A neural-network (NN)-based approach to the identification of initial seismic phase in a single channel record

*Nobuki Kame[1], Akira Nishijyo[2], Kiwamu Nishida[1]

1. Earthquake Research Institute, the University of Tokyo, 2. Dept. Earth Planet. Phys., Univ. of Tokyo

This paper applies a neural-network (NN)-based approach to the identification of initial seismic phase in a single channel record. In this approach, NNs are trained to extract an abrupt increase (or decrease) from the input waveform to identify the arrival of seismic P-wave. Such automated identification will be helpful in the posterior monitoring of off-line records using ocean bottom seismometers and deep mine in-site instruments. Several NN-based classification (or regression) models with fully connected units were developed for the initial phase extraction. Firstly, these models with small degree-of-freedom (input waveforms with 100 points) were trained and tested using 50000 waveforms (artificial model data in the presence of white background noise). The performance of these models was compared in terms of their accuracy, generalization ability, and noise tolerance limits. The results showed the fully connected three-layer NN was best able to determine the presence of initial seismic motion with high accuracy. Secondly, these models with realistic degree-of-freedom were trained and tested using 210000 waveforms (from the Hi-net data with 12000 points, 2-minute long with 100 Hz sampling, including the P-wave arrivals). The results were found to be unsuccessful: training may have required much more waveforms to extract the information necessary for the initial phase identification.

Keywords: seismic waveform, initial phase detection, neural network

©2018. Japan Geoscience Union. All Right Reserved.