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Multi-objective optimization of ANN hybrid committees based on hydrologic knowledge

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Using combinations of models is becoming a popular way of increasing hydrological models accuracy. Such combinations (in machine learning called committees) can have various forms - ensembles, mixtures of models, boosting schemes, etc. One of the widely used methods of machine learning is artificial neural network (ANN); its usefulness in the capacity of a rainfall-runoff model has been proven by many experiments. The paper deals with building optimal committees of ANNs that use hydrologic knowledge. The way the training data is split determines the type of committee to be used. In modelling natural systems it is often beneficial to use domain knowledge (in this case, hydrological) for splitting the data into subsets to be used in training individual models. In hydrology there are several methods known that allow for separation of base and high flow. We show that identification and separation of regimes improve the accuracy of ANN flow forecasting models. The known flow separation methods, however, do not always provide the clear-cut separation and hence can be tuned, or optimized, to ensure the highest accuracy of the resulting model. Such optimization problem is posed in a multi-criterial setting, and solved using randomized search techniques, in particular evolutionary and adaptive cluster covering (ACCO) algorithms. The use of regime separation shows better performance than the global network models, and improves the acceptance of such models by practitioners due to the explicit use of physical principles.