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Multi-temporal SAR Classification of Urban Areas using Extremely Randomized Trees

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ABSTRACT: Multi-temporal Synthetic Aperture Radar (SAR) images are considered as an important data source for the mapping and monitoring of urban areas. Accurate classification of urban areas is critical for metropolitan cities to monitor and control the uncontrolled changes over cities as it can expand because of the population increase by years. Classification of urban areas from the remotely-sensed data is a complicated process as small size of urban agricultural areas as well as different type of land use classes make the proper extraction of urban areas still a challenging. The objective of this research is to evaluate the impact of the textural features on urban areas classification using extremely randomized trees (ERT) from multi-temporal SAR data. In this research, multi-temporal Sentinel-1 SAR images were used for the classification of urban areas for the study area located in Istanbul, Turkey. Textural features were generated by using Gray-Level Co-occurrence Matrix (GLCM) after pre-processing of multi-temporal SAR data. Only three types of features from GLCM were incorporated into the classification (mean, variance and correlation) process. In terms of SAR images, textural features are considered as the complementary data to provide more meaningful information especially for urban areas to provide reliable classification. Furthermore, Recursive Feature Elimination (RFE) feature selection method was employed to find the less-correlated and more impactful features for classification step. Class based accuracies were assessed via F scores. Our results demonstrated the following conclusions: 1) Textural features yielded higher F-score value than original features for the classification of urban areas (from 0.93 to 0.96) 2) multi-temporal SAR data are suitable for the classification of urban areas. Our future research will focus on the analysis of the different GLCM and morphological features as well as other ensemble learning algorithms (e.g. Xgboost and LightGBM). Moreover, it can be concluded that textural features yielded higher accuracy than original features in terms of overall classification accuracy (from 93.78% to 96.63%)

Keywords: *Multi-temporal SAR, Classification, Ensemble Learning, GLCM*