Completely Automated Workflow for Sequence Stratigraphy Interpretation of Big Data

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Abstract

The pace of oil and gas industry has been accelerated recently for all aspects of exploration and production cycle from gathering of data to the full interpretation, leading to the need to automate all the workflows involved. Automation also allows us not only to get the results faster, and more accurate, but also to process and understand big data with relative ease. We are trying to use deep machine learning and quantitative techniques to provide full sequence stratigraphy interpretation of a large dataset. The workflow is used to test various datasets with different sets of lithologies. We start with sequence stratigraphic interpretation of type logs representing large dataset, use those type logs to train deep learning neural network and then process the whole dataset. Independently, well correlations are achieved through dynamic time warping used to pick the tops for large number of wells. As an output we achieve full suite of logs over the large area with the sequence boundaries and marked tops identified. Then, automatically built sequence stratigraphic cross-section is used to tie sequence boundaries. Quantitative sequence stratigraphy method (Ainsworth, 2017) then helps us in discriminating between sequence orders. Automatically picked horizons and faults is carried out on 3D seismic data and interpreted logs displayed over seismic to build the full sequence stratigraphic model. Cross-section builder can read data of automatically picked tops, well logs and sequence stratigraphic interpretation of separate wells and then to identify sequences boundaries for a large number of wells. Automated extraction of horizons and faults has been a challenge for many developers over last many years. Methods for automating these processes have been tried and were quite impressive for simple

datasets, but generally fail in more complex regions such as salt domes, multiple fault families and unconformities. However, by implementing modern research, we have been approaching a completely automated seismic interpretation workflow for very complex 3D area. A fully automatic seismic interpretation would allow the extraction of faults, horizons, unconformity surfaces and various volumes, including an un-faulted, flattened (wheeler domain), and relative geologic time cube. All of the above results are then integrated through robust velocity model building. Through over geoscience guided deep learning workflows a fully interpreted sequence stratigraphic balanced interpretation of large 3D data with thousands of wells can be achieved within relatively short time.

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