**AAPG International Conference**
**Barcelona, Spain**
**September 21-24, 2003**

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**Inferring lithofacies from well logs by applying hybrid Neural Network-Hidden Markov Model classifiers**

Artificial Neural Networks (ANNs) and Hidden Markov Models (HMMs) schemes have proven to be a viable alternative to human interpretation when applied to reservoir characterization. These techniques can allow a geological classification of lithology and facies from well log data. However, pure sample-by-sample ANN systems sometimes infer geologically incorrect vertical lithofacies transitions within a borehole. This arises because ANNs do not consider stratigraphy. In contrast, pure HMM solutions can consider the stratigraphic context, but are unsupervised and cannot be trained on a user-defined lithology.

The problem outlined above can be solved by combining the ANNs with HMMs, which are able to model the vertical sequence of lithofacies as a sequence of chained events with transition probabilities. The vertical lithofacies transition constraints are learned within a HMM lithofacies transition table and a prior lithofacies distribution. The lithofacies transitions are used during the estimation of the classes to optimize the predicted rock class curve and to honor geological prior knowledge.

We will show results from a carbonate reservoir comparing the prediction of lithofacies using the traditional sample-by-sample ANN scheme with the enhanced ANN-HMM scheme. ANN-HMM scheme shows that the stratigraphic ordering of geological facies can be honored and impermissible transitions can be suppressed.