Enhancing time to depth relation estimations in subsurface exploration using supervised neural networks

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Abstract

Conventional methods of solving time to depth relations needed for successful interpretation of seismic data and later construction of geological model include vertical seismic profiling and construction of synthetic seismogram based on available well log data from acoustic and density well logs. However, when re-evaluating the potential of mature basins that had its peak exploration and production in the pre-1990's, this data is often lacking and/or the spatial distribution data is too irregular. As the main controlling factor of the acoustic properties of the rocks is lithology in relation to compaction, we propose the usage of "sandstone to shale" ratio and general lithology in regard to the stratigraphic interval (Pliocene, Upper Miocene, Lower and Middle Miocene and Base Neogene categories) along with burial depth as a controlling factor for determining time to depth relations in wells lacking data for the abovementioned conventional approach. In this way the time to depth relation is controlled as permeable versus impermeable lithologies based on the interpretation of conventional well logs. Initial research was performed using data from four wells with vertical seismic profiling data using the multi-layer perceptron networks. Successfulness of the learning was tested on one additional well which also had vertical seismic profiling measurements. The successfulness of the prediction, although lower than in learning dataset, proved to be more accurate than using the time to depth relations from the nearest well.

Key words: *Artificial neural networks, seismic, wells, hydrocarbon exploration*

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