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Application of a national soil spectrum library for the prediction of primary soil properties using machine learning – the first results

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Soil observations of the Hungarian Soil Degradation Information System were carried out between 2010 and 2012 on 2000 parcels of 285 farms representing the whole territory of Hungary. 6600 soil samples were collected and measured in laboratory for chemical parameters (pH, SOM, CaCO₃, NO₃, P₂O₅, K₂O, Na, Mg, SO₄, Mn, Zn, Cu). The soil samples were retained and they represent a countrywide soil data bank. Very recently we initiated the spectral characterization of the stored samples. The main objective is to establish relationships between traditionally measured soil properties and spectral features to support mapping activities, which tend to rely on hyperspectral remote sensing.

The soil samples are measured with a portable spectral device, namely ASD Field Spec Pro spectroradiometer. By finalizing the spectral measurements, a nationally representative spectral library will be set up, which will contain data on (i) the above listed soil chemical parameters and (ii) reflectance values in 2151 spectral bands. This dataset provides a unique opportunity for testing the predictivity of soil chemical parameters by spectral variables.

First predictivity tests have been carried out to estimate soil organic carbon, available phosphorus and potassium by reflectance spectra. Partial Least Square Regression, Support Vector Machine, Random Forest and Artificial Neural Network were used due to their well-known performance in similar situations using 10 fold cross-validation for the validation of the developed models.

Our paper presents the elaboration of the soil spectrum library and the first results of the predictivity tests carried out between its elements.

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