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Interactive comment on “A neural network approach for the simultaneous retrieval of volcanic ash parameters and SO₂ using MODIS data” by A. Piscini et al.

Anonymous Referee #2

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The proposed manuscript presents an approach for the retrieval of volcanic ash parameters from remote sensing data by using a classical NN approach. The paper is confuse in some points and difficult to read. However, my main criticism concerns the novelty of the proposed approach. In particular, the use of a NN approach for the retrieval of biophysical parameters from remote sensing data is not new and already exploited in [1] by the same authors for the retrieval of volcanic ash from MODIS images. Aside from the novelty issue, there are many other problems that need to be addressed:

Page 3351 lines 25-27: The authors claim that the NN by default requires a very low

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computational time. However, the computation time is related to the topology of the NN, to the number of cycles and the number of samples used in the training phase. These parameters can drastically change the computational load of the training phase of the NN. On this regard, to my knowledge there is not a consolidated technique to correctly select the optimal topology of the NN. This means that several attempts, varying the number of nodes in the hidden layers should be made in order to select the best results. For these reasons I don't believe that NNs can be characterized by a low computational time. I suggest the authors to revise this sentence and provide a direct comparison of computational times obtained with different approaches.

Page 3357 line 25: The Authors should be more clear. It is not clear if the concept of NN as "universal approximator" has been introduced in Cybenko 1989 or in Krasnopolsky 1995.

Page 2258 line 14: I think the authors are making confusion between DN and physical measures.

Page 2258 line 19: As the authors proposed the back-propagation method they should also explain which activation functions have been chosen. This is a crucial point when performing retrieval using NN. In fact, while a nonlinear activation functions in the output nodes may be useful for the training phase, they also tend to compress the highest and lowest values, having a negative impact in the retrieval phase. I suggest the authors to further discuss this problem and propose a valid solution.

Page 2258 lines 23-25: In biophysical parameter retrieval tasks the selection of training samples is extremely important and should be better explained.

Page 3559 lines 7-12: There exist better feature selection approaches that work better than pruning. The pruning approach, usually tends to fit the NN to the training data. This means that the pruning reduces the generalization ability of the NN. I ask the authors to take into account this problem.

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Page 3361 lines 22-26: I believe that using pixels from the image for the training of the NN for the retrieval is not a good choice. Visual inspection and interpretation is in my opinion not a good validation approach because there isn't any certainty on the effective correspondence between the measured spectra and the expected parameters.

[1] Picchiani, M., Chini, M., Corradini, S., Merucci, L., Sellitto, P., Del Frate, F., and Stramondo, S.: Volcanic ash detection and retrievals using MODIS data by means of neural networks, *Atmos. Meas. Tech.*, 4, 2619–2631, doi:10.5194/amt-4-2619-2011, 2011.

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