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Application of Machine Learning techniques to improve the interpretation of seismic data.

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Introduction

The use of machine learning (ML) techniques has proven promising for improving seismic data interpretation, especially in onshore sedimentary basins in Brazil, such as the Amazon and Solimões basins. The revitalization of onshore exploration driven by the ANP, combined with advances in data science and Big Data, enables optimized visualization of geological structures, supporting new hydrocarbon discoveries and extending the productive life of mature fields, with both technical and socioeconomic impacts.

Method and Theory

The research began with a comprehensive literature review to understand the state of the art in applying machine learning to seismic data. Public 2D seismic datasets were then acquired from the ANP's REATE platform. These datasets were reprocessed using OpendTect software to improve quality and adapt them to project needs. Based on the data characteristics, the most suitable ML technique will be selected to assist interpretation. The reprocessed data will then be analyzed to identify hidden patterns and features. The method aims to go beyond traditional interpretation limits. Results will be evaluated to validate the effectiveness of the ML approach. The process emphasizes practical application and replicability. All steps aim to enhance data clarity for hydrocarbon exploration.

Results and Conclusions

Initial results confirm the potential of machine learning to improve seismic interpretation. After reprocessing data from wells in the Amazon and Solimões basins using OpendTect, relevant information such as seismic trace density, energy at depth, and lithological profiles was extracted. This provided a solid foundation for the future application of ML models. Figures generated revealed travel times of P and S waves through different lithologies, which are critical for training ML algorithms. These insights allow the identification of geological features not easily detected by traditional methods. The selected ML approach will be applied to reveal subtle subsurface patterns, contributing to more accurate reservoir characterization. Overall, the results point toward a more efficient and data-driven exploration process. Validation of the chosen ML model will ensure its reliability in future seismic studies.

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