# SNS COLLEGE OF TECHNOLOGY

**Coimbatore-35**

**An Autonomous Institution**

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## DEPARTMENT OF INFORMATION TECHNOLOGY

19CSE303 – ARTIFICIAL INTELLIGENCE

III YEAR IV SEM

UNIT V – **LEARNING**

TOPIC : Offshore oil & Gas threat detection Case study -5

## Who is ARC Advisory Group?

- Market intelligent and strategic advisory services firm focused on automation, both process and discrete as well as hybrid
- Global with offices in Boston, Houston, Austin, Europe, Japan, China, India, and Singapore
- Everything from basic market research reports to strategic consulting, system selection, automation strategy development
- We work closely with both owner operators/end users, global service providers and automation and technology suppliers
- Intelligence Partner to Industry Since 1986

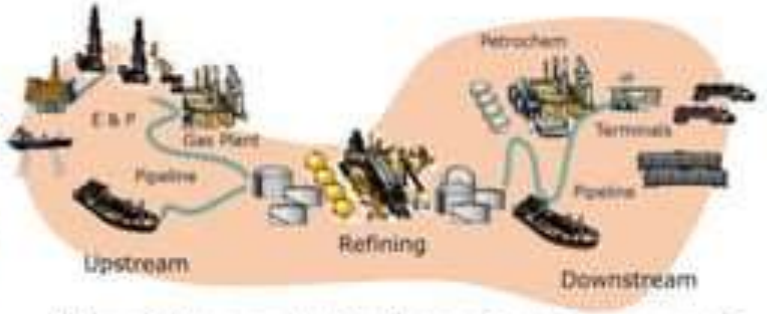
## Impact of Low Oil Prices and Near Term Future Outlook

- Upstream Capex down ≥25% in 2016 due to continued pressure on oil prices. Layoffs >250,000 and counting; bankruptcies >130 and counting
- Seeing growing number (~70) of offshore, subsea, and LNG projects delayed, some even cancelled. EIA forecasting reduction in US production of >700,000 bbl/d in 2016
- "Lower for longer" environment forcing companies **to assess new technologies** that drive down costs, increase production, improve asset uptime and/or improve collaboration
- ARC believes the total business value that new technologies such as IIoT, AI/machine learning and others can bring oil & gas lies in the **many billions of dollars**

# Innovation in Oil & Gas:
## The Digital Transformation of an Industry

Disruptive Technologies


Aging systems, business models and work processes




**Step Change to Business Outcomes and Competitiveness**

- Connected Supply Chain
- Connected Enterprise
- Connected Operations
- Connected Products

# Industrial Internet of Things
## ARC's Definition

*Industrial Internet of Things (IIoT):*

**The transformation of industrial products, operations, value chains, and aftermarket services …**

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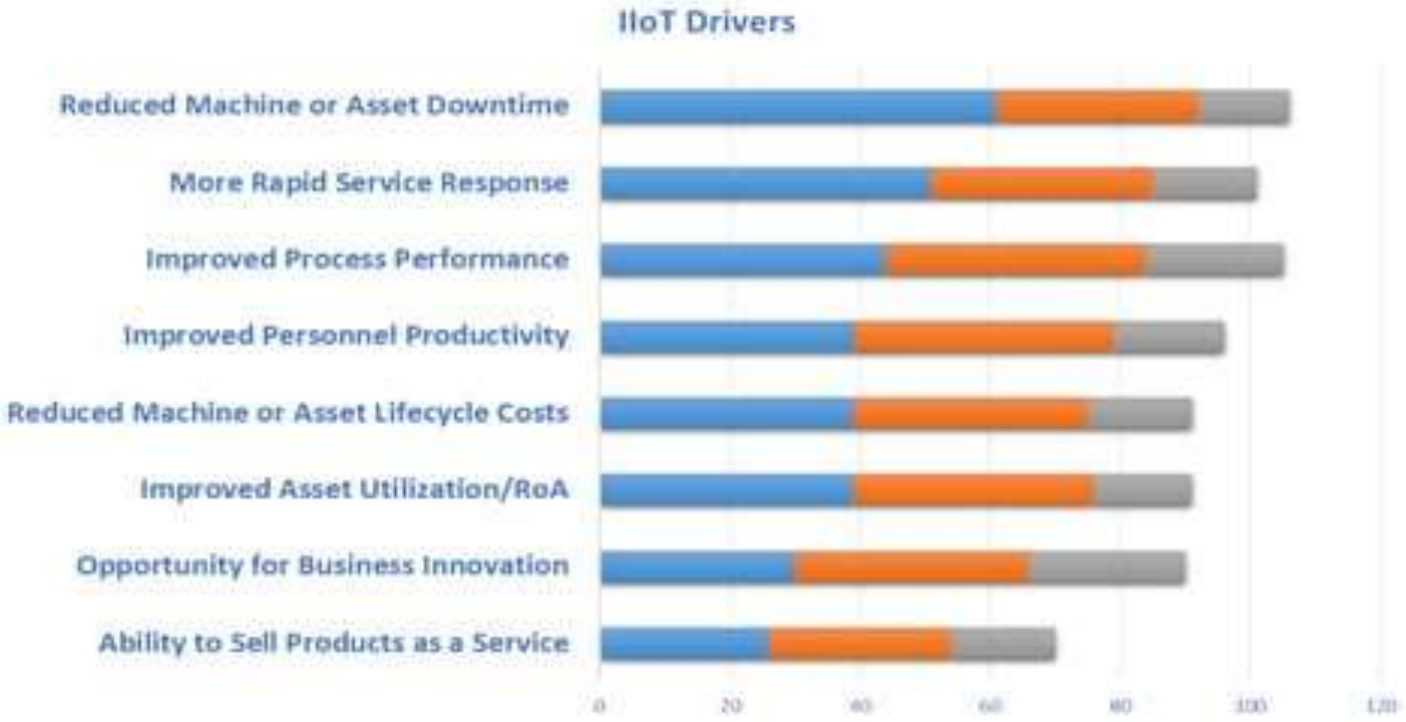
**… that is enabled through the expanded use of sensors, digitization, networking, and information systems.**

# Main Components of Industrial IoT

- Intelligent Assets, Devices, Products or Machines
  - Technology-enhanced assets with sensors, processors, memory, communications
  - Digital Twin
  - Self Powered
  - Potentially self-aware and autonomous
- Data Communications & Infrastructure
  - Cloud-based
  - Distributed Computing
  - Massive Parallel computing and In Memory
- Analytics and Software
  - Asset Optimization and System Optimization
  - Descriptive, Predictive, and Prescriptive Analytics
  - "Intelligent Information" when and where people need
- People, Processes, and Systems

# IIoT Drivers

## Reduced Downtime and Faster Service are Top Drivers Now



# IIoT Value Proposition for Asset Owners

## Some Applications Benefitting from AI/Machine Learning

- Drilling Optimization – closed loop drilling, increase ROP, etc.
- Well monitoring and optimization
  - Well spacing optimization
  - "Frac zone" multi-pad well drilling visibility
  - Field/Reservoir level optimization
- Production planning and monitoring:
  - Artificial lift (pump) optimization
  - Compressor and turbine optimization

# Some Applications Benefitting from AI/Machine Learning

- Asset Integrity Management/Asset Performance Management:
  - Leverage data and analytics to extend asset lifecycle and lower TCO
  - IIoT can enhance/automate maintenance while resource constrained
- Supply chain management/optimization
  - Visibility into supply chain and ecosystems
  - Transportation and logistics optimization

# Common Approaches

| Category | Key Features |
| --- | --- |
| Business Intelligence (BI) | • Centralized analysis<br>• Uniform data collection<br>• Average visualizations |
| Rules Based Modeling | • Fixed rules must account for all types of transactions in all types of conditions; lead to rule proliferation and management challenges<br>• May be good measures for some simple situations, but average (or even sub-par) measures for others |
| Statistical Analysis | • Identifies deviations from "normal"<br>• More a platform for model building and data scientists than an alert generating solution<br>• Not automated to account for changing conditions |
| Physics Based Modeling | • Asset-type specific<br>• Model building is a very hands-on process involving laboratory experiments<br>• Domain experts apply these physical models universally to assets |

# Cognitive Analytics is inspired by the way the **human brain** operates:

Processes Information

Draws Conclusions

Codifies Instincts & Experience into Learning

## Benefits of Cognitive Analytics

Enables machines to penetrate the complexity of data to **identify associations**

Presents powerful techniques to handle **unstructured data**

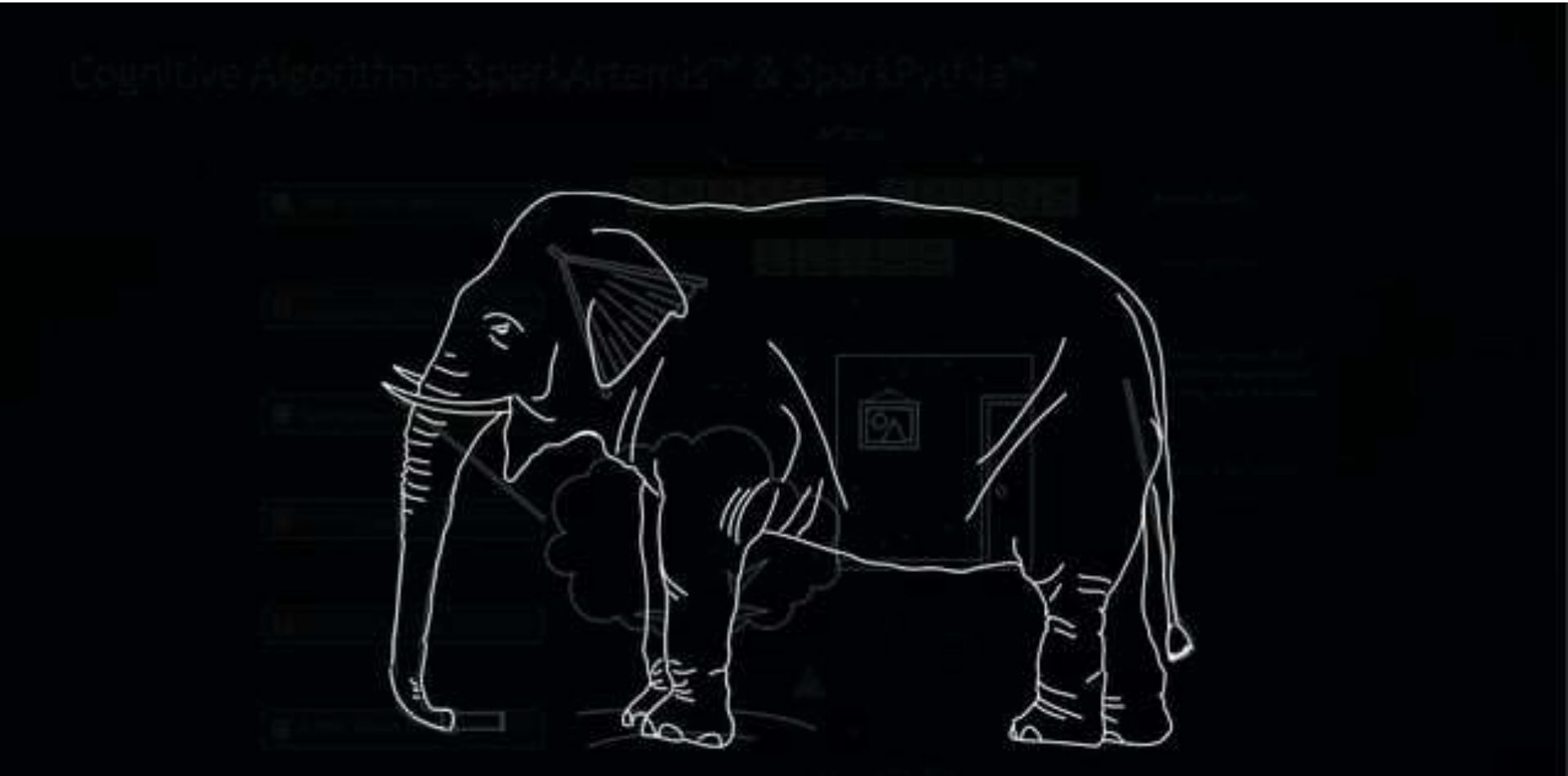
**Continuously learns** not only from previous insights, but also for new data entering the system

Provides **NLP support** to enable human to machine and machine to machine communication

**Does not require rules,** instead relies on **hypothesis generation** using multiple data sets

# Cognitive Algorithms-SparkArtemis™ & SparkPythia™

# Cognitive Algorithms-SparkPythia™



# Machine Learning & Cognitive Analytics can deliver several benefits

## Scalability

Automated model building capability does not require manual model building of every asset/component

## Adaptability

Adapts to new and changing conditions automatically

## Higher Accuracy

Automated feature enrichment and extraction that can deliver better insights and higher accuracy

## Security

Out-of-band, symptom-sensitive approach beyond IT security

## External Factors

Can incorporate external factors (e.g. environmental issues such as birds & bats)

## In-context Remediation

Advisor that understands natural language to help technical teams

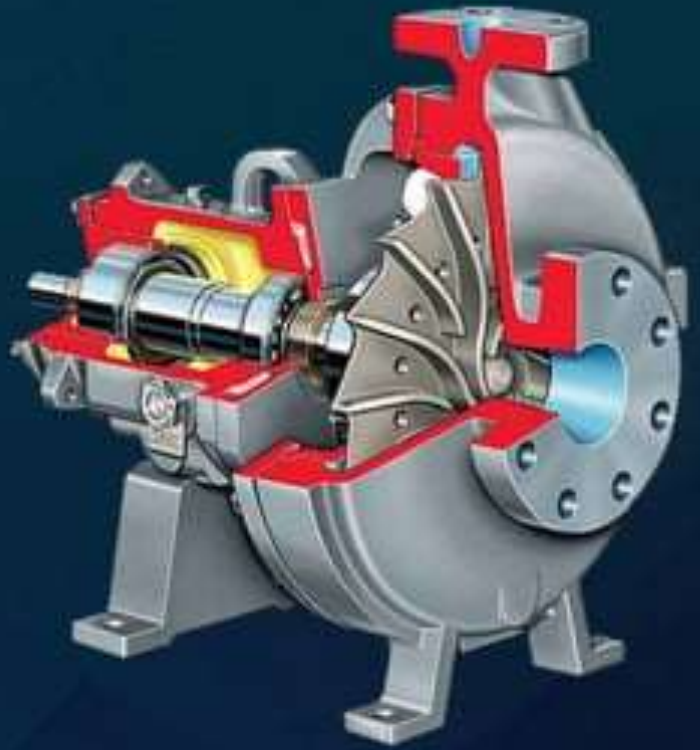
FLOWSERVE Use Case

# About FlowServe


- Largest Pump Manufacturer in the United States
- Market Cap of $6.22B
- Founded in 1790 (26 years after America)
- Over 18,000 employees

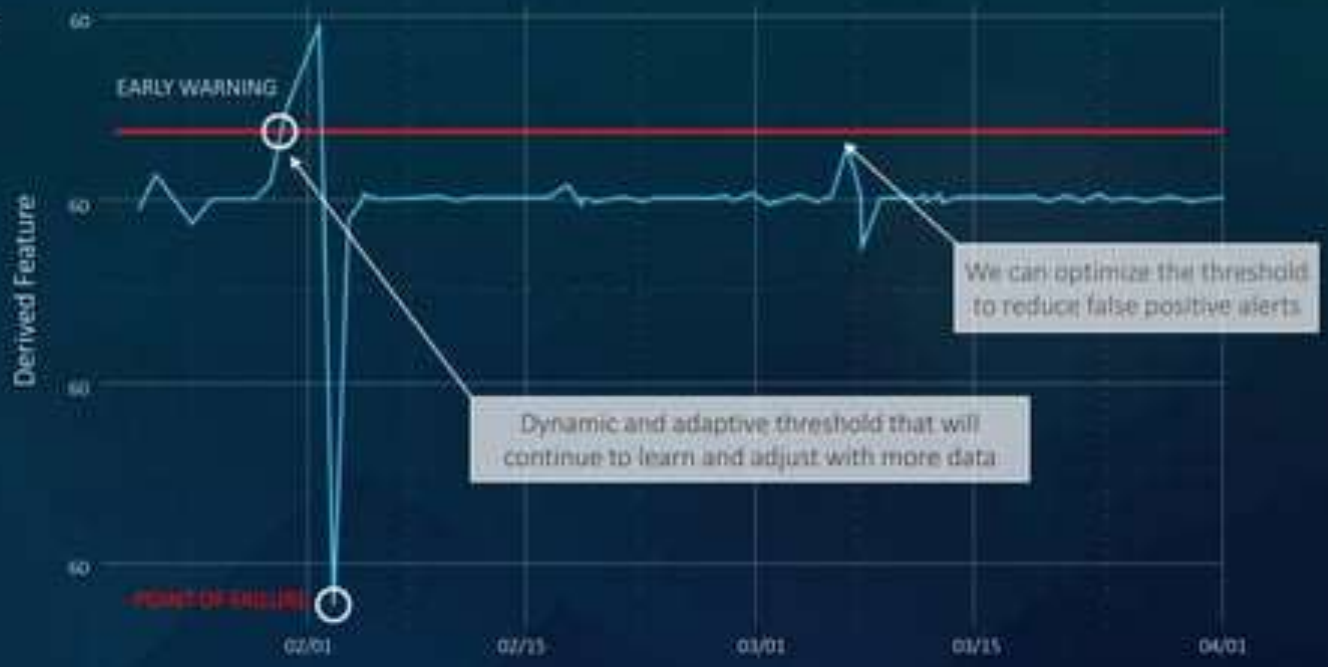
# Pump Monitoring Application Trial

- Desired Results
  - Predict failures with 1 day advanced notice
  - Zero or minimal false positives
  - "Dummy Light" output
- Data Provided
  - 3 years of historical data
  - Pre-filtered FFT data from production assets
  - 10 second time resolution
  - Major component failure logs



# Trial Outcome

- Predicted failures 5 to 6 days in advance (20x improvement)
- Previous method predicted only 3-6 hours in advance
- Completed with less than 2% false positive rates



# Next Steps

- Deploy on Azure cloud instances
- Pending results of expanded sites, committed to enterprise wide roll-out
- Explore predictive models for other major components
- Explore adjacent Intelligent Documentation problem

# Questions

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FLOWSERVE