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## Abstract


Velocity field is an essential parameter in seismic imaging process. It is derived from the recordedseismic traveltime in velocity model building method such as normal moveout (NMO) velocity analysis, traveltimetomography and full waveform inversion (FWI). However, these conventional velocity model building methods are very timeconsuming and highly require human interaction. Recently, researchers are progressively giving effort and interest in theusage of artificial intelligence (AI) technology in velocity model building. It is an alternative to cope the time consumptionand human interaction problems by the conventional methods. This study aims to use fully convolutional neural networkdeep learning in predicting velocity model on synthetic data (seismic shot records) that have complex subsurface structure.

The reliability of seismic traveltime calculation methods by ray tracing and finite differenceare analyzed first. Since finite difference yield better traveltime calculation coverage, it then employed in the seismic forwardmodeling process, generating synthetic shot records with a good resolution. The training part of deep learning is done byfeeding the network with huge amount of a pair of shot record (input) and its corresponding velocity model (label). Intesting, different shot record (input) is given, and the network try to predict the velocity model (label).

Our findings shows that deep learning is relatively less time consuming with minimalhuman interaction, compared to NMO velocity analysis. In calculating travel time upon the complex geological structure (Bell Model), gridding scheme of finite difference method covers more area at all source location, unlike ray tracing, whereits maximum coverage limited to near offset source location only. Finite difference also manages to outcome thedisadvantage of ray tracing in solving the shadow zone area.

As an alternative to the conventional NMO velocity analysis, deep learning shows anexcellent velocity model prediction outcome of the complex geological structure. Velocity model can be generated wayfaster than NMO velocity analysis once the deep learning network is well-trained.