

## PROBLEM: STUCK PIPE EVENTS PREVENTING SUCCESSFUL WELL COMPLETION

Even in carefully planned wells, exploration and production (E&P) companies face numerous challenges when drilling in high-cost, high-risk environments. During drilling operations, operators may encounter complications related to stuck pipe, in which the drill string cannot be pulled out of a borehole. Whether it's wellbore instability, differential pressure, key seating, or other related problems, stuck pipe events can bring entire drilling operations to a halt until the drill string is freed. It's considered one of the most costly drilling problems in the industry, accounting for billions of dollars annually and nearly half of the total well cost. It's also a major contributor to non-productive time (NPT), which continues to comprise 20-25% of annual rig operating time. To minimize downtime and maximize drilling optimization, it is critical to successfully predict and mitigate when a stuck pipe event may occur.

In the past, physics-based modeling has been used to identify stuck pipe events. While this approach can provide a good foundation for using surface parameters to model torque and drag, physics models are unable to flag leading indicators of drilling anomalies such as stuck pipe, with enough advance forewarning. However, with emerging technologies like machine learning, E&P companies can gain better overall control of their operations to ensure they are always up and running. By making use of data from their operations, drilling operators can switch to a predictive analytics and machine learning-based modeling approach, allowing them to predict and prevent anomalies leading to stuck pipe events.

## SOLUTION: PREDICTIVE ANALYTICS AND MACHINE LEARNING-BASED MODELING

Predictive analytics apply machine learning algorithms to historical sensor data from assets used in drilling operations to build a baseline model of what normal operations look like. This normal behavior model is then used to analyze asset sensor data in real time, identifying and flagging any values that deviate from the established norm. These deviating values indicate anomalous behaviors that are likely to precede an impending stuck pipe event. Not only does this enable operators to monitor the overall health of the drilling program, it also gives drilling engineers and crews ample time to proactively address and prevent the impending stuck pipe event from occurring.

SparkCognition, a leading industrial AI company, offers a robust predictive solution that helps drilling operators identify and prevent stuck pipe events. The SparkCognition™ Drilling Advisor predictive analytics product for anomaly management uses sophisticated algorithms to predict asset and process failures, reduce maintenance costs, and improve system efficiencies. Unlike traditional prognostics methods, the Drilling Advisor harnesses the power of predictive analytics to enable operators to mitigate drilling malfunctions before drilling gets disrupted, delivering millions of dollars in cost savings and operational efficiency improvements to operators. While drilling

can be done without machine learning, this technology alleviates many of the difficulties associated with current drilling challenges.

### Addressing speed and scale

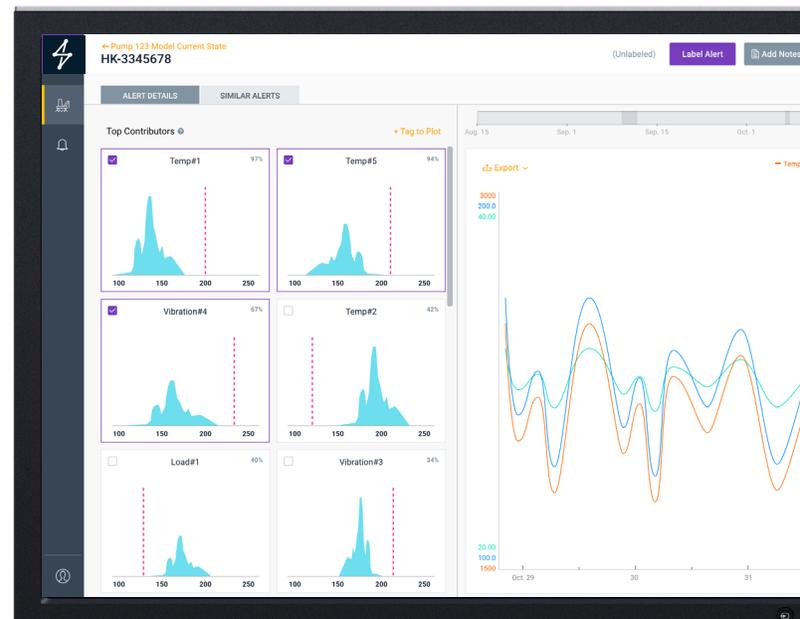
Predictive analytics, in enabling drilling optimization, analyzes the data available from disparate sources. Machine learning unlocks insights in this data quickly, efficiently, and accurately. SparkCognition Drilling Advisor analyzes large volumes of data, identifies anomalous behavior, and understands causal relationships using advanced unsupervised learning techniques. This system provides drilling operators with faster insights into drilling malfunctions and stuck pipe events.

### Alleviating the cost and burden of model upkeep

Another problem that model machine learning addresses is the need to maintain models over time. With traditional predictive models that don't employ AI and machine learning, a change in even a single variable necessitates reworking the entire model. Machine learning models avert these problems because they dynamically learn and maintain themselves by adjusting to any component or asset and adapting to changes over time. This is critical for drilling operators working and monitoring operations in high-risk environments.

### Overcoming the lack of sufficient, structured data

Not all drilling systems have the sensors to provide the types and amounts of data that predictive analytics requires. Machine learning alone can't solve this dilemma, but ML-powered natural language processing (NLP) can. Whereas most software is only able to analyze structured data, or data containing numbers or categories, machine learning-powered NLP solutions, like the SparkCognition Deep NLP platform, can decipher and use unstructured data as well—be it operations logs, daily reports, service manuals, notes,





## CASE STUDY: PREDICTIVE ANALYTICS AND MACHINE LEARNING-BASED MODELING FOR STUCK PIPE

### PROBLEM

A large drilling operator in the Middle East needed to decrease the impending threat of stuck pipe events in their operations.

### SOLUTION

Machine learning models were deployed across seven drilling wells in different fields.

### RESULTS

SparkCognition Drilling Advisor predicted 79% of overall drilling anomalies, including stuck pipe events, with up to six-hours' advance notice, saving the company millions of dollars in drilling costs and downtime.

*“SparkCognition’s ability to deliver reliable, AI-based predictive analytics helps the people working with and on the equipment to not only know what is happening, but more importantly, what is going to happen, and when. This is a game changer. Not only does this improve plant safety, but it increases productivity by reducing unplanned downtime.”*

*-Doug Smith, CEO, Texmark Chemicals, Inc.*

or any other information source used in drilling operations. With NLP, predictive models can use sources of data beyond sensors to help predict impending stuck pipe events.

### Proactively identifying corrective actions

Predictive analytics, while invaluable, are only part of the value that machine learning delivers. By incorporating NLP technology, drilling solutions are able to ingest historical records, service manuals, and past courses of action taken by subject matter experts and drilling personnel. Using this bank of information, drilling operators can speed up drilling processes by listing possible next steps and suggesting corrective measures to prevent stuck pipe events.

### RESULTS

By detecting anomalies that predict stuck pipe events in advance, operators are able to not only better plan for or even avert these expensive events, they can also mitigate drilling malfunctions and optimize drilling operations. In past deployments on offshore oil and gas drilling rigs, SparkCognition has increased the ability to identify unexpected events by 75%, and more than doubled previous lead times. While drilling operations are often filled with uncertainty, predictive analytics and machine learning-based modeling enable drilling operators to run safer, more predictable operations.

### ABOUT SPARKCOGNITION

SparkCognition’s award-winning AI solutions allow organizations to predict future outcomes, optimize processes, and prevent cyberattacks. We partner with the world’s industry leaders to analyze, optimize, and learn from data, augment human intelligence, drive profitable growth, and achieve operational excellence. Our patented AI, machine learning, and natural language technologies lead the industry in innovation and accelerate digital transformation. Our solutions allow organizations to solve critical challenges—prevent unexpected downtime, maximize asset performance, optimize prices, and ensure worker safety while avoiding zero-day cyberattacks on essential IT and OT infrastructure.

To learn more about how SparkCognition’s AI solutions can unlock the power in your data, visit [www.sparkcognition.com](http://www.sparkcognition.com).