAR Data for Mapping of Complex Irrigated Agriculture Regions: A Case Study in Punjab, Pakistan

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Abstract

Accurate information on land use is very important to ensure all humans have access to food for healthy living. Remote sensing has gone through many advancements in the recent years with the launch of new optical and synthetic aperture radar (SAR) satellites. This study compares the effectiveness of optical and SAR imagery alone and in combination for complex cropping region of Punjab, Pakistan. Lower Chenab Canal command area, located in Punjab province, one of the major and more complex-cropping regions was selected. Smaller field size, diverse cropping patterns, and cloudy climate especially during monsoon season make it difficult for mapping using coarse spatial resolution, and optical data. Optical and SAR data from Sentinel II & I were used after processing for normalized difference vegetation index (NDVI), and back scattering (Sigma0), respectively. Supervised classification using random forest algorithm was performed on three data-sets i.e NDVI, Sigma0 and integrated use of NDVI and Sigma0 for summer season (i.e. May to October 2017). For training of model, 75 % ground truth points were used and the 25 % rest were used for accuracy assessment. All the major crops in summer season including rice, cotton, sugarcane, maize and fodder were mapped and accuracy of classified maps were checked using error matrix. The results showed that separate use of NDVI and Sigma0 for both polarisation produced overall accuracy of 71 % and 72 %, respectively. The kappa coefficient with these two data-sets were 0.64 and 0.66, respectively. The integration of NDVI and Sigma0 shows increase in overall accuracy and kappa coefficient. The overall accuracy and kappa coefficient for combined data-set were 77 % and 0.71 % respectively. The results encourage the combined use of optical and SAR data to improve the mapping accuracy in regions with heterogeneity and cloudy climate.

Keywords: Fusion, LULC, random forest, remote sensing, SAR

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