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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Backpropagation Neural Network as Earthquake Early Warning Tool using a new Elementary Modified Levenberg–Marquardt Algorithm to minimise Backpropagation Errors" *by* Jyh-Woei Lin et al.

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Final responds to two reviewers from Author; I have given the responds in GI discussion. Now the responds are the same You can find in the GI discussion Addressing to the comments of Pro. Dr Eppelbaum Dear Pro. Dr Eppelbaum (1) This MS, without hesitation, will be interesting for GI readers. ANS: Thank you. (2) However, without significant and careful English editing, reviewing of this MS is impossible. ANS: I sent to an editor to rewrite the English for the paper and arrange the submitted format ========== Dear Reviewer#1 Thank you for your comments. Now I

address your comments point-by-point and marked the changes with red words. (1) I wrote more clear as follows; The aim of this paper is to determine whether the EEW can be performed by a better real-time and on-line performable training method in BPNN rather than the previous works as stated. The microseismic data in the records are firstly used as training data for the BPNN model; in each station shown, the behaviour of microseismic data at each station records the ray tracing path, allowing for the prediction of upcoming signal. When the large predicted errors are presented, then it is expected that the behaviour of the microseismic data has changed because of this model reflecting the pattern of microseismic data. (2) Because the earthquake forces mostly acted on the center of gravity of the sliding soil mass, and the influences of vertical ground motions were on the seismic-induced displacements of the structures. Therefore I wrote the reasons more clear as follows; The vertical component of an earthquake was the most dangerous because the earthquake forces mostly acted on the centre of gravity of the sliding soil mass, and the influences of vertical ground motions were on the seismic-induced displacements of the structures (Sawicki, et al. 2007; Zhao, et al. 2017). (3) I re-wrote in the text as follows; surveying of the consideration of local building damages from past events under different local geological conditions. (4) Thank you. I have done it by attached file. PS: red words are added by author. Please also note the supplement to this comment: https://www.geosci-instrum-method-data-syst-discuss.net/gi-2018-13/gi-2018-13- AC4-supplement.pdf

By the way in section 2, for reader to understand clearly, I add some statements with red words. I also upload the revise paper.

Jyh-Woei Lin, Chun-Tang Chao, Juing-Shian Chiou 05, July, 2018, Taiwan ========== Dear Reviewer 2

Thank you for you comments. Now I address your comments pointby- point. Author: Lin, Jyh-Woei 26, May, 2018 1. On page 1, no line 13: The word 'a' in the sentence 'a trade-off decision-making process .....' should be capital. ANS: In Abstract, I have change as follows; Abstract. A new Elementary Modified Levenberg– Marquardt Al-

gorithm (M-LMA) was used to minimise backpropagation errors in training a backpropagation neural network (BPNN) to predict the records related to the Chi- Chi earthquake from four seismic stations, Station-TAP003, Station-TAP005, Station- TCU084 and Station-TCU078, with the learning rates of 0.3, 0.05, 0.2 and 0.28, respectively. For these four recording stations, the M-LMA has been shown to produce smaller predicted errors compared to Levenberg–Marquardt Algorithm (LMA). A sudden predicted error could be an indicator for Early Earthquake Warning (EEW), which indicated the initiation of strong motion due to large earthquakes. A Trade-Off Decision- Making Process with BPNN (TDPB), using two alarms, adjusted the threshold of the magnitude of predicted error without a mistaken alarm. This approach was not necessary to consider the problems of characterising the wave phases and pre-processing, but did not require complex hardware; an existing seismic monitoring network-covered researched area was already sufficient for these purposes. In page 6, line 30, the text is also changed as follows; A decision-making process called " Trade-Off Decision- Making Process with BPNN (TDPB)" was performed. In this study, the past records of the Chi-Chi earthquake was examined by TDPB, and then the thresholds and were subjectively determined. 2.The yellow colored spot in figure 1 is too light to be distinguished. ANS: I have also change in the figure caption for Figure.1 with more clear colors as follows; Figure 1 The figure shows the position of Chelungpu fault (No.11) on a map of Taiwan. Slip on this fault caused the Chi-Chi earthquake, which occurred at 01:47:15 on September 21, 1999 (TST), at a depth of 8.00 km, with a Richter magnitude (ML) of 7.3. The epicentre was at the coordinates (23.85_ N, 120.82_ E) (Orange-colour spot near the Chelungpu fault for No.11). The four corresponding positions of the research stations are shown by a dark blue coloured spot (Station-TAP003), baby blue coloured (Station-TAP005) spot, red coloured spot (Station-TCU084) and dark red coloured spot (Station-TCU078) in this figure. Station-TCU078 is very close to the epicentre. 3.Figure 4 which is mentioned in page 7 can't be found in figure captions.

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