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Application of data-driven ANN and K-NN techniques for lead-time flow forecasting for two Irish catchments

M. Goswami and K. M. O'Connor

Department of Engineering Hydrology, National University of Ireland, Galway, Galway, Ireland

In this application-based study, non-linear data-driven Artificial Neural Networks (ANNs) and the K-nearest-neighbour (K-NN) approach are used for lead-time river flow forecasting. Whereas ANNs depend on available data for their 'training', K-NNs rely on a non-parametric regression methodology for pattern recognition that exploits the nearness of the pattern of the most recent sequence of observations to K similar previously observed patterns chosen from an adequately large training data set. In the context of their application to the hydrometeorological data from two Irish catchments, the relative efficiency of these techniques in yielding lead-time river-flow forecasts, within the framework of rainfall-runoff modelling, is discussed. Different Quantitative Precipitation Forecast (QPF) scenarios are adopted for assessing the relative merits of these forecasting techniques. In addition to the application of the flow data series (with or without exogenous inputs) as inputs to the ANN model, the application of the series of residuals/errors derived from a substantive model (the SMAR conceptual model) is also demonstrated. Amongst the different structures of models considered, for different combinations of QPF scenarios and choices of inputs, those based on Neural Networks are generally found to produce high forecasting efficiency. The software package called the 'Galway Flow Modelling and Forecasting System (GFMFS)', developed by the present authors at the Department of Engineering Hydrology of the National University of Ireland, Galway, which incorporates a suite of lumped deterministic rainfall-runoff models, is used for the application of the neural networks and the K-NN models described here.

Keywords: Neural Network, nearest neighbour, QPF, lead-time forecast, consensus forecast, multi-model approach