



zabol university

graduate school management

faculty of water and soil

water engineering department

thesis for obtaining senior ba in water resources engineering field

predicting soil moisture content using soil thermal properties through machine learning
technique

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Abstract

Knowledge of soil moisture status is necessary for proper planning of irrigation and more use of water resources and achieving sustainable agriculture. Conventional methods of measuring soil moisture are often laborious, time-consuming and expensive. Research has shown that soil thermal properties have a significant effect on soil moisture content. The purpose of this research is to predict soil moisture from soil thermal properties with the help of artificial intelligence methods. For this purpose, the thermal properties of the soil were measured at about 80 points on the surface of the Sistan dam research farm at the surface depth (0 to 20 cm) in 1401. Also, soil samples were taken from the measuring points to measure moisture and other soil properties (such as texture components of soil and apparent density of soil). Thermal properties (heat capacity, conductivity and diffusivity) were measured using the KD2-Pro device in situation and humidity, bulk density and soil texture components were measured in the laboratory by standard methods. After statistical analysis and pre-processing of data, soil moisture modeling using artificial neural network (ANN), fuzzy-enhanced inference system (ENFIS) and support vector machine (SVM) methods was done through MATLAB software based on the input data. The comparison of the results of the three mentioned methods was done using two measures of error (MSA) and correlation coefficient (R). The results showed that the neural network has the best performance in predicting soil moisture among the investigated methods. Based on the results, the MSA value of this method for the test data is 13.7 and the correlation coefficient value is 0.94.

Keywords: Soil moisture, thermal conductivity, thermal diffusion, regression, artificial intelligence