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Earth Surface Dynamics Discussions

Interactive comment on "Systematic Identification of External Influences in Multi-Year Micro-Seismic Recordings Using Convolutional Neural Networks" *by* Matthias Meyer et al.

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RC: Referee Comment
AC: Author Comment

1 Response to RC2

AC: We thank the anonymous reviewer for the extensive review and the hint to additional literature. In the following we will address the comments and hint to the improvements in our manuscript. For a preliminary revised manuscript highlighting all the modifications please refer to the response to the editor.

RC: This paper proposed a new method for identifying external influences such as winds or mountaineers in micro-seismic recordings. Because the external influences may cause bias interpretations, its identification is very important for understanding micro-seismic recordings. In addition, the method may help to interpret the external influences which are keys to improve our understanding of rock-slope failure processes. The similar idea using machine learning is already applied to seismic wave discrimination such as Li et al., 2018. This study is interesting and suitable for the publication after moderate revisions. I suggest the authors revise this manuscript and pay attention to the following list as general suggestions:
RC: 1. Acknowledge previous studies on this topic or related topics and make sure the readers understand your contribution;

AC: We have acknowledged them. Moreover, we have rewritten the introduction and now the contributions are clearly demonstrated.

RC: 2. Introduce more about methods especially for Convolution Neural Network since readers may not be familiar with this method at all;

AC: We have added a new subsection "Convolutional Neural Networks" (starting Page 9, Line 7) which introduces convolutional neural networks and we have referenced additional literature to provide the reader with more background information on neural networks.

RC: 3. Discuss more future works such as how to automatically learn signal pattern in the external influences to improve the classification and interpretation of rock-slope failure processes;
RC: Page 20 line 14-22: The method is trained based on negative examples. But in most conditions, we should pay more attention to the phenomena of interest. In the discussion part, the author should discuss how this method can improve our interpretation of the processes of interest.

AC: We have added another paragraph to the discussion subsection "Classification of Negative Examples" (starting Page 23, Line 20) in which we explain how the method can improve the interpretation of the phenomena of interest. Moreover, we have extended our outlook (Page 26, Line 9) to include other methods which can improve the classification of external influences for example using semi-supervised and one-shot classification.

RC: Here are more specific comments:

RC: Page 9, line 1-4: I am confused about this part. Does this part mean that the dataset may be mislabeled due to fog, lens flares or other reasons? Have this data been included in the training dataset? Similar problem for the rockfalls in line 8-10?

AC: In case of limited visibility the images are not mislabeled, since the label represents what the annotator sees. However, since the seismic data is labeled with the help of images a certain probability of mislabeled samples exist if only images are used for annotation. In our case we reduce this probability by using an experienced annotator who can identify mountaineers on spectrograms and by using image sequences for annotation (before/after) when applicable. In the case of rockfalls we can only annotate time periods where we have additional information. Therefore it is most likely that we were unable to annotate all rockfall occurrences. As a consequence we did not consider a rockfall classifier. We have added this information on (see Page 9, Lines 6 - 9; Page 10, Lines 9 - 10).

RC: Page 11, line 12-15, the dataset including training dataset and test dataset seems to be small and may have serious overfitting problem. The authors need to address this issue during the discussion part and prove the trained model can handle it well.

AC: In the initial manuscript we have addressed the problem of overfitting in several paragraphs. In the revised manuscript we added another subsection "Overfitting" (starting Page 25, Line 31) to the discussion section explaining the impact of overfitting in our study.

RC: Page 14, line 12-14 The results with ten iterations are presented in this paper, but it will be better to show how the results change for a different number of iterations (such as 1, 5, 10, 20 iterations).

AC: We extended the evaluation section and have evaluated the impact of different training/test iterations in the "Classifier Evaluation" section (Page 20, Lines 9 - 19) and in Figure 11. We can confirm our choice of ten iterations.

RC: Page 15, Line 10: The learning rate is very small, which may make the code very slow. Is there any specific reason to set this small value?

AC: The value is the outcome of a preliminary hyper-parameter search and has been fixed for classifier training. Since the number of required iterations until convergence is rather small in comparison to other datasets/networks we found it reasonable to use such a small learning rate without negative impact regarding the total training duration. We have added the information explaining the learning rate to the revised manuscript (Page 16, Line 23 - 24).

RC: Page 16, line 10-16: Since it needs to manually relabel for the dataset in some cases, it will be worth to discuss how the potential human errors during data labeling will influence the classifier performance.

AC: We introduce a new evaluation which investigates how false labels affect the

classifier performance. This evaluation is presented and discussed in the section "Classifier Evaluation" (Page 20, Lines 20 - 22) and in Table 3.