SparkPredict® by SparkCognition

Improving Offshore Production with AI Based Analytics

PROBLEM

Recurring failures in production subcomponents resulted in >10% downtime and **millions of dollars of lost production**.

PROJECT

Predict impending failures **at least 4 days in advance** using a machine learning model.

RESULTS

SparkPredict® successfully identified 75% of production-impacting events **an average of 8 days in advance.**

The oil supply chain starts at the production well, and the complexities of offshore operations necessitate thoughtful innovation. McKinsey estimates that only 77% of full petroleum production potential is being realized, which represents an annual $60B gap* between maximum capacity and actual offshore production.
Leading oil companies know that the path to harvest this opportunity exists through data and analytics. They are actively exploring how best to apply machine learning methods to maximize platform availability and optimize maintenance processes that lead to profits, stability, and insulation from the next industry downturn.

THE EVALUATION

One major oil platform operator faced significant bottlenecks in their fluid separation process with a direct impact to production. Annually, it observes 5 to 10 unique failure events which result in an estimated 10-15% downtime and up to $8M in lost production per event. 80% of these failure events are attributed to three subcomponents—one glycol system and two export compressors—each of which is instrumented differently and operating at different stages in their lifecycle.

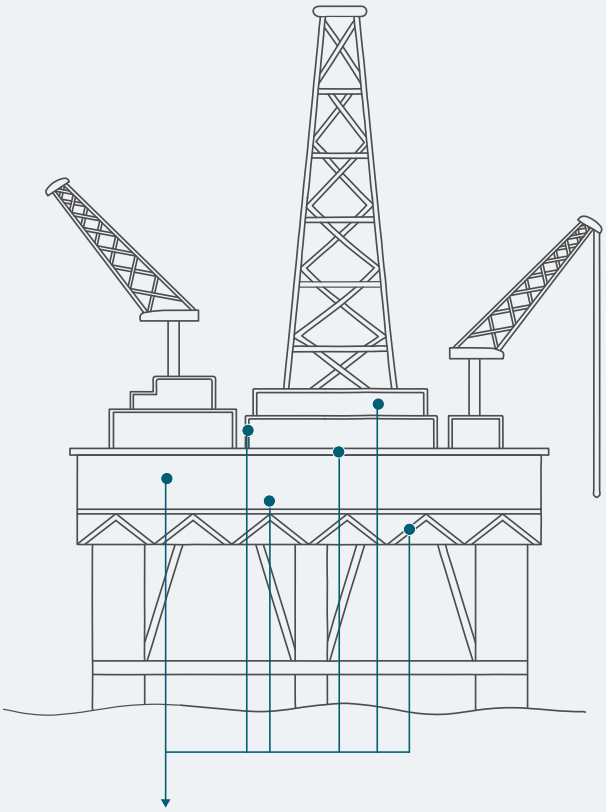
The operator was already measuring sensor data and had attempted to use regression-based analytics to predict failures in these subcomponents previously. However, the rarity of similar, repeating failures (necessary to train a high-performing regression model) meant their operations team was constantly observing false positives that further complicated the maintenance process. In effect, the plant engineers relied on their domain expertise to try to predict impending failures, but still experienced multiple unplanned downtime events each year. This operator turned to SparkCognition™ to implement a machine learning approach that could predict failures with more accuracy and less noise than their regression model.

THE PROJECT

In May of 2017, the operator shared two years of blind sensor data from their gas system with SparkCognition to build the initial model. In order to keep the results as unbiased as possible, the operator purposely did not offer any additional insights about operating states or observed events during the time period.

Their main objectives were to:

- See if SparkPredict® could identify failures in this data with at least 4 days of advance notice
- Improve visibility into the timelines and key contributing features for the known failures



Applying unsupervised learning to detect anomalies for an offshore gas production system

- *Monitoring over 600 tags to anticipate production loss events*

Contact SparkCognition today at info@sparkcognition.com

SparkPredict® data scientists started with thousands of tags, including pressure, vibration, and temperature, and reduced these to about 130 useful tags per subsystem. This sample was further reduced via dimensionality reduction techniques to remove noise in the data. This high quality data set was used to build unsupervised learning models for each subcomponent that identify new, previously unknown operating states. With this information, a SME can predict and diagnose impending failures and prioritize work orders.

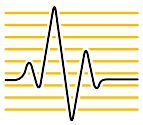
THE RESULTS

Within three months, SparkCognition had completed the unsupervised models that characterized the system behavior over the two years of given data. These are being used in production with notable successes:

With these promising results, the platform operator is expanding predictive analytics to other platforms in the Gulf of Mexico and North Sea in a phased approach over the next five years.

Accurate Detection of Operating States:

Using only the provided, unlabeled data, SparkPredict precisely identified the signatures that define the various operating states of the asset. This includes being able to detect subtle irregularities, for example, periods of personnel training, which are not readily observable. Identifying these operating states adds to the credibility of the model and accuracy of clusters.

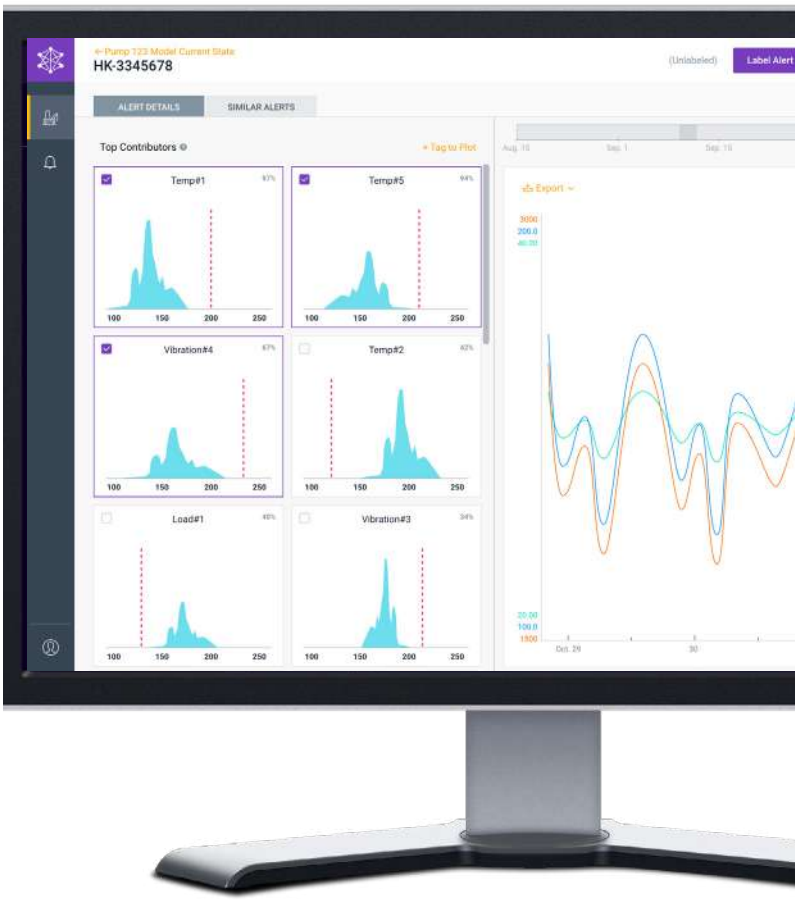


Improved Advance Failure Warnings:

During validation, SparkPredict accurately detected new anomalous clusters in blind data which mapped to unique, known failure events. The new clusters appeared with an average of 8 days' advance notice, exceeding the expectations set for the project.

Explainable Insights:

Accompanying these failure warnings are additional insights used by the engineering team to diagnose root cause and streamline repairs. For example, SparkPredict surfaced a prioritized list of data features pointing to issues in the glycol reboiler heater, disconnect switch, and export compressor.



ABOUT SPARKCOGNITION™

SparkCognition builds leading artificial intelligence solutions to advance the most important interests of society. We help customers analyze complex data, empower decision making, and transform human and industrial productivity with award-winning machine learning technology and expert teams focused on defense, IIoT, and finance. For more information, visit www.sparkcognition.com

REFERENCES

https://www.mckinsey.com/industries/oil-and-gas/our-insights/why-oil-and-gas-companies-must-act-on-analytics

*30% of production is offshore per:
http://www.oilscams.org/offshore-vs-onshore-oil-drilling

Contact SparkCognition today at info@sparkcognition.com