Hydrol. Earth Syst. Sci. Discuss., 7, C987–C989, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C987/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Dynamic neural networks for real-time water level predictions of sewerage systems – covering gauged and ungauged sites" *by* Y.-M. Chiang et al.

Y.-M. Chiang et al.

changfj@ntu.edu.tw

Received and published: 1 June 2010

Comment #1: Authors introduce AI technology of neural network into flood prediction. Although recurrent type system is not updated, the application possibility can be discussed with readers. As total research flow is very understandable, this paper will become useful in hydrology and water resources. Frankly speaking, the optimization for network must be introduced and other methodologies of GA, GP and PSO should be compared for their possibility.

Author Response: Thank you very much for the essential and valuable comments. The application possibility of the ANN depends on both model reliability and stability. In

this study, the results obtained from RNN are precise and show that the reliability of the constructed RNN is qualified to be applied to the water level predictions at urban sewerage systems. As for model stability, it can be demonstrated (Table 2) that the model was well constructed using a considerable amount of data during training phase. Meanwhile, the second independent dataset was used to optimize the structure and connected weights in the validation phase. The function of validation data is to prevent the model from being over-trained and to efficiently increase the model's generalization capability. Results obtained from RNN strongly revealed that the model has optimized and stabilized in terms of highly accurate and consistent performance in both training and validation phases. Once the model was well trained and validated, it would be able to make on-line forecast instantaneously and recursively for the coming storm event. Therefore, we then make recursive forecast by using the testing dataset. The testing results produced by RNN were comparable to those of training and validation which means the stability of RNN is robust. Overall, we believe that the built RNN model can be applied and perform well in practice. As far as the optimization procedure is concerned, the number of hidden neurons was first decided by using the trial-and-error method after the determination of input dimension. Second, a tolerable error was set to 0.0001 and the number of iteration was set to 500 because the learning algorithm used herein was the gradient descent method which has the characteristic of fast convergence. Such training process is usually no more than 5 minutes and is repeated for 50 times to find appropriate initial values. Consequently, the time spent for optimizing the parameters is about 4 hours. After the model constructed, it can use to make on-line forecast. Regarding other methodologies such as GA, GP and PSO, they were adopted in many previous studies to analyze their application possibility (Holenda et al., 2007; Lai et al., 2009; Omkar et al., 2009). However, they are not within the scope of this study and therefore the discussion of their application possibility may not be included in the manuscript. Readers who are interested in these methods can refer to the aforementioned references.

References

Holenda, B., Domokos, E., Redey, A. and Fazakas, J., 2007. Aeration optimization of a wastewater treatment plant using genetic algorithm. Optimal Control Applications & Methods, 28(3): 191-208.

Lai, C.C., Wu, C.H. and Tsai, M.C., 2009. Feature Selection Using Particle Swarm Optimization with Application in Spam Filtering. International Journal of Innovative Computing Information and Control, 5(2): 423-432.

Omkar, S.N., Senthilnath, J. and Suresh, S., 2009. Mathematical model and rule extraction for tool wear monitoring problem using nature inspired techniques. Indian Journal of Engineering and Materials Sciences, 16(4): 205-210.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 2317, 2010.