Evaluation of Hybrid Prediction Models for Accurate Rate of Penetration (ROP) Prediction in Drilling Operations

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Abstract

The precise prediction of the rate of penetration (ROP) is of utmost importance for optimizing drilling operations and minimizing costs while increasing efficiency. However, the complex and nonlinear nature of the drilling process can pose significant challenges in achieving accurate ROP predictions. To address this challenge, multiple hybrid prediction models have been developed, and their accuracy in ROP prediction has been compared. To accomplish this objective, we created four different hybrid models, including Artificial Neural Network – Genetic Algorithm (ANN-GA), Artificial Neural Network-Particle Swarm Optimization (ANN-PSO), Support Vector Regression – Genetic Algorithms (SVR-GA), and SVR-PSO to estimate ROP. These models were trained and tested using drilling data collected from surface sensors, including drilling parameters such as weight on bit (WOB), revolutions per minute (RPM), flow rate, ROP, and drilling torque. The hybrid models were able to accurately estimate the ROP for the given drilling conditions by utilizing these parameters. Furthermore, the models' accuracy and effectiveness were assessed by training and testing them using the collected drilling data. Upon evaluating the performance of the four algorithms, we concluded that all four models demonstrated an acceptable level of accuracy in predicting the rate of penetration (ROP). The acceptable level of accuracy achieved by the models can be attributed to the hybrid nature of the algorithms, which combine the strengths of two or more methods, such as artificial neural networks and genetic algorithms, to improve prediction accuracy.