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Soil moisture determination by means of the data driven models

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Information's about soil water content are in the planning of water resources and management very valuable. Modeling and predicting soil water transfer is very important in agriculture or hydrology - e.g. for purposes of the effective irrigation management. Many tried and proven methods of estimating or measuring soil moisture are available. The choice of the method which in particular case is eligible, depends on a variety of factors such as accuracy, cost, and ease of use. One of the most important hydro physical characteristics of soil is water retention curve (WRC), which is input to various hydraulic and hydrological models and reflects the energy dependence of soil water and the water content, e.g. the relationship between soil moisture and moisture potential. The method of determining the water retention curve points in laboratory conditions is very expensive, time consuming and labor intensive. In soil physics, therefore, were developed methods for determining soil hydro physical characteristics from easier obtained characteristics - soil granularity composition, organic matter content and bulk density. For these models (or relations) have been established title pedotransfer functions (PTF). These functions specify different soil characteristics and properties from relationship with another. The submitted work compares the creation of such functional dependencies using neural networks, hybrid self-organizing map (SOM) and support vector machines (SVM) model and standard multi-linear regression method. The SVMs formulate a quadratic optimization problem that avoids local minima problems, which makes them often superior to traditional (iterative) learning algorithms such as multi-layer perceptron (MLP) type of neural network. Input data are taken from Zahorská lowland in Slovakia. It was taken 140 soil samples from various localities of Zahorská lowland on finding soil characteristics and on the expression of water retention curve points. Sandy soils are prevailing in this area. Main input data were percentage of granularity categories I to IV according to Kopecky method, reduced volume weight (d) and measured humidity for potentials hw = -2.5; -56, -209, -558, -976, -3060, -15300 cm specified in laboratory in the overpressure equipment for testing the regression made with abovementioned methods.
To compare the results between measured and modeled data by various data driven methods, was accomplished an analysis using correlation coefficient and other statistical characteristics. This evaluation revealed most accurate results by using hybrid SOM-SVM model, in comparison with a conventional multi-layer artificial neural networks, multi-linear regression and standalone SVM model. Greater stability and need of less time devoted to calculations was observed in computation using SVM methodology, since the MLP training sometimes stuck in a local minimum so the training process has to be reset and run many times.
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