10.5 SEISMIC VELOCITY INVERSION BY IMPROVED INVERSIONNET DEEP MODEL: NOISY AND NOISELESS TRAINING DATA SETS

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ABSTRACT

To investigate the seismic velocity inversion process by deep neural network, we study the InversionNet deep model structure and create two learning data sets: noisy and noiseless. Two different versions of InversionNet have been published so far. We made changes in its architecture especially in the decoder part and achieved a new version of it. The new version of InversionNet can map seismic shot gathers to velocity model better with lower loss function than the others. Labeled data set is one of the essential needs in supervised deep learning methods. In our study InversionNet maps the seismic shot gathers to a related velocity model therefore seismic shot gathers are used as input and velocity models as target or ground truth. We develop a stochastic method to construct 18000 two dimensional(2D) realistic velocity models consisting of dense layers, faulty, and salt dome models. It is used as targets. To prepare the input data sets, 20 synthetic seismic shot gathers are calculated in each velocity model by using 2D acoustic wave propagation equation. In total we calculate 20×1800 shot gathers. It is used as noiseless inputs. Adding coherent and random noises to prepared seismic data made it difficult to recognize the signal patterns. Thus, on the one hand the shot gathers are more like real data and on the other hand the training ability of InversionNet can be investigated. We created a synthetic coherent noise seismogram like ground roll waves pattern and added random noise to it, then summed the outcome with related noiseless shot gather and repeated this for all of them. It is used as noisy inputs. In other words, in this study we prepared noisy and noiseless ‘seismic shot gathers-velocity model’ labeled data sets. The three versions of InversionNet are trained with two noisy and noiseless learning data sets. The results of the test phase for two different data sets are compared and analyzed.

KEY WORDS: Seismic velocity inversion, Deep learning, Convolutional neurol network

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