CLASSIFICATION OF SENTINEL-1A SAR DATA USING PRINCIPAL COMPONENT ANALYSIS AND KERNEL PRINCIPAL COMPONENT ANALYSIS

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ABSTRACT

Spectral context of remotely-sensed data presents significant details for analyzing the Earth's surface in numerous applications. In this study, the impacts of the extracted spectral features from Principal Component Analysis (PCA) and Kernel Principal Component Analysis (KPCA) for the classification of Sentinel-1A SAR (Synthetic Aperture Radar) data were investigated. Dual-polarized Sentinel-1A (VV and VH) SAR data and three additional bands from the original data (VV-VH, VV+VH, VVVH/VV+VH) were used for the study region in Istanbul, Turkey. Pre-processing steps were applied to the data as following; apply the precise orbit file, calibration, multi-looking, speckle filtering and terrain correction. Following the pre-processing steps, PCA and KPCA transformations were carried out to extract the spectral features from the data. These transformations, are mapping the data from the input space to a new feature space, were applied to the three bands (VV, VH and VV-VH) first and then to the all bands (five bands). Support Vector Machines (SVM), Random Forests (RF) and K-Nearest Neighbors (KNN) methods were implemented for the classification of the data. Original features were compared to the extracted spectral features from PCA and KPCA within classification accuracy. Our results suggest that spectral features from PCA achieved higher classification accuracies compared to original features for SVM and RF while features from KPCA decreased the classification accuracies for all methods. Highest classification accuracy (81.39 %) were obtained by SVM along with the spectral features from PCA. Furthermore, it is proven that spectral features from PCA and KPCA have different impacts on each method.

Key words: Image Classification, Synthetic Aperture Radar, Kernel Principal Component Analysis, Support Vector Machines, Random Forest