Contribution ID: **143** Contribution code: **P3.6-143** Type: **e-Poster**

Application of a Paired Neural Network to Aftershock Identification

Thursday, 1 July 2021 11:45 (15 minutes)

Large aftershock sequences cause problems for the International Data Centre (IDC) because the seismic event rate increases dramatically during an aftershock sequence, making correct association of arrivals difficult for the automated pipeline. Aftershock sequences can continue for days or even months after a large earthquake and although aftershocks aren't events of interest for treaty monitoring purposes, they must be reviewed and eliminated by analysts, resulting in delayed release of the IDC bulletins. We turn to machine learning to automatically identify aftershock events and improve automated pipeline performance. In our research, we train a paired neural network (PNN) to automatically perform aftershock identification based on waveform similarity, even when only a few datapoints are available for training. This allows the model to be applied to classes outside of the original training dataset. We analyze the ability of our PNN to classify aftershock data constructed from signals recorded by the IMS network and several open IRIS networks added to real noises from the STanford Earthquake Dataset (STEAD) or the University of Utah network. We apply the trained model and waveform cross-correlation on the constructed test dataset and compare the performance of the two approaches.

Promotional text

This study aligns with the SnT2021 goal of improving nuclear test monitoring and verification. This research aims to provide a method to automatically identify nuisance aftershocks that could potentially be used to improve the IDC automated data processing pipeline.

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Session Classification: T3.6 e-poster session

Track Classification: Theme 3. Verification Technologies and Technique Application: T3.6 - Artificial Intelligence and Machine Learning