The Use of Neural Networks on Well Logs and Seismic Data for Reservoir Characterization

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The methodology to use an artificial neural network to classify two data sets independently, and correlate the two as a means to characterize subsurface lithology is presented. The initial data set for this method was a post stacked seismic amplitude volume, and well log curves from wells with in the seismic volume. A specific zone of interest is the focus of this type of reservoir characterization. The seismic and well data are tied via a synthetic seismogram generated from the *in situ* well log values, and is constrained by check-shot and time to depth values. The Kohonen Self Organizing Map (***K-SOM***) unsupervised neural network was used to classify both seismic attribute volumes and well logs. The ***K-SOM*** algorithm is an *n* dimensional classifying algorithm that requires little *a priori* knowledge. The algorithm allows for a large number of classes and multiple topologies to classify each *n* dimensional sample. Multiple seismic attributes are organized into a large number of classes by the ***K-SOM*** algorithm (i.e. 100 classes). Each seismic sample is given a class based on the *n* dimensional multiple attribute response. The result is a seismic volume of *n* number of classes. Each class however, does not possess a physical meaning, only a class that results from the *n* dimensional multiple attribute response. Multiple well log curves were measured for each well. The multiple well log curves were independently input into the ***K-SOM*** algorithm, using a similar topology as was used for the seismic data. The result is a new well log curve that organized each sample into a class based on the multiple well log attribute response. The large number of classes was then distilled into a smaller number of classes based on physically and acoustically relevant criteria. For example, the 105 classes from 2 wells were grouped into 12 classes based on acoustic impedance, volume shale, and water saturation. The seismic ***K-SOM*** class value was then extracted at each well. The result was a well log curve from the seismic ***K-SOM*** algorithm. The seismic ***K-SOM*** classes were then grouped into a similar number of classes using the same criteria as with the well log values. The ***K-SOM*** seismic volume was then grouped accordingly, resulting in a volume that is calibrated to the wells, and possesses physical characteristics of interest (i.e. pay sand, wet sand, shale, etc). The calibrated ***K-SOM*** volume then can be used for further exploration as well as reservoir development with in a given field. *This methodology was presented and awarded US Patent # 6,957,146 B1, in October of 2005.* *The authors would like to thank Rock Solid Images for consent to publish this material.*

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