1. Introduction

The contribution of production from the unconventional reservoirs like shale and coal is increasing everyday to the energy needs of the World.

These reservoirs have low permeability often act as both the primary source rock as well as the reservoir rocks.

The characterization of these reservoirs is a challenge to the geoscientists in terms of resolution and distribution in an area.

The calibration of well logs (high) resolution with 3D seismic data (low resolution) is a challenge while building the comprehensive geological models.

2. Probabilistic Neural Networks

A PNN is a mathematical interpolation method implemented via a 3-layered feed forward neural network architecture.

The key parameter in the PNN method is the sigma factor, which controls the width of each Gaussian function.

3. Example from Australia

(a) Geology of N-E Australia (b) The black box surrounds the location of the Bowen and Surat basins in Australia. These basins contain more than 70 small commercial oil and gas fields (Korsch, 2004).

Application of PNN comparison of impedance logs

Validation of PNN using predicted and actual Impedance logs

Cross-plot between actual and predicted Imp logs of wells

PNN impedance cross section along well-A

Data slice from the PNN impedance volume

Inputs: Initial Model + Amplitude Envelope + Amplitude Envelope Cosine Phase

Total of 25 sigmas generated range from 0.1 to 3 with global sigma of 0.825

The correlation coefficient is 0.8287 with an average error of 3440.42 [(ft/s)/(g/cc)]

The cross-validation with 5 wells is 0.7012 with an avg error of 4152.33 [(ft/s)/(g/cc)]

PNN based prediction of impedance logs retain more of the dynamic range and high frequency content at the well locations.
Probabilistic Neural Network inversion for characterization of coalbed methane
Malleswar (Moe) Yenugu*, Jeremy C. Fisk and Kurt J. Marfurt, ConocoPhillips School of Geology and Geophysics, University of Oklahoma
Dennis Cooke, Santos Ltd, Australia

4. Predicting Density using PNN

PNN error plot for the attributes
Cross plot for predicted vs actual density at the wells
Computed Density section along the well-A
Application of PNN at the trained wells
Validation at the other wells

5. Conclusions
The main advantages of the probabilistic neural network inversion of seismic data are not only improved the vertical and lateral resolution but it also uses cross-validation as a quality assurance tool.

We used PNN to invert the seismic data to exploit the thin bedded coalbed methane reservoir.

PNN also gave better results when compared to other methods like band-limited, colored, sparse-spike inversion techniques.

6. References

7. Acknowledgements
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