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Inference of S-wave velocities from well logs using a Neuro-Fuzzy Logic (NFL) approach

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The knowledge of S-wave velocity values is important for a complete characterization and understanding of reservoir rock properties. It could help in determining fracture propagation and also to improve porosity prediction (Cuddy and Glover, 2002). Nevertheless the acquisition of S-wave velocity data is rather expensive; hence, for most reservoirs usually this information is not available. In the present work we applied a hybrid system, that combines Neural Networks and Fuzzy Logic, in order to infer S-wave velocities from porosity (), water saturation (Sw) and shale content (Vsh) logs. The Neuro-Fuzzy Logic (NFL) technique was tested in two wells from the Guafita oil field, Apure Basin, Venezuela. We have trained the system using 50% of the data randomly taken from one of the wells, in order to obtain the inference equations (Takani-Sugeno-Kang (TSK) fuzzy model). Equations using just one of the parameters as input (i.e. [U+F02C], Sw or Vsh), combined by pairs and all together were obtained. These equations were tested in the whole well. The results indicate that the best inference (correlation between inferred and experimental data close to 80%) is obtained when all the parameters are considered as input data. An increase of the equation number of the TSK model, when one or just two parameters are used, does not improve the performance of the NFL. The best set of equations was tested in a nearby well. The results suggest that the large difference in the petrophysical and lithological characteristics between these two wells, avoid a good inference of S-wave velocities in the tested well and allowed us to analyze the limitations of the method.