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Prediction of soil depth using Bayesian maximum entropy approach

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The study aims to develop an efficient and accurate approach for predicting the soil depth for a given slope. Soil depth is an essential resource for land management. However, it is not an easy task to deliver a satisfied prediction and often, a significant discrepancy is observed between the predicted and the measured depths. The spatial variability and corresponding spatial soil parameters, derived from high-resolution digital elevation data, are utilized in this study to establish a model for forecasting the soil depth. To be specific, six terrain attributes, generated from GIS, such as slope, aspect, plane curve, profile curve, geology and compound topographic index are used to build a preliminary prediction model. The Bayesian maximum entropy (BME), which is a non-linear statistic method that is capable of processing diverse information sources, is adopted to further increase the model accuracy. A case study from Taiwan is provided to illustrate the proposed approach. In Taiwan, soil depth is classified into four groups: extremely shallow, shallow, deep and extremely deep. Two different models: the traditional Kriging and the proposed approach are examined using the collected data based on the aforementioned category. Results indicate that the prediction accuracies are 37.48% and 94.81 for the Kriging method and the proposed BME approaches, respectively. It is shown that the Kriging method cannot provide a satisfied estimation. Alternatively, the proposed BME approach is able to deliver a very promising prediction. Possible reasons are that he Kriging method is a least-squares-based algorithm and is a linear estimator. In contrast, the proposed model incorporating the terrain attributes with the BME approach, which is a fully non-linear model, is proven to be a better approach to calculate soil depth estimation.