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Joint stochastic modeling using copulas for the dependency between petrophysical properties and seismic attributes at well-logs scale

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The use of petrophysical data and seismic attributes in the oil industry have allowed the characterization of the reservoirs due to their value as predictive tools, for the evaluation of reservoir information is needed the petrophysical parameters such as porosity, permeability, saturation, etc. And the seismic information can infer the physical properties of the rocks on the place (Li & Zhao, 2014).

However, we have problems related to the characterization of these reservoirs due to the uncertainty inherent in the data, in most of the studies conducted in earth sciences is fragmented, we have limited information, it is not statistically representative, or you must resort to nonparametric perspectives to reduce the error in the calculations based on the data obtained and thus, comply with the aspect of continuity.

Due to this condition, stochastic modeling is used, which is an effective tool that allows obtaining the probability distribution of one or several random variables, in this case of the petrophysical data and seismic attributes, so we can manage the uncertainty of the generated model, especially if the spatial distribution is not so good.

Recent work has modeled the dependency relationship between seismic attributes and petrophysical properties using Geostatistical estimation methods such as Cokriging (J.O. Parra, Iturrarán-Viveros, Parra, Jiménez-Andrade, & Carrillo-Calvet, 2015), (J. Parra & Emery, 2013). This approach requires that the model has a strong "linear" dependence between the properties because otherwise their application is not viable, which is uncommon in deposits with complex lithologies. On the other hand, estimation methods such as Cokriging underestimate the dispersions and extreme values that exist in the data, which can be critical for properties such as permeability, where the most important are high values (preferential flow paths) or very low (seals). As alternative can be used stochastic model with general dependences using copulas (Diaz-Viera, et al, 2016).

A copula is a set of functions that combine or couple the function of multivariate distribution with their marginal distribution functions and whose marginal distribution function is uniform (Nelsen, 1999). Then, we can represent the dependency structures between one or several petrophysical properties with one or several seismic attributes, this represents a very important advantage, since for the copulas it is not required that the dependence between the petrophysical properties and seismic attributes be of some type specific (Díaz-Viera, Erdely, Kerdan, del-Valle-García, & Mendoza-Torres, 2017).

The application of the method is shown in a case study of deep marine reservoir at well-log scale.

References

-Cooper, J. C. (2002). Flexible Functional Form Estimation of Willingness to Pay Using Dichotomous Choice Data. Journal of Environmental Economics and Management, 43(2), 267–279. https://doi.org/10.1006/jeem.2000.1177

-Embrechts, P., Lindskog, F., & Mcneil, A. (2003). Ch.8 Modelling dependence with copulas and applications to risk management. Handbook of Heavy Tailed Distributions in Finance, 329–384. https://doi.org/10.1016/B978-044450896-6.50010-8

-Jaworski, P., Durante, F., Härdle, W. K., & Rychlik, T. (2010). Copula Theory and Its Applications: Proceedings of the Workshop Held in Warsaw, 25-26 September 2009. Springer —Berlin Heidelberg. Retrieved from https://books.google.com/books?id=vX233feaA6MC-

-Joe, H. (2014). Dependence Modeling with Copulas. Taylor & Francis. Retrieved from https://books.google.com/books?id=09ThAwAAQBA
-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
-Nelsen, R. B. (2013). An Introduction to Copulas. Springer Series in Statistics (Vol. 53). https://doi.org/10.1017/CBO9781107415324.004
-Sancetta, A., & Satchell, S. (2004). the Bernstein Copula and Its Applications To Modeling and Approximations of Multivariate Distributions. Econometric Theory, 20(3), 535–562#NST–The Bernstein copula and its applic. https://doi.org/10.1017/S026646660420305X

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