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Pattern Matching in Facies Analysis from Well Log Data—a Hybrid Neural Network-Based Application

Geoscientists, representing many areas of geology, routinely employ recognition of patterns. The application of the concept of uniformitarianism for example, involves a pattern matching process. Although a few neural network-based applications designed to extract lithologic information from wireline logs have been developed, little has been done in the area of facies identification. Our work is particularly concerned with the implementation of an intelligent system meant to assist geologists in the identification of genetic facies from well logs.

The analysis of well logs is primarily a problem of shape recognition. Given the nature of well-log curves however, this analysis becomes similar to the recognition and classification of outline representations of real objects (contours or boundaries). Thus, the automated recognition of simple shapes (primitives) such as bell, funnel, cylinder, etc. is apparently simple. Difficulties however, arise when sequences represented by a suite of primitive shapes have to be isolated and identified. Prior to applying any matching routine, well log curves are divided into segments that represent either primitive shapes (low-level segmentation) or sequences of primitive shapes (high-level segmentation). Once the low-level segmentation is performed, a backpropagation neural network performs pattern matching on pixel-based images with the aim of classifying primitive shapes along the well log. A high-level segmentation algorithm then isolates intervals of several contiguous primitives representing individual facies units. Shape descriptors (mainly of numerical type) characterizing each of the isolated sequences form the input data for a knowledge-based system that performs matching and classification of patterns representing various genetic facies.