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Neuroevolution modelling applied to the HFC Bird Creek Data Set

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Neuroevolution involves using genetic algorithms to train neural networks. This paper reports the application of a neuroevolution toolbox to the contest dataset in which complex neural solutions were developed using a series of different objective functions. JavaSANE is based on the concept of ‘cooperative coevolution‘ (Horn et al., 1994; Potter, 1997). Essentially, this involves the evolution of a population of hidden neurons, rather than the traditional genetic algorithm approach of evolving a population of functional neural networks. Each neuron cooperates with other neurons in an efficient search procedure that is designed to find the optimal solution to a particular problem in terms of stated goals. For further particulars and a hydrological forecasting comparison with ’backpropagation of error’ modelling see Dawson et al. (2006). The cooperative coevolution algorithm has been incorporated into two software packages that are designed to produce neural network models using Symbiotic Adaptive Neuro-Evolution (SANE: Moriarty and Miikkulainen, 1998): SANE-C ’research code’ and JavaSANE ’platform independent code that requires minimum effort to implement novel applications in fresh domains’. The original source code, documentation and research papers can be found at: http://nn.cs.utexas.edu/pages/software/software.html.

Each neural network model contained six hidden units. JavaSANE offers competitive solutions and a reduced likelihood of overfitting. No cross-validation dataset or early stopping procedure is required and the full training dataset can be used for model calibration purposes. Initial analysis suggested that the best performing inputs on the calibration dataset for a lead time of 6 hours would be: Flow at time t, Flow at t-6 hours and Rainfall at t-18 hours. For a lead time of 24 hours, the best performing inputs appeared to be: Flow at time t, t-6 and t-12 hours and Rainfall at t-18, t-24, t-30 and t-36 hours. JavaSANE was run at T+6 and T+24 with the following objective

functions: [1] relative error; [2] root mean squared error; and [3] root mean squared error applied in association with a timing error correction procedure. The results are compared with multiple linear regression outputs developed on identical datasets.

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