A DEEP LEARNING ALGORITHM FOR MASW SOUNDINGS

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Standard MASW (Multi-channel Analysis of Surface Waves) processing workflows imply various interpreter operations such as trace editing, hand picking of the dispersion curve, and higher mode identification. These operations can be, at a certain level, subjective, and require a high level of expertise from the interpreter, especially for complicated data sets. In addition, standard unconstrained inversion routines are non-unique and provide infinite solutions. Finally, a proper interpretation of complex data sets is time consuming, even for a highly skilled geophysicist. The authors have developed a machine learning algorithm to automate the interpretation of standard MASW data sets used for the calculation of the "Vs30" parameter and the prediction of the sounding's shear wave velocity profile.

The Vs30 results is obtained using Resnet34, a 34-layer convolutional neural network that can be utilized as a state-of-the-art image classification or regression model. In the case of the MASwAi network, Resnet34 is utilized as a regression against the combined stacked shots dispersion image ("phase shift" for MASW, and "cross-correlation" for SPAC) and other geophysical constraints such as the rock depth. The MASwAi neural network was trained using a large number of field data and augmented by complimentary synthetic data. The MASwAi network results accuracy was assessed with validation datasets, highly skilled geophysicists cross-interpretations, and direct in-situ Vs measurements conducted on test sites using the downhole seismic method and sCPT soundings. Vs30 results show that the network predictions fall within the accuracy rate of the MASW technique for shear wave velocity measurements.

Increasing demand for geophysical surveys, a competitive market, and the limited availability of skilled geophysicists are increasing challenges that need to be met to maintain a high level of quality necessary to provide accurate seismic site classifications required by national building codes. The development of a reliable machine learning tool to assist geophysicists in MASW interpretation will help to cope with these obstacles in such contexts.