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Neuroevolution modelling of flood wave predictors for Smeda river

Roman Neruda (1), Jan Srejber (2), and Martin Neruda (3)

(1) Institute of Computer Science, Academy of Sciences of the Czech Republic, Prague, CZ (roman@cs.cas.cz), (2) Czech Hydrometeorological Institute, Usti nad Labem, CZ, (3) Faculty of Environment, University of J. E. Purkyne, Usti nad Labem, CZ

We present a neuroevolution approach to rainfall-runoff modeling for small size river basins based on several time series of hourly measured data. The binary-based evolutionary algorithm is used for adaptive filtering of time series variables in order to maximize four-to-six hour runoff prediction. It has been demonstrated that the combination of evolutionary input selection with perceptron network model trained by Levenberg-Marquardt gradient learning leads to 5-15 percent better prediction results in comparison to other relative approaches [1].

In our current work we focus on on-line prediction using real-time data from Smeda River (Czech Republic) with 6 hours lead time forecast. Following the operational reality we reformulated the time series prediction problem as a classification of the runoff values into flood alert levels while utilizing classification-related error measures. Flood levels are connected to defined decisive water level tresholds in each observation stations. Moreover, in contrast to our previous work [2], the modelled system utilizes data from three subsequent runoff gauges, namely Bily Potok, Frydlant and Visnova. The distance between them is 15 km respectively 12 km. The watershed area is 180 km2. Together with flood wave time series we utilized relevant precipitation totals from Hejnice rain gauge.

The dynamics of the flood wave is studied with respect to these data. While it is difficult to forecast the time of occurrence and the extend of floods, it is possible to predict fairly accurately the movement of the flood wave along a river. Several methods are available for the flood wave propagation forecasting in general. Two simple hydrometric methods based on the extrapolation of the discharge difference and discharge-travel time are in use in CHMI. On a similar base the neural model is created whose inputs are historical runoff values and an output is a classification of predicted runoff with certain prediction length. Number of previous runoff values depends on the shape of a flood wave.

The main goal of this work is to improve real time flood warning system operated by the Czech Hydrometeorological Institute in a very sensitive part of Northern Bohemia. This area has been subject to two flash floods during last year, and thus it is important to be able to model and predict the dynamics of the flood wave.

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