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Comparison of PLSR and SVM methods for predicting the organic carbon content using VNIR DRS at five locations with different soil types

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Visible and near-infrared diffuse reflectance spectroscopy (VNIR DRS) is cost- and time-effective and environmentally friendly techniques method used for prediction of soil properties. There are many studies dealing with this approach for particular conditions (single locality, different area size, etc.). This study was therefore focused on evaluating the suitability of VNIR DRS (400 – 2500 nm) for predicting organic carbon content, using samples collected at 5 agricultural lands from the municipalities of Brumovice (107 samples), Hostoun (58 samples), Sedlcany (78 samples), Vidim (86 samples) and Zelezna (69 samples). In Brumovice original soil type was Haplic Chernozem on loess, which was due to erosion changed into Regosol (steep parts) and Colluvial soil (base slope and the tributary valley). A similar process has been observed at other four locations Hostoun, Sedlcany, Vidim and Zelezna where the original soil types were Calcaric Leptosol, Haplic Cambisol on gneiss, Haplic Luvisol on loess and Haplic Cambisol on shales, respectively. Samples were taken from the topsoil within regular grid covering studied areas. Variable approaches may be applied to relate reflectance spectral data to particular soil property. Here were used Partial Least Square Regression (PLSR) and Support Vector Machine (SVM) with cross-validation to relate organic carbon content data to the reflectance spectral data by applying different preprocessing strategies. According to the criteria of minimal Root Mean Square Error of Prediction of Cross Validation (RMSEPcv) and maximal coefficient of determination (R2cv), the PLSR and SVMR models with raw spectra, the first and second derivative pretreatment provided the most accurate prediction for the organic carbon content from Brumovice (SVM, 1st. derivative, R2cv = 0.87, RMSEPcv = 0.11) and decreased as follows: Hostoun (PLSR, 2nd. derivative, R2cv = 0.69, RMSEPcv = 0.11), Sedlcany (SVM, 2nd. derivative, R2cv = 0.66, RMSEPcv = 0.17), Zelezna (SVM, 1st. derivative, R2cv = 0.66, RMSEPcv = 0.24) and Vidim (SVM, 2nd. derivative, R2cv = 0.64, RMSEPcv = 0.11).
Overall, SVM models for the VNIR spectra are better than PLSR models and the results confirmed that the measurement of soil spectral characteristics is a promising technology for a digital soil mapping and predicting studied soil properties.

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