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ESTIMATION OF PETROPHYSICAL PROPERTIES AT SEISMIC SCALE USING ARTIFICIAL NEURAL NETWORKS TO BUILD REALISTIC GEOLOGICAL MODELS TO BE USED WHEN INVERTING SEISMIC VELOCITIES

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Abstract *We use supervised Artificial Neural Networks (ANN) to estimate petrophysical properties such as porosity (ϕ), water saturation (Sw), clay volume (Vcl) and non-supervised ANN such as Self-Organizing Maps and other clustering techniques to determine petrophyscial facies (i.e. sands, shales and limestones). The inputs to the ANN are the seismic data, the seismic attributes (computed form the seismic data) and the petrophysical parameters measured at the well-log (ϕ, Sw, Vcl). This process helps to delineate the layers of the Earth and their properties. This is very useful to build a realistic initial velocity model which is iteratively refined to produce a synthetic seismogram (by means of the forward model) to match the observed data. The inversion algorithm that minimizes the misfit between the observed and synthetic full-waveform data improves the P-wave velocity resolution. We apply a non-linear square method for the inversion of the seismic velocities. The forward step is carried out by using a well known technique called the Thomson-Haskell method which helps to simulate plane waves propagating in a multi-layered half-space. We obtained a very good fit for the final results of the synthetic data with respect to the real observed data.*