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Interactive comment

Interactive comment on "Prediction of rainfall induced landslide movements by artificial neural networks" *by* Janko Logar et al.

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The purpose of the article is to test the ability of artificial neural networks to develop reliable short-term predictions based on data that is normally available. The paper is of interest for the journal by treating an extremely fascinating subject and, according to many authors, full of prospects.

In particular, authors face two cases of slope instability, on which data sequences are available. Specifically, in the first case, the Macesnik landslide, they processed data regarding the displacement of geodetic points, in the second, the well-known landslide of Ventor, the data was derived from measurements on a crackmeter.

In this respect it should be noted that the historical series used are limited and, since neural networks are very powerful nonlinear interpolators, they need long historical series to "learn" the phenomenon, otherwise they tend to over-adapt to the few data

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Discussion paper

available. This could lose the ability to generalize predictions. This problem has not been commented by the authors.

On the basis of the above, the following points are highlighted which, in my opinion, should be improved or rewritten.

1. The introduction is particularly long and addresses aspects not directly related to the subject. Many of the papers are cited without a specific purpose (15-20).

2. In the same introduction, as in the following, the authors refer to landslide and earthflows (5) (25): the reason for this is not clear being earthflows themselves landslides.

3. In relation to the data, and as far as the Macesnik landslide is concerned, the meaning of the highest intensity of earthflow movements should be clarified. In addition, earthflows show, especially when particularly extensive, complex movements that may involve differentiated sectors over the time. In this regard, papers such as Guerriero, et al (2014). Influence of slip-surface geometry on earth-flow deformation, Montaguto earth flow, southern Italy. Geomorphology, 219, for example, should be referred as examples of kinematism over time.

4. Even for the Ventor landslide, the meaning of the measures should be clarified in the kinematic characteristics and evolution of the movement in order to understand its overall significance.

5. As a result, it would be opportune to describe the landslide phenomena through maps and models that could permit to understand the meaning of the data.

6. Clarifications should also be made on the choice of cumulative displacement output. This parameter defines the history of the movement itself. This facilitates the prediction, while it would appear more appropriate to use the displacement velocity. The chosen model seems to give the illusion of very accurate predictions.

7. Explanations should be given regarding the use of neural networks. In particular, it is not clear how the training data, on which the network is built, the validation data,

and the test data were shared. This also to prove what the real capacity of the network generation.

8. The so-called neural network kernel functions are not easily understandable.

9. Forecast reliability is demonstrated only graphically, without providing performance index values, which are normally calculated on the training set. This in order to demonstrate the effective capacity of the network to predict with data different from those used for the construction of the same. It would be advisable to define statistics or performance indices.

10. Selected networks are quite complex (with many neurons) and, at least in the first case, layered. Given the limitations of the data analyzed, this could be a problem, because the complexity of the architecture of neural networks should be linked to the available data.

11. Knowing superficially the two case studies, it would be appropriate to reinforce the reasons why we use a neural network, which is a nonlinear modeling technique.

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