Geophysical Research Abstracts
Vol. 21, EGU2019-6483, 2019
EGU General Assembly 2019

An Automatic P Phase Picking Toolbox Using Deep Learning Method

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Picking seismic events is a time-consuming task by just relying on manpower, especially in high seismicity regions. For instance, Taiwan, on February 2018, over 4,000 aftershocks were detected within 12 days after the Hualien earthquake. Although there are lots of papers propose various deep learning models that are suitable for dealing the problem, there is still a gap between the picking routine and the AI research. Thus, we design a toolbox that can be easily integrated into the regular work flow.
In this study, based on PhaseNet developed by Zhu et al. (2018), the masking arrival-time label with a Gaussian distribution is the essential part for the training methodology. In addition, we implement the neural network model UNet++, which re-designs the skip pathways for better performance comparing to the original U-Net that is used by the PhaseNet. Here, we provide an open-source framework that can be easily installed and operated. This automatic picking toolbox is built upon Obspy and Keras with Tensorflow backbone, by reading S-file catalogs from SEISAN for generating labeled datasets. Besides, a Docker image is available for fast server deployment. As a result, in our scenario, most of the temporary stations are only contained single channel and mainly focus on P arrivals. We reduce the training set from input: three-components – output: P/S/Noise categories into input: Z-component – output: P category. The testing data is successfully identified by the model trained with 90,000 traces. Moreover, minor events missed by manually picking are detected by the model.