A Comparison of Popular Neural Network Facies Classification Schemes*

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ABSTRACT

There are two learning networks commonly used for seismic facies classification: unsupervised and supervised neural networks. While unsupervised neural networks have been proven effective processes in macro- and meso-scale depositional facies characterizations, published results from supervised neural networks have more often demonstrated effective reservoir-scale characterization studies, using neural network mapping rather than neural network classification methods. Neural networks are sophisticated techniques that reduce data dimensionality and assist in seismic interpretation for exploration, exploitation and production projects. In essence, neural networks for seismic interpretation map multiple seismic attributes to an output attribute or attributes, that incorporate combined facets of the input data sets that yield a more accurate interpretation of the subsurface. Selecting an appropriate neural network is a crucial to maximize interpretation benefits, yielding an accurate representation of the subsurface, such that it can be used meaningfully to effectively support exploration and production efforts.

A comparison of these two classification techniques is performed using Oligocene Catahoula oil-bearing sands overlying a shallow salt structure along the U.S. Gulf Coast, where well control is abundant, and used to ground-truth the seismic classifications of shale, brine-sand, and oil-sand extent and thickness. Extraction of the seismic facies traces at various wells within the 3D volume permits direct comparison of the two techniques with known geology, permitting an unbiased evaluation, and inferring the advantages of supervised neural networks for the classification of pertinent geologies. The advantages of the supervised network are further demonstrated by horizon and stratal slices that properly identifying productive fault blocks while minimizing false positives of single seismic attributes.

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