

Land Cover Classification for Seismic Data Acquisition in the Arid Area from Drone-Based Imageries: Comparing Ground Filtering, Random Forest, and Conditional Generative Adversarial Network

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Abstract

Land seismic data acquisition requires an accurate land cover map to achieve a successful project execution. Aerial drone surveys offer a faster, safer, and more sustainable method with a low CO₂ footprint to obtain a high-resolution accurate orthomosaic image of the area. This study investigates the applicability of ground filtering, random forest algorithm, and conditional generative adversarial network (CGAN) for land cover classification using drone-based imageries tailored for seismic data acquisition in the arid area. Ground filtering, random forest algorithm, and CGAN represent a spectrum of method complexity commonly utilized to classify land cover from ortho imageries. The dataset is a drone-based orthomosaic image from a ~4 km² area at the KAUST university test site. This image is accompanied by a manually-drawn land cover map based on ~300 site visits to the area as the ground truth. This study employs the overall accuracy method (OA), the kappa index (K), and the Structural Similarity Index Measurements (SSIM) to measure the accuracy of the resulting classification. Results show that the CGAN performs better with the overall accuracy (OA) of 96%, Kappa index (K) of 0.95, and Structural Similarity Index (SSIM) value of 0.9 than the random forest with the OA of 93%, K of 0.93, and SSIM value of 0.86. The ground filtering is not far behind the random forest (OA of 94%, K of 0.92, SSIM value of 0.85) with a faster computing time. All methods correctly classify large connected land cover features (e.g., “active farms”, “wadi deposits”). However, the CGAN method outperforms random forest at classifying small features within a densely-populated area (e.g., “buildings” and “fences” in a village). The resulting methodology comparisons provide insights into the best classifier methodology for constructing a land cover map to aid seismic data acquisition in the arid area. CGAN is a preferred method due to its higher classification accuracy. However, ground filtering is a more viable alternative if a rudimentary ground vs. non-ground classification is needed.