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## Ensemble Machine Learning: An Untapped Modeling Paradigm for Petroleum Reservoir Characterization

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### Abstract:

The successful applications of the conventional Computational Intelligence (CI) techniques and Hybrid Intelligent Systems (HIS) in petroleum reservoir characterization have been reported. However, these techniques are limited in their capability to handle a single hypothesis of a problem at a time. The major objective of the reservoir characterization process is to produce models that are robust enough to help improve the accuracy of the predictions of reservoir properties for use in full-field and large-scale simulation models. Research in CI continues to evolve new techniques and paradigms to meet this noble objective. It has been shown that there are uncertainties in the reservoir characterization process as well as the optimal choice of CI/HIS models parameters. The main challenge is to develop models that are capable of handling multiple hypotheses to reduce the uncertainties thereby ensuring optimal solutions. The ensemble machine learning paradigm has been established to tackle this challenge. This new machine learning technology has not been adequately explored in handling some of the petroleum engineering challenges. This paper rigorously reviews the concept of ensemble learning paradigm, presents successful applications outside petroleum engineering and the geosciences, discusses a few successful

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