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Interactive Seismic Facies Classification of Stack and AVO Data Using Textural Attributes and Neural Networks

We present an interactive method for volume-based seismic facies mapping using seismic textural attributes and probabilistic neural networks. Textural analysis can quantitatively describe many aspects of the classic seismic facies description preformed by the interpreter. Stratigraphically-steered seismic texture is a quantitative, multi-trace (image-based) attribute that mimics the visual process of the seismic interpreter more effectively than traditional trace-based attribute analyses do. Probabilistic neural networks (PNNs) are parallel implementations of a standard Bayesian classifier that can efficiently perform pattern classification. A primary advantage of the PNN is that it does not require extensive training. In the case of seismic analysis, a reliable seismic facies classification can occur with as little as one example per facies class.

Among the important aspects of our workflow are the interactive training of multiple seismic facies classes simultaneously and the iterative training and quality control between the seismic interpreter and the neural network results prior to full analysis. Our method can, with reliable seismic data, reduce the subjectivity and cycle time of seismic facies analyses yet retain the interpretative quality of the analysis. We apply our technique to near and full stack seismic data, the subject of classic seismic facies. Further, the extension of our techniques to the interpretation of AVO attribute volumes, such as "A+B" (intercept + gradient), demonstrate that their application fo "hybrid" attribute volumes can reduce the non-uniqueness of a seismic facies analysis and significantly increase the predictive power of a seismic facies volume.