



ABSTRACT SUBMISSION

Optimizing Archaeological Surveys in Neom with Machine Learning: Improved Stone Feature Detection Using Mask R-CNN and ArcGIS Pro

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Abstract

In the rapidly developing NEOM region, preserving cultural heritage is crucial. In 2022-2023, the NEOM Heritage Department commissioned two land surveys totaling 5948 Km², recording over 2000 sites. To optimize archaeological survey strategies in this vast landscape, we employed a machine learning-based object detection algorithm combined with human analyst techniques. To enhance discoveries of new sites and areas of high potential, we've trained a model to semi-automatically identify new features based on satellite imagery. We compared results between human analysts, machine learning only, and combination of approaches. Our method employed ArcGIS Pro's Deep Learning toolbox to analyze 4-band optical satellite imagery and train a model from datasets prepared during the first land survey. We used Mask R-CNN with ResNet101 to create 5 models of different rock archaeological typologies as cairns and stones circles, leveraging image augmentation techniques and filtering methods to minimize false positives.

Our study found that ML methods dramatically outperformed traditional human-only visual inspection techniques and that this combined approach successfully detected 2.47 to 2.96 times more sites than human-only methods with a very low number of false negatives. Our study suggests that ML-guided approaches help optimize the selection of survey areas by prioritizing locations with highest probability.

Keywords

Machine Learning, Mask R-CNN, ArcGIS Pro, survey, Arabia

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