

Interactive comment on “Application of a hybrid model of neural networks and genetic algorithms to evaluate landslide susceptibility” by H. B. Wang et al.

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Received and published: 23 April 2013

We really appreciate their suggestions to improve the manuscript. Thanks for their time and work on our manuscript. In view of the topic in our manuscript, it is really novel in landslide susceptibility, however, the method of GA-BPNN was broadly applied to different areas. We introduced the method for the landslide susceptibility, taking the advantages of GA and BPNN. After incorporating all the comments from both reviewers, we update our manuscript again, and response to their comments as following. 1. More information was provided including environmental characteristics of the study area. In this area, the lithology of the strata in these units is mainly Neogene

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argillites and fluvial deposits consisting of clayey silts and gravels and Quaternary loess. There are no faults and folds in the studied area, so we don't pay attention to the structures affecting the landslide occurrence. In addition, the type of landslides was introduced in the updated version. Actually, the landslides in loess are characterized for the geomorphological conditions, however, we followed the international standards of landslide, referring to the following publications: (1) Derbyshire E, Meng, X.M., Dijkstra, T.A. (eds). Landslides in the thick loess terrain of north-west China. John Wiley, 2000. (2) Wang, H.B., Zhou, B., Wu, S.R., Shi, J.S. Characteristic analysis of large-scale loess landslides: a case study in Baoji City of Loess Plateau of Northwest China. *Natural Hazards and Earth Sciences*, 11, 1829–1837, 2011. 2. We made the GA-BPNN clear, from the selection of model and GA parameters, and the application of GA for optimizing the BPNN. This part can be found in Line 321-337. 3. The manuscript was re-organized, especially, for the results, discussion and concluding remarks. In Discussion, we discussed the selection of parameters for GA and BPNN, and the environmental factors in the study area. Further studies was also pointed for the landslide hazard, based on the present study. 4. With respect to the number of landslides, the landslides were counted as 39 landslides in the study area, which were classified into three types, e.g., paleo-landslides, old landslides and recent landslides. In the analysis of landslide susceptibility, we divided all the landslides into slope units affected by landsliding, so the number changes to 123, while all the slope units was counted as 216. During the processin of GA-BPNN, 120 units, including 80 with landslide presence and 40 without, were used for training the neural network models, and 96 slopes, i.e., 43 with landslide presence and 53 without landslide presence, were used for the validation of landslide susceptibility. 5. For the figures, we made the following changes: (1) the orientation was added to Fig.1. For the Figure 1, we just wanted to show the location of the studied area, so the scale is not very important. (2) Figure 3 shows the trace of the main rupture surface and the main movement, so we can clearly see the boundary of landslides. (3) Figures 6-9 were revised to make the adopted classes consistent with the description in the text. I am sorry about these

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mistakes. (4) We made some changes in the description of Figures 12 and 13. (5) As you know, the slope unit affected by landsliding was valued as 1, while the unit without landslides was assigned as 0 in the analysis of susceptibility. After training of networks improved by GAs, we can get the results from 0 to 1 for the prediction of landslide susceptibility. In fact, the area of susceptibility in value is closed to 0 or 1. So we don't have the relative classes. 6. Two more environmental factors, e.g., distance to rivers and human activities, was introduced in the updated manuscript, but we don't think it is necessary to put the figures inside the manuscript. 7. Other technical corrections were made in the updated versions. 8. A new reference was added in the reference list, related to the GA-BPNN for the landslide, however, it is not applied in the landslide susceptibility evaluation. 9. The English spelling and grammar were checked through the manuscript.

Please also note the supplement to this comment:

<http://www.nat-hazards-earth-syst-sci-discuss.net/1/C141/2013/nhessd-1-C141-2013-supplement.pdf>

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 353, 2013.