# A Review of Applications of Artificial Intelligence for Predictive Analysis in Petrophysics - Practical Example Using Symbolic Regression

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Between the venerable Archie formula to the most advanced interpretation workflows, there seems to be a huge gap but petrophysics interpretation is still in the hand of the engineer. However, the physical relations between the various petrophysical parameters are often non-linear and calculating one parameter from others can become very challenging.

Artificial intelligence brings a solution to this challenges and in this paper, we will review common methods using artificial intelligence used in petrophysical analysis but also cutting edge applications which could lead to breakthrough in this domain with the help of example from West African sub-region.

The most common methods are neural networks usually used for predicting missing values such as permeability. Self organizing maps, a class of unsupervised neural networks are also quite common and can be used for any classification purposes.

Other classifications methods are used like hierarchical cluster analysis which can be very useful to see the relationships between items.

However, some methods have not yet been fully adopted by the petrophysical community. Naïve Bayes analysis coupled with the use of nomograms turns as extremely powerful in stochastic prediction. Some methods focus on retrieving underlying classification rules like CN2 rules algorithm or associated rules. The most promising algorithms are based on analogs like genetic or swarm behavior algorithms. Finally, the holy grail of petrophysics analysis is to find the equations between the various variables. This is what symbolic regression is all about: uncover equations and hidden mathematical relationships, more specifically, to identify the simplest mathematical formulas which could describe the underlying mechanisms that produced the data. This domain has been so far reserved to human brain but with the increasing complexity of log data, the help of computer to select the proper regional equation for example is welcome. In this paper, we will demonstrate the power of such an approach using West African log data.