Title
Identification of Neolithic Circular Enclosures through Aerial Imagery

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Abstract

Traditionally, archaeological investigations, especially archaeological remains detection, mostly depend on human observation. In order to find the objects in large areas, a lot of fieldwork has to be done and it takes a long time for archaeologists to travel around. Nowadays, the development of LIDAR provides accurate 3D geometric information, which can be used for computer-based detailed terrain study. The application of deployment of computer vision methods also provides a new idea for the automatic object detection approach.

In this study, the neural network architecture "ResNet18" was applied to airborne LiDAR data from the Western regions of Slovakia for the automated detection of undiscovered Neolithic Circular Enclosures (also called rondel in the thesis). NCEs are mysterious stone hedge-like rings scattered through Central/Eastern Europe. The LiDAR data was processed into digital rater data and realized data enhancement by the visualization technique -- Simple Local Relief Model (SLRM). Since the positive samples were limited, expanding the training dataset was crucial and was realized by data augmentation methods based on the positive samples of rondels. The augmented roundels were created by cropping the real roundels and pasting them on the new empty areas after slight modification. After that, the positive image samples and the same number of negative image samples constructed the whole data set and it was divided into two parts -- training data and test data. After the training process of ResNet18, the performances of deep learning models with different combinations of parameters were evaluated, and the selected model was applied to a large area (44276 × 29984 m2), the spatial distribution of the probabilities could be observed and 32 possible new rondel areas were chosen for further validation.