

Automatic picking of seismic arrivals in strong motion data using an artificial neural network

Aki Hidani[1], Hiroaki Yamanaka[2]

[1] Environmental Sci. and Tech., T. I. Tech., [2] T.I.Tech

<http://yama1.depe.titech.ac.jp/>

In this study, applicability of an artificial neural network (ANN in the following) in automatic picking of seismic arrivals in strong motion data was examined. Three ANNs were discussed with different input parameters. We used 1:envelope of vertical component, 2:envelope of vertical and horizontal component, 3:envelope of vertical component and V/H(ratio of amplitude of vertical component and horizontal component) as input to the ANN with one hidden layer for P-wave picking. The inputs to the ANN in picking S-wave arrivals are 1:envelope of horizontal component, 2:envelope of vertical and horizontal components, 3:envelope of horizontal component and V/H. The accuracy of detection of each algorithm was investigated by comparing estimated arrival times with those determined manually. The algorithm using envelope of vertical component is the most accurate one for initial P-wave picking, while the most accurate initial S-wave is estimated by the ANN using envelopes of vertical and horizontal components. We, next, apply the best algorithms to about 1300 strong motion data of the K-NET obtained in Kanto District. It is noted that we could estimate these first arrivals of large amount of data in a short time by using the ANNs. Travel time residual defined as the difference between observed and theoretical travel times, which were calculated using velocity structures used in determining hypocenter locations in Japan Meteorological Agency (JMA). The distributions of the travel time residuals for P- and S-waves obtained in this study agree with results of previous studies indicating the appropriateness of our procedure.