Novel Integrated Machine Learning Rock Physics Workflow

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Abstract

Objectives: Conventional well log processing and interpretation methods that rely on physics-based equations were always the go to methods. These methods have the disadvantage of being subjective and inconsistent since the user input plays a major role on the output. With the technology transformation and the industry development, machine Learning techniques have been recently introduced and widely used in different industries. A new Class based Machine Learning workflow was developed in a borehole analysis software in combination with a state-of-the-art data science platform with capabilities that strengthened the integration of Machine Learning, data science, and well log data in optimizing the turnaround time, user biasness, and inconsistent results. Procedures: Geomechanics workflow was optimized using machine learning approaches to deliver consistent rock properties yielding to complete Mechanical Earth Model. Open Hole log data and conventionally computed rock properties were used for training generating learning models per class. Consequently, for new data introduced, the workflow computes the probabilities of each data point belonging to the existing classes, then applying the learnt models per class. Additionally, as more information is introduced, the model refreshes itself by incorporating new data for further accuracy. This approach eliminates the need for large training data each time as it stores more information in the model. It also removes the subjectivity and the user biasness, which results in consistent outcome each time. The data science platform's capabilities of integrating workflows and customizing APIs was very helpful in this process. It allowed us to fully automate multiple steps such as automated log processing, and data driven complete Open Hole logs when needed. In addition to automated log correction for effects has provided the ability to run this process on multiple wells at the same time. Results: This process greatly and confidently optimizes the turnaround time spent through the conventional workflows. As well as it automates the repetitive data preparation process that takes place every time. And finally, it provides robust and consistent output each time by reducing the user input that creates biasness in the results. Conclusion: The comparison between both workflows and the integration between them allowed us to discover not only the integration between old and new workflows, but also the merging between technical domains like Petrophysics, Geomechanics and Production. This led to widening our horizon of exploring more integrated, automated, time saving, sustainable options with endless deployment fields.