

Tuning and extending artificial neural networks used in automatic phase identification of detections at 3-component seismic stations of the International Monitoring System

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Phase identification is one of the steps in automatic processing of seismic, hydro-acoustic and infrasound (SHI) data at the International Data Centre (IDC) of the Comprehensive Nuclear-Test-Ban Treaty Organization. The current algorithm automatically identifies phases and groups together signals recorded at a station, that are likely to originate from the same event. Techniques for phase identification vary among respective SHI technologies. Generally, rule-based systems with artificial neural networks (multilayer perceptrons) and with a Bayes classifier are employed to tackle the discrimination between different phase types. All techniques used at present are based on detection features measured in prior processing steps, such as horizontal velocity and the quality of the f-k measurement for arrays, and polarization features and detection context for 3 component stations. We report on our experience with tuning the current phase identification software for 3 component seismic stations by re-training the artificial neural networks on station-specific historical data. Training and testing datasets were constructed from the results of IDC interactive analysis and review which is readily available but has shortcomings in particular in that it does not extensively classify automatic detections which remain orphan and unrelated to an analyzed seismic event. Further we assess the feasibility of replacing the current multilayer perceptron used in phase identification with more advanced types of neural networks (recurrent and convolutional) that take as input waveform data instead of detection feature measurements.