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An Autonomous Adaptive Meta Model (AAMM) for Real-Time Oil Rate Prediction and Optimization in Dynamic Environments

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This study introduces a groundbreaking Autonomous Adaptive Meta Model (AAMM) as an innovative solution to meet the escalating demand for precise and reliable oil prediction rates over a 20-year horizon. By leveraging machine learning algorithms and edge computing techniques, the AAMM dynamically adapts and optimizes its prediction model in real-time, responding to changing oilfield conditions. It integrates Extremely Gradient Boosting (XGBoost), Random Forest (RF), Bidirectional Long Short-Term Memory (BiLSTM), and Artificial Neural Network (ANN) to autonomously learn and adjust its parameters based on real-time feedback from the oilfield data. This adaptive capability enhances the predictive accuracy and reliability in dynamic and complex oilfield environments. Additionally, the AAMM incorporates edge-computing technologies to process and analyze data directly at the source to reduce latency and expedite decision-making. Utilizing a comprehensive dataset comprising historical oil production data, geological information, well characteristics, and other relevant factors, the AAMM remains up-to-date with the latest information through real-time integration of streaming data. Validation and test on real-world oilfield data demonstrate the AAMM's superiority over the traditional standalone models and static meta models. It's autonomous adaptation is proved crucial in maintaining accuracy midst changing conditions, providing a robust solution for oil production optimization.

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