Machine Learning Boosts Interpretation Confidence

Machine learning algorithms empower interpreters with new tools to solve an old problem.

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A growing machine learning approach taken by Emerson through the Paradigm Integrated Canvas has enabled the implementation of new workflows for interpreters, with each workflow using a different machine learning algorithm suited to the task at hand.

Using these workflows, interpreters can easily integrate and use huge amounts of data from multiple sources (e.g., well cores, well logs, prestack and post-stack seismic data and attributes) to produce rapid results as well as reducing the level of uncertainty.

The Attribute Clustering Workflow released in Paradigm 18 offers the ability to create unsupervised classification volumes with three different detection objectives:

- Anomalies for amplitude versus offset analysis and improved geobody identification;
- Structural delineation to aid fault interpretation; and
- Stratigraphy for seismic facies analysis.

To accomplish these tasks, the algorithm uses a self-growing neural network approach based on growing neural gas. This algorithm provides a good solution for matching the data's high dimensionality. However, as with any self-organizing network, growing networks are attracted by data density. Since the goal is to overcome this issue to map anomalies, the algorithm is adapted to also focus on outliers. To accomplish this, the workflow performs neural network training through the following steps:

1. Train the network on a subset of points of the interval of interest;
2. Detect outliers from the previous stage to populate the network with outlier zones;
3. Train only on outliers; and
4. Agglomerate the neurons into classes using a hierarchical clustering algorithm.

For each point of the interval of interest the classification process affects a class based on distance criteria between neurons and computes a posteriori probability of class assignments. It generates new displays and provides interpreters with a clearer image. It enables easy extraction of the different geobodies based on their class or on a combination of different classes.

The Rock Type Classification Workflow released in Paradigm 17 is a supervised classification algorithm that predicts facies lateral distribution and probability of occurrence using a democratic neural network association (DNNA).

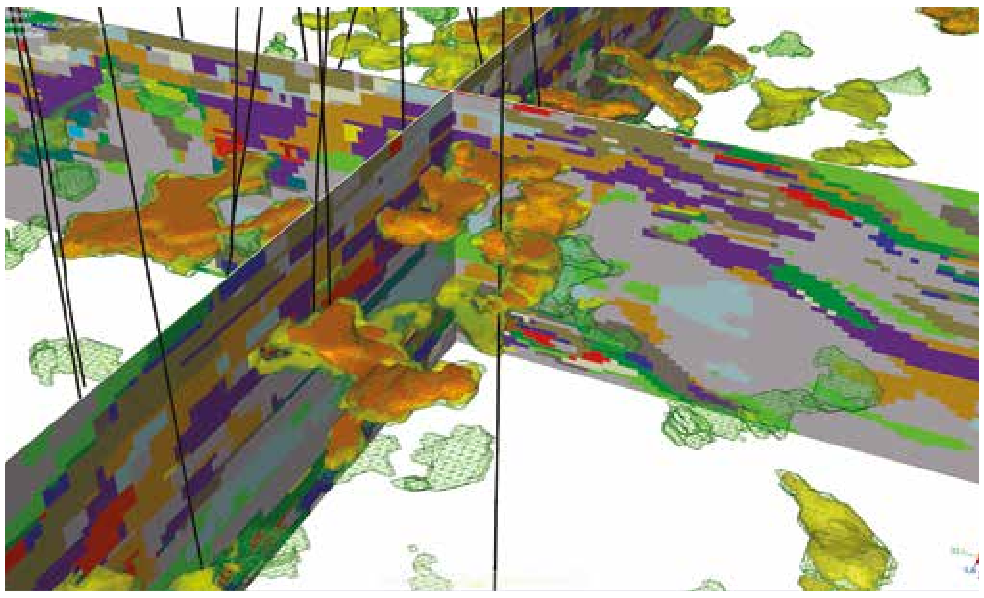
Well log information is the main source of information for lithology and fluid content. Therefore, a key step in lithology and fluid prediction is precise and careful analysis of the well data. DNNA is designed to use lithology logs or facies that are determined using petrophysical properties calibrated to cores.

Alternatively, raw data such as gathers bring a huge quantity of highly valuable but often subtle information that is difficult to handle without making approximations. A neural network application using DNNA offers the ability to infer facies defined at wells using prestack seismic data.

The neural network is composed of several independent networks in parallel. The training identifies patterns in the data that can be used to make predictions while the parallel training provides a suite of independent predictors.

The DNNA probabilistic approach combines all seismic-related information to build facies probability cubes.

For more information, visit Emerson at booth 720. ■



Geobodies detected from the most probable facies volume show a high probability of the best quality reservoir distribution to help optimize well planning. (Image courtesy of Emerson Automation Solutions)