Operations Optimization and Performance Analytics Powered by Machine Learning and AI

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Abstract

Objectives
A typical Drilling Rig is equipped with hundreds of sensors which transmit data in real time (or near real time) which is then monitored by Drilling Engineers, Geologists and others in Real time Operation Centers to ensure a smooth operation and compliance to the plan. The drilling crews also report every day on the various aspects of the operation and a typical day/shift at a Rig starts with the analysis of the previous day's reports. Extracting and interpreting information from morning reports and correlating it with the high frequency sensors data is complex and time consuming which makes it difficult to apply the learnings to control/improve/optimize the ongoing operation. This often results in inefficient operations with increased time, money and carbon footprint and can further cause safety incidents and accidents leading to the loss of lives.

Procedures
If the high frequency sensors data can be combined with the morning reports in time, it can highlight any potential problems/risks in advance and gives an opportunity to the Drilling crew to proactively prevent and/or mitigate the same. However, the large volume and frequency of data and the presence of multiple companies playing different roles on the Rig makes this task challenging, more so with the manual approaches often used currently. This case study will focus on a Smart performance analytics and optimization workflow enabled by an intelligent fusion of drilling sensors data with the daily operations reports and the BHA data, powered using a seamless integration of Drilling Domain knowledge with Machine Learning and AI techniques. It uses the learnings from historical data encapsulated into novel AI models which are then applied to real-time data so that the drilling engineers visualize, analyze, predict and optimize the various KPIs and operational parameters and further investigate potential areas of improvements to minimize ILT, NPT and carbon footprint of the operations.

Results
The automated approach to collect, consolidate, and process the data at scale and decode the knowledge hidden in this data using Machine Learning techniques, provides novel and timely insights to optimize the whole process. Additionally, the practical steps required to build, deploy and sustain such end-to-end hybrid domain & ML workflows which the end users can use reliably will be discussed.

Conclusions
Smart Operations Optimization system using Machine Learning techniques to process and learn from both real time drilling data and historical data in a rapid and timely fashion leads to a vastly efficient operation saving Rig time and costs, preventing and minimizing safety incidents and reducing the carbon footprint of the operations. It also allows the learnings from various ongoing operations to be applied to other concurrent ongoing operations as well as to optimize the future jobs.