Commentary

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Review of Machine Learning Studies for Drilling Applications

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Description

The most expensive step in upstream operations, drilling is crucial to the development of oil and gas resources. Numerous machine learning studies have been conducted in a variety of drilling applications, particularly in the last two decades, thanks to the increased availability of data and the rapid development of artificial intelligence (AI) technology. During drilling, service companies routinely record a significant amount of high-frequency drilling data. Numerous wells also have high-resolution petrophysical logs recorded. It has a lot of potential to combine drilling and petrophysical data, and some of its applications include predicting rock properties, avoiding problems during drilling, and enhancing drilling operations. The information driven models in view of AI techniques can offer impressive benefits over customary logical or mathematical models like adaptable model data sources, better expectation exactness, and capacity to track down secret examples. Nevertheless, there has not yet been a comprehensive examination of machine learning for drilling applications.

AI: A Subset of Machine Learning

Similar to those in a drilling textbook, the reviewed studies are divided into five main fields: 1) fluids for drilling; 2) hydraulics for drilling; 3) the dynamics of drilling; 4) issues with drilling; and (5) various applications for drilling. It is important to keep in mind that the purpose of this paper is not to cover every machine learning study that has been done on drilling applications; rather, it is to systematically review studies that have been done in the same field, identify similarities between them, and talk about possible future research. Some important inputs are presented for studies with too many inputs. Studies that use algorithms that aren't part of machine learning, like fuzzy logic, expert systems, etc. are not included. Additionally, due to space constraints, only the best outcomes may be presented if multiple machine learning algorithms are utilized. AI is a subset of machine learning. It is defined as using experience and data to automate a particular task by using computer algorithms. To put it another way, machine learning makes predictions for the future by learning patterns and drawing inferences from the data. Natural language processing (NLP), online advertising, and medical diagnostics are just a few of the many areas it has advanced. One important part of the drilling system is drilling fluid, which is also known as drilling mud. It is used to transport cuttings, cool and lubricate the drill bit, control the subsurface pressure to keep the borehole stable, and so on. The most common types of drilling fluid are Oil-Based Mud (OBM) and Water-Based Mud (WBM). In particular, the OBM contains more than half oil while the WBM contains approximately 80 percent water. As a result, their fluid properties differ. The term "drilling hydraulics" refers to the circulation of drilling fluid throughout the wellbore. As a result, its primary focus is on the drilled borehole's fluid mechanics.

Brief Examples of How Drilling Data can be used by Machine Learning Applications

In the borehole, high wellbore pressure is to be expected, particularly in some scenarios involving deep drilling. It is important to know about drilling hydraulics because they are related to the following applications: 1) a pressure that is safe for drilling (to avoid borehole collapse or tensile fracturing); 2) choosing the size of the bit nozzle; 3) pressure from the surge and swab during drilling. The process of drilling a well to reach the desired formations is dynamic. Numerous surface and downhole parameters, such as ROP, torque, RPM, and Weight-On-Bit (WOB), are routinely measured and recorded during drilling. Drillers can use these parameters to keep an eye on the drilling and make decisions in real time to improve drilling efficiency or spot anomalies. During drilling, numerous issues like stuck pipes, lost circulation, poorly controlled wells, and so on can arise. This part presents AI research on these boring issues. Predicting these issues with machine learning can potentially save a significant amount of time and money. In addition to the usual drilling locations discussed in the preceding sections, there are some novel applications that are worth mentioning. This section gives a few brief examples of how drilling data can be used by machine learning applications to get useful information, such as for data mining, finding sweet spots, and determining drilling activities. High-frequency drilling data (1 Hz drilling data is available), which is unavailable in reservoir or production studies, can be generated by drilling. Joined with high-goal petrophysical logs, incredible assets have been made to uncover rock properties and further develop boring exercises. From fundamental drilling fluid properties to complex data mining with NPL, it is evident that machine learning has been utilized in almost every aspect of drilling.

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