



# SBGf Conference

18-20 NOV | Rio'25

**Sustainable Geophysics at the Service of Society**

**In a world of energy diversification and social justice**

**Submission code: XK656X79B7**

See this and other abstracts on our website: <https://home.sbgf.org.br/Pages/resumos.php>

## **Estimation of Petrophysical Properties in Oil Reservoirs using Supervised Machine Learning Models.**

**Larissa Carla De Oliveira (Universidade Federal Fluminense - UFF), Leonardo Miquelutti (Universidade Federal Fluminense - UFF), Mario Martins Ramos (Universidade Federal Fluminense - UFF), Victor Matheus Joaquim Salgado Campos (Universidade Federal Fluminense - UFF)**

## Estimation of Petrophysical Properties in Oil Reservoirs using Supervised Machine Learning Models.

Copyright 2025, SBGf - Sociedade Brasileira de Geofísica/Society of Exploration Geophysicist.  
This paper was prepared for presentation during the 19<sup>th</sup> International Congress of the Brazilian Geophysical Society held in Rio de Janeiro, Brazil, 18-20 November 2025. Contents of this paper were reviewed by the Technical Committee of the 19<sup>th</sup> International Congress of the Brazilian Geophysical Society and do not necessarily represent any position of the SBGf, its officers or members. Electronic reproduction or storage of any part of this paper for commercial purposes without the written consent of the Brazilian Geophysical Society is prohibited.

### Abstract

The accurate determination of petrophysical properties in oil and gas reservoirs plays a fundamental role in the industry, directly influencing reserve evaluation and production planning. This study proposes an innovative approach to estimate porosity and permeability in Namorado Formation reservoirs (siliciclastic reservoirs) in the Campos Basin, RJ, using supervised machine learning models.

Initially, real well data was utilized, integrating basic geophysical logs (Transit Time - DT, Bulk Density - RHOB, Gamma Ray - GR, Neutron Porosity - NPHI, and Resistivity - RES) with laboratory data (porosity, permeability, and grain density). These data were carefully selected from 17 wells with core samples, where 15 were used in the main dataset and 2 were reserved as a "blind data set" for independent validation.

Rigorous data preprocessing was performed, followed by Exploratory Data Analysis (EDA) to identify and select the most relevant features (independent variables) capable of optimizing the prediction of porosity and permeability (dependent variables). This step was crucial to ensure the robustness and representativeness of the training data.

The data was then used to train various machine learning regression models, including K-Nearest Neighbors (KNN), Random Forest, Decision Tree, and Multiple Linear Regression. Cross-validation was employed to optimize each model's hyperparameters, ensuring their generalization and performance. The models' performance was statistically evaluated, utilizing metrics such as the coefficient of determination ( $R^2$ ), Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE), focusing on their ability to make accurate predictions on unseen data, demonstrating the validity of the proposed methodology.

The obtained results suggest that the proposed methodology offers a robust and efficient tool for reservoir characterization, with significant potential to optimize reserve evaluation, assist in drilling and production planning, and reduce uncertainties in oil fields. The practical application of these machine learning-based models can lead to more informed decisions and more effective strategies in the exploration and development of siliciclastic reservoirs.