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PREDICTION OF WATER QUALITY PARAMETERS IN A RESERVOIR USING ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

Water quality brings to the ground the discussion on water utilization once the consumption, of degraded water, is not possible or safe. On the other hand, the assessment of the water quality in a reservoir is constrained due to geographic considerations, the number of parameters to be studied, and the huge financial resources needed to get the necessary data. To this picture it should be added the latency times between the sampling moment and the instant that portrait the results of the laboratory analyses. However, new approaches to problem solving, namely those borrowed from the Artificial Intelligence arena have proven their ability and applicability in terms of simulation and modeling of the physical phenomena. Indeed, Artificial Neural Networks (ANNs) capture the embedded spatial and unsteady behavior in the investigated problem, using its architecture and nonlinearity nature, when compared with the other classical modeling techniques. This work describes the training, validation, and application of ANNs models for computing the oxidability and total suspended solids (TSS) levels in the Monte Novo reservoir, in Portugal, over a period of 15 years. Different network structures have been elaborated and evaluated. The performance of the ANNs models was assessed through the coefficient of determination (R^2), mean absolute deviation, mean squared error, and bias computed from the measured and model calculated values of the dependent variables. Goodness of the model fit to the data was also evaluated through the relationship between the errors and model computed values of oxidability and TSS. The ANNs selected to predict the oxidability from pH, conductivity, dissolved oxygen (DO), water temperature, and volume of water stored in reservoir has a 4-11-5-1 topology, while the network selected to predict the TSS has a 5-6-5-1 topology. A good match between the observed and predicted values was observed with the R^2 values varying in the range 0.995–0.998 for the training set, and 0.994–0.996 for the test set.
Keywords: Artificial Neural Networks, water quality, water reservoirs.

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