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# A Prediction of the Spatial Distribution of Petrophysical Properties with Bernstein Copula using Seismic Attributes as Secondary Variables

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One of the main objectives of oil reservoir geological modeling is to predict the spatial distribution of petrophysical properties from a few poorly distributed data. To achieve this goal, it is usually necessary to establish some dependence model so that it is possible to predict petrophysical properties of interest through its relationship with seismic attributes that are more densely sampled.

The usual models that are commonly applied to represent the dependencies between petrophysical properties and seismic attributes, are limited to linear or empirical correlations that, due to their simplicity, do not adequately capture the complex dependency relationships that exist between them, underestimating in most of the cases, the variability of the data and their extreme values.

In modern statistics, a systematic and flexible way of modeling complex dependencies is through copulas. Copulas are functions that allow to capture the relation of joint dependency between random variables independently of their individual marginal behavior.

In this work a method for spatial stochastic simulation of petrophysical properties with Bernstein copulas using seismic attributes as secondary variables is applied. The method basically consists of two stages, in the first one a Bernstein copula for dependency structure between the petrophysical properties and seismic attributes is modeling, while in the second one the spatial distribution of petrophysical property is simulated by including the relationship of dependence previously obtained applying the simulated annealing method. The resulting simulation method has among other advantages that it does not asume any probability distribution, it honors the hard data and reproduces the spatial correlation specified by the variogram.

The developed methodology was applied to a real case study for a deep water siliciclastic reservoir, obtaining highly satisfactory and competitive results when compared with regression techniques and traditional geostatistical simulation methods such as the Gaussian sequential simulation.

## References

[1] M. A. Díaz-Viera, A. Erdely, T. Kerdan, R. del-Valle-García and F. Mendoza-Torres, "Bernstein copula-based spatial stochastic simulation of petrophysical properties using seismic attributes as secondary variable", Geostatistics Valencia 2016, Editors: Gómez-Hernández, J.J., Rodrigo-Ilarri, J., Rodrigo-Clavero, M.E., Cassiraga, E., Vargas-Guzmán, J.A. (Eds.), Quantitative Geology and Geostatistics, Vol. 19, ISBN 978-3-319-46818-1, 1057 pages, March 14, 2017.

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