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Satellite-derived shallow wetland bathymetry using different classification algorithms and datasets

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ABSTRACT

Remote sensing (RS) effectively identifies, analyzes, and monitors wetlands. In addition to these two-dimensional studies, RS is used with several techniques in determining shallow water depths. The primary purpose of this study is to obtain shallow wetland bathymetry utilizing spectral reflections obtained at different water depths by field study and satellite images. Machine learning (ML) algorithms, which are widely used in remote sensing, are used in this study. Four algorithms were selected as random forest (RF), support vector machine (SVM), Neural Networks (NN), and Maximum Likelihood Classification (MLC). Since machine learning algorithms use training samples/datasets, the classification accuracy is directly related to selecting these data. The effect of pixel counts on classification was investigated by using two different training data set also. Duden (Kulu) Lake, which is a shallow wetland, was chosen as the study area. The Iterative Self-Organizing Data Analysis Technique (ISODATA) classification algorithm divided into as many clusters as possible was applied on Sentinel-2 multispectral images. All classes were redefined using measured spectral signatures and were created a bathymetric map. This map was used as reference data in creating training sets and the accuracy assessment of ML algorithms. When the water surface areas obtained from algorithms were compared with the bathymetric map and Normalized Difference Water Index, the best result was obtained with RF. According to the accuracy assessment results, it was seen that the number of training data affects the accuracy, and the best results were obtained with SVM and RF algorithms with training data containing more pixels (overall accuracy 93.87% and 92.64, kappa 0.89 and 0.87, respectively).

Keywords: Wetland; Remote sensing; Satellite-derived bathymetry; Machine learning; Maximum likelihood classification; Support vector machine; Random forest; Neural networks

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