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A two-stage surrogate model based on ANN and AdaBoost for multi-objective parameter optimization of the Variable Infiltration Capacity model

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Distributed hydrologic models have been widely used for its functional diversity and rationality in theory. However, calibration of distributed models is computationally expensive with a large number of model runs, even if an efficient multi-objective algorithm is employed. To alleviate the burden of computation, we develop a two-stage surrogate model by coupling backpropagation neural network with AdaBoost to calibrate the parameters of the Variable Infiltration Capacity (VIC) model. The first stage model selects the parameter sets with simulated outputs in the crucial range and the second stage model estimates the values of outputs accurately with the parameter sets picked out by the first stage model. The developed surrogate model is tested in three different river basins in China, namely the Lanjiang River basin (LJR), the Xiangjiang River basin (XJR) and the Upper Brahmaputra River basin (UBR). With sufficient samples generated by ϵ -NSGA II, the surrogate model performs very well with a low error rate of classification (ER) and root mean square error (RMSE). The streamflow simulated with the surrogate model is nearly the same as that from the original VIC model, indicating that the surrogate model does gain a remarkable speedup compared with the original VIC model.