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# Using visible and near-infrared diffuse reflectance spectroscopy for predicting soil properties based on regression with peaks parameters as derived from continuum-removed spectra

Radim Vasat, Ales Klement, Ondrej Jaksik, Radka Kodesova, Ondrej Drabek, and Lubos Boruvka
Czech University of Life Sciences Prague, Soil Science and Soil Protection, Prague, Czech Republic (klement@af.czu.cz)

Visible and near-infrared diffuse reflectance spectroscopy (VNIR-DRS) provides a rapid and inexpensive tool for simultaneous prediction of a variety of soil properties. Usually, some sophisticated multivariate mathematical or statistical methods are employed in order to extract the required information from the raw spectra measurement. For this purpose especially the Partial least squares regression (PLSR) and Support vector machines (SVM) are the most frequently used. These methods generally benefit from the complexity with which the soil spectra are treated. But it is interesting that also techniques that focus only on a single spectral feature, such as a simple linear regression with selected continuum-removed spectra (CRS) characteristic (e.g. peak depth), can often provide competitive results. Therefore, we decided to enhance the potential of CRS taking into account all possible CRS peak parameters (area, width and depth) and develop a comprehensive methodology based on multiple linear regression approach. The eight considered soil properties were oxidizable carbon content (Cox), exchangeable (pHex) and active soil pH (pHa), particle and bulk density, $CaCO_3$ content, crystalline and amorphous (Fed) and amorphous Fe (Feox) forms. In four cases (pHa, bulk density, Fed and Feox), of which two (Fed and Feox) were predicted reliably accurately ($0.50 < R2cv < 0.80$) and the other two (pHa and bulk density) only poorly ($R2cv < 0.50$), we obtained slightly better results than with PLSR and SVM. In one case (pHex) we achieved a significantly higher, although just reliable, accuracy (R2cv = 0.601) than with PLSR and SVM (R2cv = 0.448 and 0.442, resp.). But most interestingly, in the case of particle density, the presented approach outperformed the PLSR and SVM dramatically offering a fairly accurate prediction (R2cv = 0.827) against two failures (R2cv = 0.034 and 0.121 for PLSR and SVM, resp.). In last two cases (Cox and $CaCO_3$) a slightly worse results were achieved then with PLSR and SVM with overall fairly accurate prediction ($R2cv > 0.80$).

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