Hydrol. Earth Syst. Sci. Discuss., 7, C3376–C3381, 2010
www.hydrol-earth-syst-sci-discuss.net/7/C3376/2010/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Generalized versus Non-Generalized Neural Network model for multi-lead inflow forecasting at Aswan High Dam" *by* A. El-Shafie and A. Noureldin

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Received and published: 8 November 2010

We would like to thank the referee for his objective and thorough review of our paper. We have addressed all the referee's comments in the following point-by-point response. All changes made to accommodate the referee's comments are underlined in the revised manuscript.

Referee#1

âĂć The manuscript presents generalized versus non-generalized neural network model for multi-lead inflow forecasting at Aswan high dam, which is interesting. The

subject addressed is within the scope of the journal. However the manuscript, in its present form, contains several weaknesses. Adequate revisions to the following points should be undertaken in order to justify recommendation for publication.

Reply

The author thanks the reviewer for his comments. The authors address all of his comments one-by-one hereafter and modify the manuscript

âĂć Full names should be shown for all abbreviations in their first occurrence in texts. For example, NN in p.7972, etc. Reply

The authors carefully consider the above comment in the revised manuscript.

âĂć For readers to quickly catch the contribution in this work, it would be better to highlight major difficulties and challenges, and your original achievements to overcome them, in a clearer way in abstract and introduction.

Reply

Owing to the referee feedback, challenges and difficulties about the flow forecasting and also the original achievements have been reported more clearer way in the introduction section. The limitation of the number of words (150) in the abstract makes it difficult to highlight that in the abstract, the authors focus on the main contribution of the current research in the abstract.

âĂć Many assumptions are stated in various sections. More justifications should be provided on these assumptions. Evaluation on how they will affect the results should be made.

Reply

It is true that there are some assumptions in our research. Hereafter, we will try to highlight the major ones.

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âĂć Assume the input pattern only three previous months. Keep in mind that our proposed forecasting model is to have 12 neural networks model one for each month. This is because each month has particular pattern different than the others. The findings of the cross-correlation analysis between two consequences months shows that the cross-correlation is relatively poor if go more than 3 months behind the one under study to be forecasted for most of the months. Based on that observation, theoretically, for the multi-lead forecasting, the use of the forecasted value as presented in equations 2 and 3 rather than using the actual value of the months (t-1), (t-2) and (t-3) “which is 4 month behind in case of forecasting (t+1)” to forecast the value at (t+1) is more logic to provide more accurate pattern as input and thus more accurate output. The auto and cross-correlation analysis have been added in the revised version of the manuscript.

âĂć The performance indicators Actually, in developing such forecasting model using Neural Network, the model could perform well during the training period and might provide higher level of error when evaluating during either validation or testing period. In this context, in this study the authors used these performance indices to make sure of that the proposed model could provide consistent level of accuracy during all periods. The advantages of utilizing these two statistical indices as a performance indicator of the proposed model are as follow:- 1- Using the maximum error is to make sure that the highest error while evaluating the performance is within the acceptable error for such forecasting model. 2- While utilizing the Root Mean Square error is to ensure that the summation of the error distribution within the validation period is not high. 3- Consequently, using both indices is guaranteed consistent level of errors which is providing a great potential for having same level error while examining the model for unseen data in the testing period.

âĂć The key ANN parameters are not mentioned. The rationale on the choice of the particular set of parameters should be explained. Have the authors experimented with other sets of values? What are the sensitivities of these parameters on the results?

Reply

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In fact, there is no formal and/or mathematical method for determining the appropriate "optimal set" set of the key parameters of Neural Network (number of hidden layers, number of neurons with each hidden layer and the type of transfer function between two consequence layers). Accordingly, the authors decide to perform this task utilizing trial and error method. The authors experimented several sets and examined each experiment but we report only the best trial. However, the authors reported some observations about the proposed model performance and sensitivity analysis under different set of key parameters in the revised version of the manuscript.

âĂć It is mentioned in p.7964 that the back-propagation algorithm, which has the drawbacks of local convergence and slowness, is adopted. Some justifications should be furnished on this.

Reply

The authors fully agreed with the referee in this point. The back-propagation algorithm experienced several drawbacks such as, local optima, slowness. There are many advanced methods offered by researchers to overcome these drawbacks such as Particle Swarm Optimization (PSO) and Genetic Algorithm (GA). In fact, the authors preferred to introduce the proposed algorithm to overcome the over-fitting problem within the classical neural network modeling method (feed-forward back-propagation neural network algorithm) for better understanding. However, the proposed algorithm to treat the over-fitting problem could be re-adjusted to be included in more advanced neural network types whether static (radial basis function or self-organizing neural network or probabilistic neural network) or dynamic neural network (recurrent, input delay and NARX neural network) with different types of training algorithms PSO and GA.

âĂć Moreover, the manuscript could be substantially improved by relying and citing more on recent literatures about case studies of application of various types of soft computing technique in discharge prediction such as the followings: - Cheng, C.T., Wu, X.Y. and Chau, K.W., "Multiple criteria rainfall-runoff model calibration using a parallel

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genetic algorithm in a cluster of computer," Hydrological Sciences Journal, Vol. 50, No. 6, 2005, pp. 1069-1087. - Lin, J.Y., Cheng, C.T. and Chau, K.W., "Using support vector machines for long-term discharge prediction," Hydrological Sciences Journal, Vol. 51, No. 4, 2006, pp. 599-612. - Wang, W.C., Chau, K.W., Cheng, C.T. and Qiu, L., "A comparison of performance of several artificial intelligence methods for forecasting monthly discharge time series," Journal of Hydrology, Vol. 374, No. 3-4, 2009, pp 294-306. - Wu, C.L., Chau, K.W. and Li, Y.S., "Predicting monthly streamflow using data-driven models coupled with data-preprocessing techniques," Water Resources Research, 45, W08432, doi:10.1029/2007WR006737, 2009. - Cheng, C.T., Ou, C.P. and Chau, K.W., "Combining a fuzzy optimal model with a genetic algorithm to solve multiobjective rainfall-runoff model calibration," Journal of Hydrology, Vol. 268, No. 1-4, 2002, pp. 72-86. - Chau, K.W., "Particle swarm optimization training algorithm for ANNs in stage prediction of Shing Mun River," Journal of Hydrology, Vol. 329, No. 3-4, 2006, pp. 363-367.

Reply

All the above references have been reviewed and included in the revised manuscript.

âĂć Some inconsistencies and minor errors that needed attention are: Replace ": : :performance function of Eq. (10): : :" with ": : :performance function of Eq. (5): : :" in line 3 of p.7966 Replace ": : :Assembly Neural Network Procedure: : :" with ": : :Assembling Neural Network Procedure : : :" in line 6 of p. 7966 Reply

All the above mistakes have been corrected.

1- In the conclusion section, the limitations of this study, suggested improvements of this work and future directions should be highlighted.

Reply

The conclusion section has been improved and includes the limitations of this study, suggested improvements of this work and future directions.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 7957, 2010.