FLOOD FORECASTING MODEL USING RADIAL BASIS FUNCTION EMBEDDED K-MEANS CLUSTERING ALGORITHMS

SUNGWON KIM

Assistant Professor, Department of Railroad and Civil Engineering, Dongyang University, 1 Kyochon-dong, Yeongju, Kyungbuk, 750-711, South Korea
(Tel: +82-54-630-1241, Fax: +82-54-637-8027, e-mail: swkim68@phenix.dyu.ac.kr)

In recent years, artificial neural networks (ANNs) have been used for forecasting in many areas of engineering. The main advantage of ANNs approach over traditional methods of modeling is that it doesn't require the complex nature of the underlying process under consideration to be explicitly described in mathematical terms. Some of the earliest applications of ANNs in hydrology and water resources engineering were reported by Daniell (1991). After that time, successful simulations of flow for synthetic data generated from known conceptual models have been reported by Liong and Chan (1993) and Minns and Hall (1996), among others. Flow simulations and predictions for short time interval (Isobe et al., 1994; Kim and Lee, 2000) and long time interval (Smith and Eli, 1995; Raman and Sunilkumar, 1995; Kim, 2000) also have been reported for real situation.

Many applications use multilayer perceptron (MLP) ANNs with back propagation (BP) technique, which leads to model (MLP/BP model) that are nonlinear in the parameters. The BP algorithm is essentially a gradient descent search technique that may descend to a local minimum, resulting in a suboptimal solution to the problem. In contrast, the radial basis function (RBF) neural networks has the nonlinearity embedded in the transfer functions of its hidden layer nodes, making the optimization of the tunable parameters a linear search. More recently, RBF neural networks model also have been developed to make flow predictions for real situations (Fernando and Jayawardena, 1998; Kim et al., 2001) as well as for simulated conditions (Mason et al., 1996).

REFERENCES

Daniell, T.M., 1991. Neural networks – application in hydrology and water resources engineering, *Int. Hydro. and Water Resour. Sym.,* Inst. of Engineers, Perth, Australia, pp. 797-802.

Fernando, D.A.K., and Jayawardena, A.W., 1998. Runoff forecasting using RBF networks with OLS algorithm. *J Hydro. Engr.,* ASCE, Vol. 3, No. 3, pp. 203-209.

Isobe, I., Ohkado, T., Hanyuda, H., and Gotoh, Y., 1994. The development of a forecasting system of the water levels of rivers by neural networks. *J. Japan Soc. of Hydro. and Water Resour.*, Vol. 7, No. 2, pp. 90-97.

Kim, S., 2000. A study on the forecasting of daily streamflow using the multilayer neural networks model. *J. Korea Water Resour. Assoc.,* Vol. 33, No. 5, pp. 537-550.

Kim, S., and Lee, S., 2000. Forecasting of flood stage using neural networks in the Nakdong River, South Korea. *Proc., Watershed Management & Operations Management 2000*, ASCE/EWRI, Fort Collins, CO.

Kim, S., Lee, S., and Cho, J.S., 2001. Hydrological forecasting based on hybrid neural networks in a small watershed. *J. Korea Water Resour. Assoc.,* Vol. 34, No. 4, pp. 303-316.

Liong, S.Y., and Chan, W.T., 1993. Runoff volume estimates with neural network. *Proc., 3rd Int. Conf. In Application of AI to Civ. And Struct. Engr. : Neural Networks and Combinational in Civ. And Struct. Engr.,* Topping, B.H.V., and Kahn, A.I., eds., Civil Comp. Press, U.K., pp. 67-70.

Mason, J.C., Price, R.K., and Tem' me, A., 1996. A neural network model of rainfall-runoff using radial basis functions. *Hydro. Sci. J.,* Vol. 41, No. 3, pp. 399-417.

Minns, A.W., and Hall, M.J., 1996. Artificial neural network as rainfall runoff models. *Hydro. Sci. J.,* Vol. 41, No. 3, pp. 281-294.

Raman, H., and Sunilkumar, N., 1995. Modeling water resources time series using artificial neural networks. *Hydro. Sci. J.,* Vol. 40, No. 2, pp. 145-162.

Smith, J., and Eli, R.N., 1995. Neural network models of rainfall-runoff process. *J. Water Resour. Plng. and Mgmt.,* ASCE, Vol. 121, No. 6, pp. 499-508.