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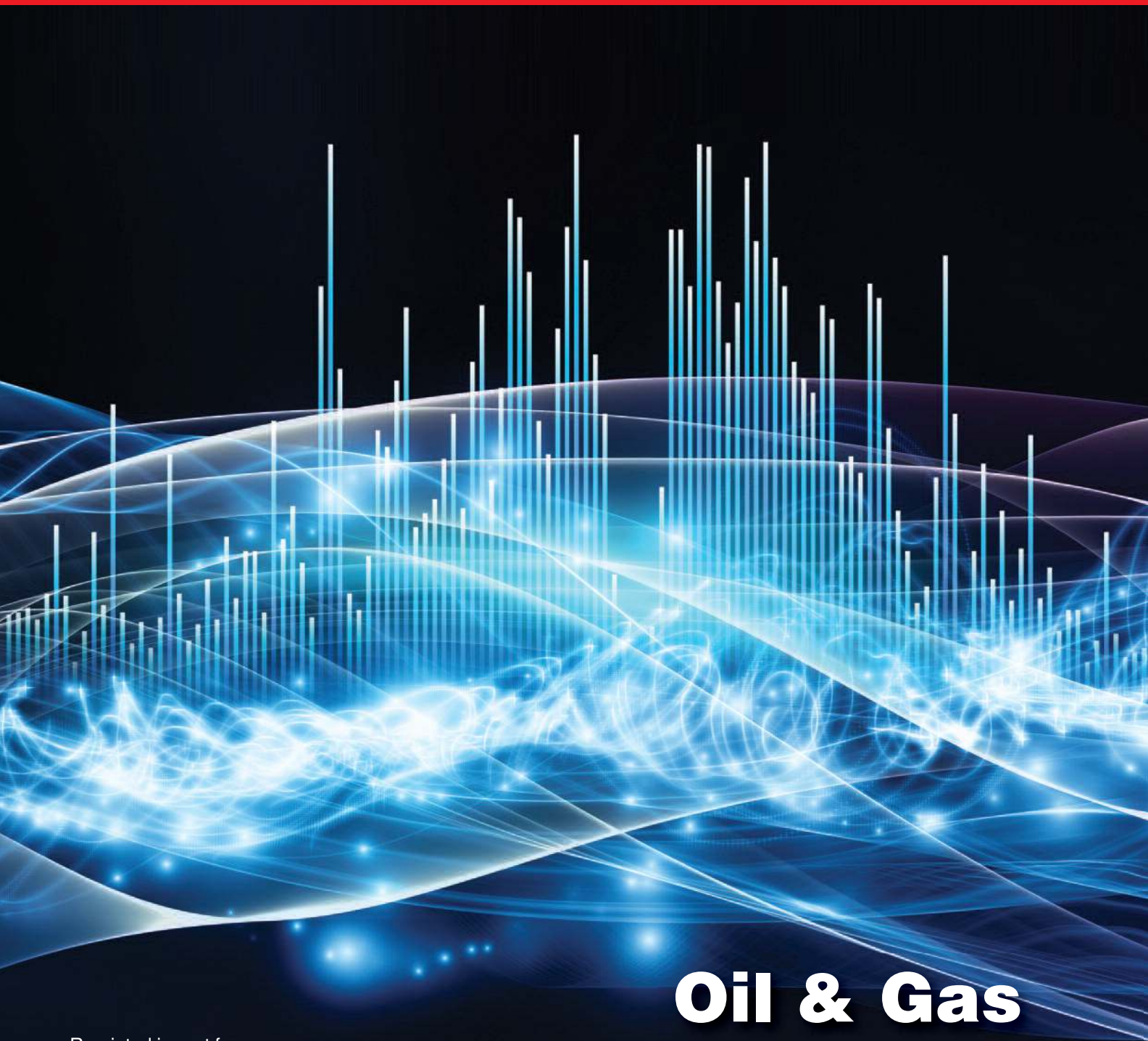


Oil & Gas Computing

Innovative Solutions Pave Way Forward

By Kari Johnson

Not long ago, the playbook in unconventional operations called for drilling horizontal wells about anywhere in a "blanket" formation, so long as the wellbore stayed in zone to allow stimulation at regular intervals spaced along the lateral. The name of the game was breaking rock. While well productivity remains a function of creating fractures in low-permeability rock, oil and gas producers have come to appreciate the importance of how and where laterals are placed to ensure access to quality rock.

Advanced Attribute Analysis

Techniques that concentrate on a few key seismic attributes have proven highly effective in finding anomalies in subsurface datasets. But Tom Smith, chief executive officer of Geophysical Insights, says technological advances are making it possible to use seismic attributes in almost infinite combinations to delineate anomalies in unconventional plays.

There are hundreds of potential attributes of interest in seismic data, he notes. Reviewing them all to find the best attributes for analysis, and then using them to find sweet spots is a demanding task. "We set out to apply automated, unbiased analysis to this problem," Smith says. "We developed Paradise™, an advanced geosciences analytic software platform, to enable interpreters to apply these advanced pattern recognition methods to address this problem."

Smith says Paradise provides workflows that guide geoscientists through the application of unsupervised neural networks (UNNs) and principal component analysis (PCA). "Paradise also takes full advantage of high-power, multicore processing using large-scale parallelism to accelerate performance of these advanced techniques," he says.

Unconventional reservoirs have introduced a new suite of rock mechanics properties, and Smith says the industry is still learning which ones provide the most valuable insights. UNNs have the advantage of running uninterrupted and unbiased by human assumptions.

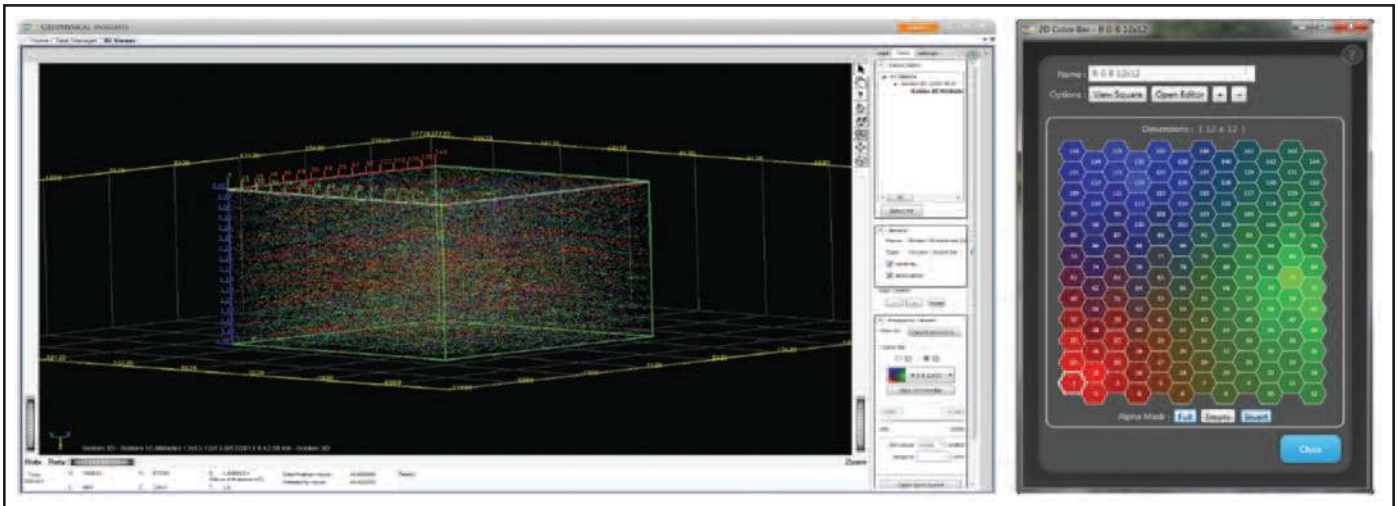
"UNNs offer the advantage of operating on seismic data alone without the need for well logs. Where well logs are available, those data can be included in the UNN analysis, as can data from hydraulic fracturing," Smith states. "The more data provided to the system, the more information we can discern from the results. We view this process as advantageous because we make no assumptions about linear or statistical combinations."

Smith points out that even the most detailed well logs represent a tiny sampling of the subsurface. "It is not that obvious how to sort the properties," he observes. "Running a supervised neural network is problematic in unconventional plays because the rock properties known at the borehole are an extremely limited sample set. Better tools are needed to lower exploration risk in unconventional plays. By applying both UNN and PCA on the seismic response, greater insights can be realized about the geology and sweet spots identified."

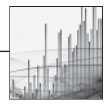
UNNs look at the natural properties and find natural clusters that are not artificially biased in any way. "We are working in n-dimensional space, where n is the number of attributes," Smith details. "Attributes can vary in data type and some parameters are predetermined."

In unconventional formations, interpreters typically search for overpressured zones, sweet spots, AVO and fracture networks. They also look for anomalies and anything that is out of the ordinary. "Neural networks can scan large volumes to find areas of interest for further analysis," Smith explains. "This capability enables interpreters to focus more effectively and efficiently."

While the results of attribute analysis are presented in a 3-D cube, Smith says his team has built a 2-D color bar in the Paradise software to more effectively analyze and interact with the volume. The user selects a few neurons on the 2-D color bar, and the 3-D representation highlights only the regions in the volume that correspond to those neurons, enabling isolation of the classification results.



Geophysical Insights' Paradise™ analytic software platform applies automated pattern recognition to analyze seismic attributes in almost infinite combinations to delineate anomalies in unconventional plays. The workflows use unsupervised neural networks and principal component analysis while taking advantage of high-power multicore processing using large-scale parallelism to accelerate performance. Shown here are attribute analysis results presented in a 3-D viewer with a 2-D color bar for interacting with the data volume.



"Each neuron illustrates a different aspect of the data, including geologic features," Smith says. "The 2-D color bar reduces the complexity to an interface that is more easily understood."

To help "tease out" the best attributes, Smith says he recommends principal component analysis. "PCA looks at every possible pair of attributes for statistical correlation," he says. "The covariance matrix is reduced through Eigen analysis to sort out in multidimensional space the primary direction that gives the best information and the highest variability of the seismic attributes. The attributes identified as contributing the most information then can be analyzed using UNN. This combination is very powerful for solving certain problems."

Smith says he sees great potential for neural networks and their application throughout the industry. "There is a lot of number crunching that goes into each of the neurons, which learn, adjust and are attracted to natural clustering. We should not simply throw them away, but instead, gather them into libraries of corporate wisdom. In the Paradise software, we refer to this capability as enterprise neural assets (ENAs)," he attests. "We believe ENA is the next generation in the evolution of geoscience analysis tools, building libraries of knowledge assets in the form of neural network results that can be shared among disciplines to reduce exploration time and risk." ❒

The following Paradise™ press release also appeared in the November issue.

Geophysics Software Aims To Reduce Exploration Risk

HOUSTON–Geophysical Insights has introduced Paradise™, an analysis software platform the company promises will reduce exploration risk by providing geoscientists new insights into seismic and engineering data.

The software suite enables users to rapidly analyze and compare different aspects of seismic and engineering data while revealing complex and subtle relationships in that data, Geophysical Insights reports. The company says the software executes and manages workflows based on advanced pattern recognition methods, including self-organizing maps and principal component analysis. It also features guided workflows, interactive world maps, 3-D imaging and a unique 2-D color mapping capability that is integrated and interactive with 3-D imaging, the company adds.

"Applying self-organizing maps running as background tasks, Paradise is the only geoscience software that can operate on seismic-related files automatically as new data files are added to the system," says Geophysical Insights President and Chief Executive Officer Tom Smith. "This capability will generate new knowledge continuously for an oil and gas business."

For information, visit www.geoinsights.com. ❒

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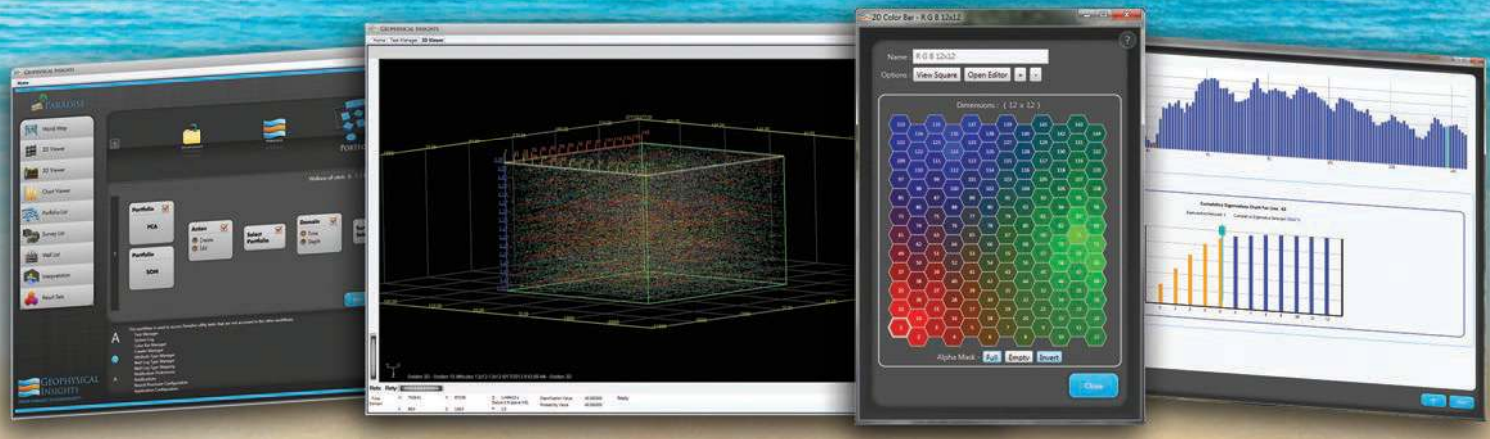
New Insights



Guided Workflows • Interactive 2D Color Bar • Principal Component Analysis • Neural Networks

Introducing PARADISE

Reducing Exploration Risk and Time

Dramatic New
Geosciences Analytic Software

Optimizing Seismic Attribute Analysis

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