P-wave Polarity Determination of Waveform Data Observed in Western Japan, Using Deep Learning

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In order to determine focal mechanisms of earthquakes, it is necessary to determine first-motion polarities of P-wave. Researches on various automatic determination algorithms has been developed, but the performance of conventional algorithms has been significantly lower than that of human experts. Therefore, check by human experts is commonly needed, when we apply an automatic determination algorithm to observed waveform data. In this study, we develop a model of the convolutional neural network (CNN) that can determine P-wave first-motion polarities of seismic waveforms, in which P-wave arrival times determined by human experts are given beforehand. We use about 130 thousand 250 Hz and about 40 thousand 100 Hz waveform data observed in the San-in and the northern Kinki area, western Japan, to train and test the CNN. The P-wave polarities determined by the CNN have the accuracy of about 98 % for the 250 Hz data and about 95 % for the 100 Hz data. To examine the regional dependence, we divide seismic waveform data according to the observational area and trained the CNN using the data of one region, and applied the CNN to the data of the other region. As a result, the accuracy was different only by about 2 %. This means that there is almost no need to retrain the CNN by region.

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