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Quantifying the Uncertainty of Elastic Facies Classification

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ABSTRACT

In order to relate known facies to seismic data, we must first determine how those facies map in an elastic parameter domain. Elastic parameters are based on properties that control how elastic waves propagate in the subsurface. While the three basic properties are P and S velocity and density, there are others such as Vp/Vs, Lambda, Mu, Poisson's Ratio, P and S Impedance, that can be derived from the three fundamental properties. It is important to determine what facies can be distinguished in a given two dimensional, elastic domain. It is equally important to quantify how certain or uncertain the facies can be mapped in this domain. Surprisingly this is often not done, or if it is done, it is not done in a consistent manner. There are several ways to measure "accuracy". For instance you can measure what percentage of a certain facies falls within the elastic region that maps to that facies. Another criteria would be to measure how many of the points within a certain region actually belong to the facies associated with that region. It is also important to consider the overall proportions of each facies. Mathematicians try to represent this uncertainty using a "confusion matrix". A confusion matrix is simply a square matrix of numbers showing how the "true" facies map to elastic facies. The problem with the confusion matrix is that it is non-graphical and frankly, confusing. We have developed a facies mapping tool which includes a display with shows the various types of uncertainties in an intuitive, graphical way. Capturing this uncertainty can be done at both log resolution and at seismic resolution. This should be an important part of any feasibility study where seismic is being proposed as a method to determine facies.