



## ЛАБОРАТОРИЯ ПРИЕЗЖЕВА

IPLAB LLC “Priezzhev Laboratory limited liability company” is a resident company of the SKOLKOVO Innovation Center that develops software for predicting the productivity parameters of oil and gas formations.

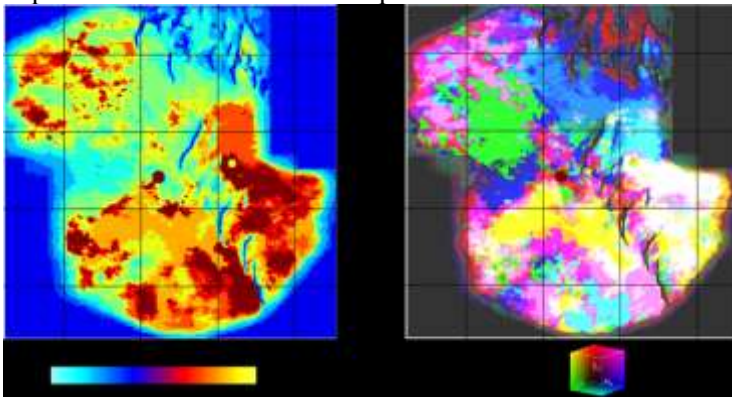
Software products of IPLAB LLC - "Priezzhev Laboratory" allow you to perform predictive inversion constructions:

- \* Forecast of effective thickness maps.
- \* Forecast of lithological and facies maps.
- \* Predictive-inversion constructions for cubes of elastic and rock property.
- \* Forecast of lithological and facies cubes.

Software products of IPLAB LLC - "Priezzhev Laboratory" are based on the use on:

- \* Modern machine learning algorithms, including a new generation of neural networks – Kolmogorov neural networks
- \* Using the theory of solving unstable problems for predictive inversion constructions-regularization by A. N. Tikhonov.
- \* Joint use of seismic inversion theory and neural networks.
- \* Building a low-frequency model using neural networks and other machine learning algorithms.
- \* Seismic inversion for total, angular, and azimuthal stack;
- \* Fracture analysis based on seismic data based on machine learning.

We use state-of-the-art innovative machine learning algorithms to process and interpret complex data of various scales and accuracy (well surveys, seismic surveys, ground surveys, and aerospace surveys). The development of technologies based on such algorithms involves the use of large amounts of input data in order to build reliable forecasts of reservoir productivity for traditional and non-traditional hydrocarbon deposits. The offered software products use builds without a teacher (classification) and with a teacher.



*Figure 1. Comparison of results of classical seismic facies analysis based on 1D Kohonen neural networks and 3D Kohonen neural networks.*

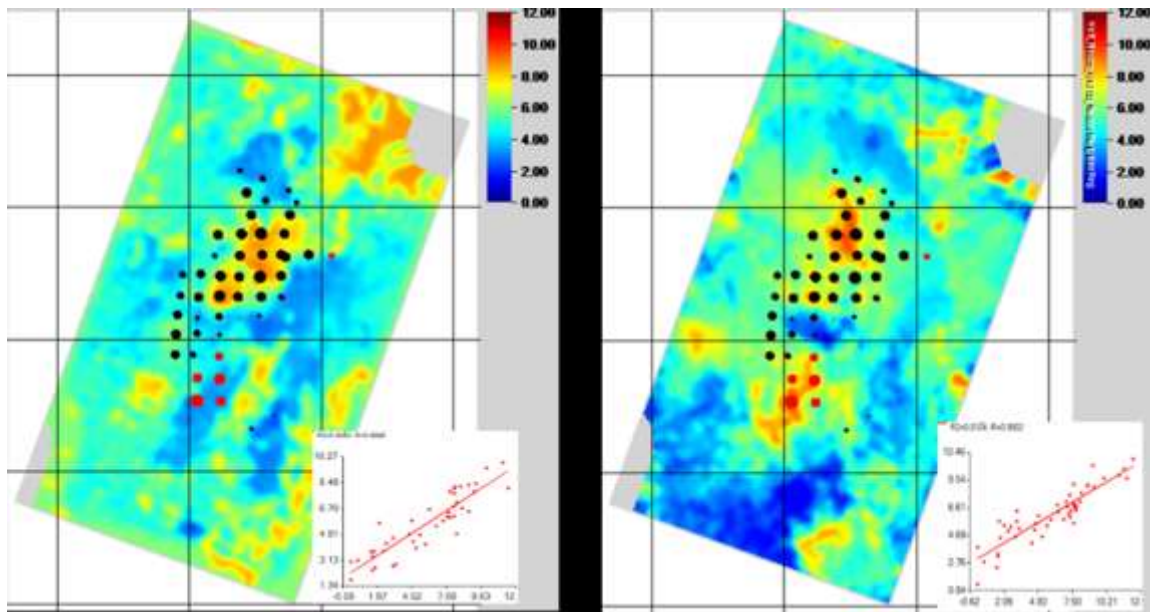


Figure 2. Forecast map of effective thicknesses using the conventional method (left) and the proposed method (right).

Special artificial intelligence algorithms are used to identify fracture zones and hidden faults based on 3D seismic data. The use of machine learning algorithms makes it much more efficient to solve such a problem.

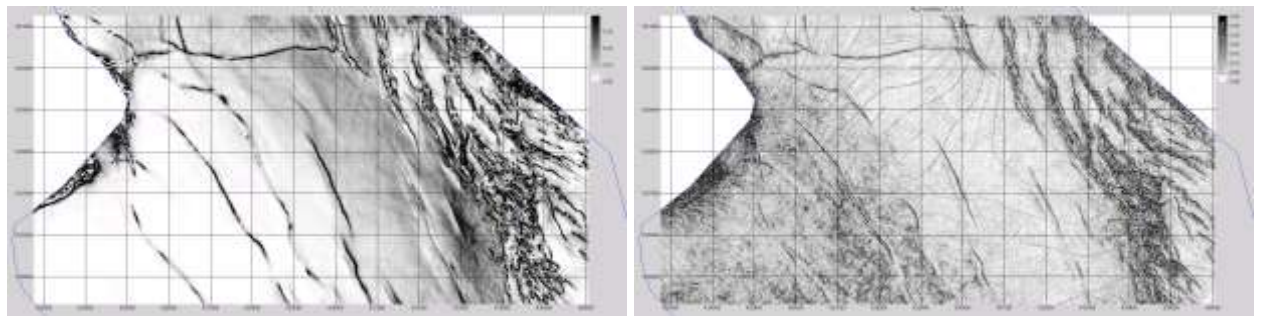


Figure 3. A comparison of the results of fracture zones and hidden faults based on the classical technology (left) and our approach (right) shows a better resolution.

A new technology is proposed for predictive inversion constructions of cubes of elastic, elastic, filtration-capacitance or lithofacial properties based on a new generation of neural networks constructed using fully functional Kolmogorov neurons. To build and train neural networks, a hybrid technology is used, developed on the basis of mathematical techniques set out in the Kolmogorov theorem. To stabilize neural networks, the methods of regularization according to A. N. Tikhonov were used.

The proposed technology uses a combination of neural network techniques and traditional inversion technologies in terms of building low-frequency models based on all available information-well data, structural models, speed cubes, and a seismic field.

Neural network technology of predictive inversion constructions shows a significant increase in the resolution of effective cubes built on the basis of the proposed nonlinear solutions compared to the results based on traditional inversion technologies.

Large-scale parallelization of neural network calculations with effective use of multi-core computing capabilities is possible.

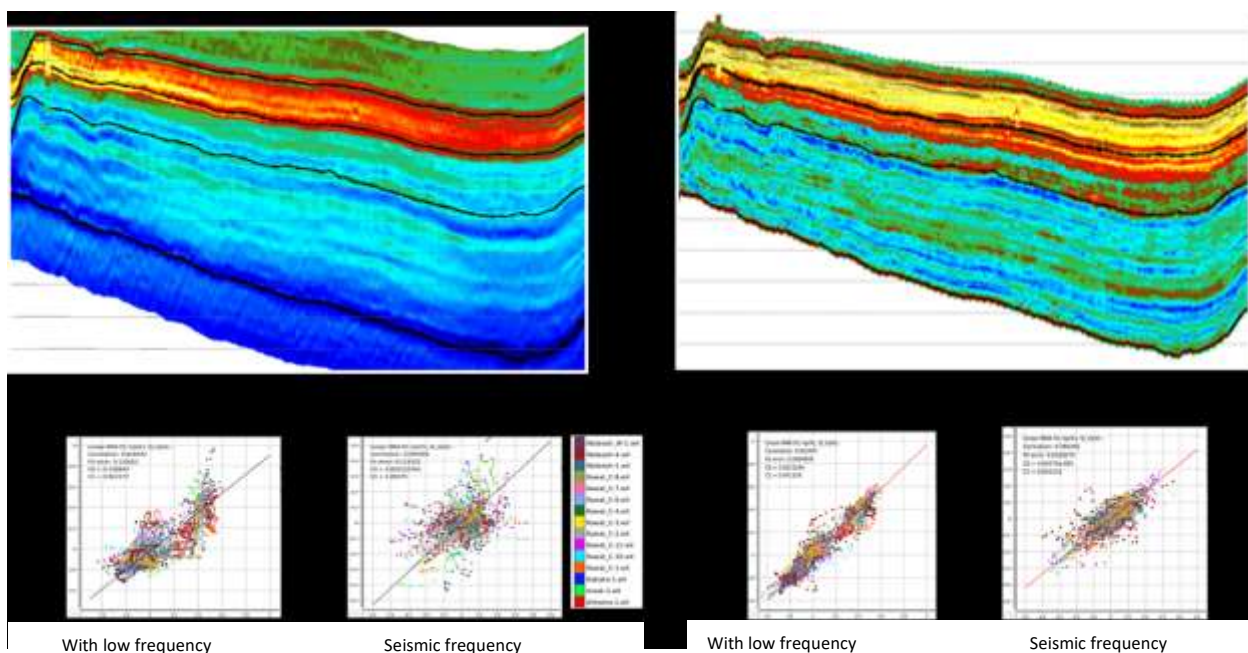


Figure. 4. Comparison of the results of the  $V_p/V_s$  forecast for the classical inversion (on the left) and neural network forecast (right).

Software products of the company IPLAB LLC is the following:

**IP\_Seismic**-standalone package for predictive inversion constructions of 2D (maps) and 3D (cubes)

**IP\_Connector** Petrel plugin for transferring data to / from Petrel

Commercial plug-ins for the Petrel complex:

**IP\_Classification2D, IP\_Classification3D, IP\_Prediction2D, IP\_Prediction3D**

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