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Identification of erosion rills via machine learning

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Water erosion is the physical wearing of the earth's surface. Erosion removes surface soil material (topsoil), reduces levels of soil organic matter, and contributes to the breakdown of soil structure.

The large amount of time required for manual identification of the rills is an obstacle in effective erosion research. Nevertheless, a significant number of rills have already been manually marked for various studies. It is therefore possible to use these already obtained data to train an algorithm, which will then automatically identify the grooves. The experiment is carried out using a rain simulator. The first part of the precipitation lasts 30 minutes, followed by a 15-minute break and another 30-minute precipitation. Photos for SfM method of creation detailed DMT are taken in three states a) before the simulation, b) between the simulations and c) after the experiment. On the finished DMT rills are manually digitalized in ArcGIS Pro, and their cover polygons are thus created.

Nhu et al. 2020 in his work dealt with the evaluation of the capabilities of the Keras deep learning model and their optimization algorithms. Keras is a deep learning API written in Python, running on top of the machine learning platform TensorFlow.

The image is converted to a matrix using the Raster to Array tool. The corresponding square is selected from each band and a mosaic is then created from these squares. The length of the square edge is chosen. The resulting mosaic consists of individual squares of the image spectrum bands placed side by side to form a rectangular image.

The Kaggle Cat Dog model was used as the basis for creating the model. This is a model designed to sort color images into two groups. This model was modified by inserting mosaics into the model instead of images. The training dataset is loaded into the model and divided into calibration and validation parts for the purpose of model calibration. This distribution was chosen to be 20%. The image size was specified as 100x200 pixels, with pixel of size 0,1 cm.

The individual mosaics not used for model training are then classified by this trained model. Loading mosaics for classification is controlled by a CSV file, which contains the name of the mosaic, the position of the mosaic in the image and whether it is intended for training or not. The probability value with which the mosaic is classified as erosive or not is then added to this CSV file. Training mosaics are omitted and assigned a no_data value.

The CSV file of the classified image is loaded back into the GIS environment using a Python script. The script loads the CSV file and creates an according classified raster.

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