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Learning the Relationship between Seismic Attributes and Lithofacies by Back-Propagation Neural Network

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Characterization of carbonate (or classic) reservoir requires integration of data and knowledge from various types, scales and accuracy. In our approach, 3-D seismic data are integrated with other geological information to determine reservoir physical properties. The major problem in using well data and seismic data is that well data is often fairly limited and has a much smaller sampling scale compared with the seismic data. Thus, a relationship between seismic responses and underlying well properties must be established. Using an artificial neural network, we derived an empirical relationship between seismic attributes and well-log data. Based on this relationship, synthetic log data can be generated in interwell areas, and the log-derived porosities can then be obtained with a smaller scale.

Back-propagation Neural Network (BPNN), a feed-forward neural network with supervised learning, is one of the most popular approaches for computer learning and modeling. It has been successfully applied to the area of log analysis and lithofacies prediction. Because well data may be limited in a new or small field, the learning ability of the BPNN becomes very valuable for extracting the relationship between a 3-D seismic data volume (that spanned the entire study area) and the existing limited well data. We demonstrate this approach using a case study from the Jurassic Smackover Formation at Appleton field in Escambia County, Alabama.