



ENGINEER
NEXT
NIDays

The logo is centered on a blue gradient background. It features the words "ENGINEER" and "NEXT" in a large, white, sans-serif font, stacked vertically. A yellow graphic element, resembling a stylized 'X' or a folded ribbon, is positioned between the two words. Below "NEXT" is a white rectangular box containing the text "NIDays" in a smaller, white, sans-serif font. The entire logo is tilted at an angle. To the left of the logo, there are several diagonal stripes in shades of green, orange, and red. To the right, there are several diagonal stripes in various shades of blue.

Extraire des informations utiles à partir de données provenant de l'Internet industriel

What Information Do You Care About?

| Priorities: 1-3 years | Aviation | Wind | Power Generation | Power Distribution | Oil & Gas | Rail | Manufacturing | Mining |
|---|----------|------|------------------|--------------------|-----------|------|---------------|--------|
| Increase profitability through improved resource management | 61% | 71% | 56% | 59% | 56% | 67% | 58% | 55% |
| Gain a competitive edge | 58% | 55% | 53% | 69% | 50% | 50% | 76% | 48% |
| Improve environmental safety and emissions | 39% | 61% | 50% | 75% | 59% | 43% | 52% | 58% |
| Gain insights into customer behaviors, preferences and trends | 58% | 61% | 47% | 56% | 38% | 60% | 70% | 39% |
| Gain insights into equipment health for improved maintenance | 55% | 48% | 34% | 56% | 47% | 73% | 67% | 39% |
| Drive operational improvements and workforce efficiencies | 42% | 48% | 41% | 72% | 44% | 53% | 55% | 64% |
| Create new business opportunities with new revenue streams | 45% | 61% | 34% | 53% | 47% | 40% | 52% | 58% |
| Meet or exceed regulatory compliance | 32% | 39% | 41% | 63% | 50% | 33% | 39% | 39% |

Source – [Industrial Internet Insights](#) report by Accenture

Today's Topics

- Analytics 101
- Best practices for predictive analytics
- Case study

Analytics 101

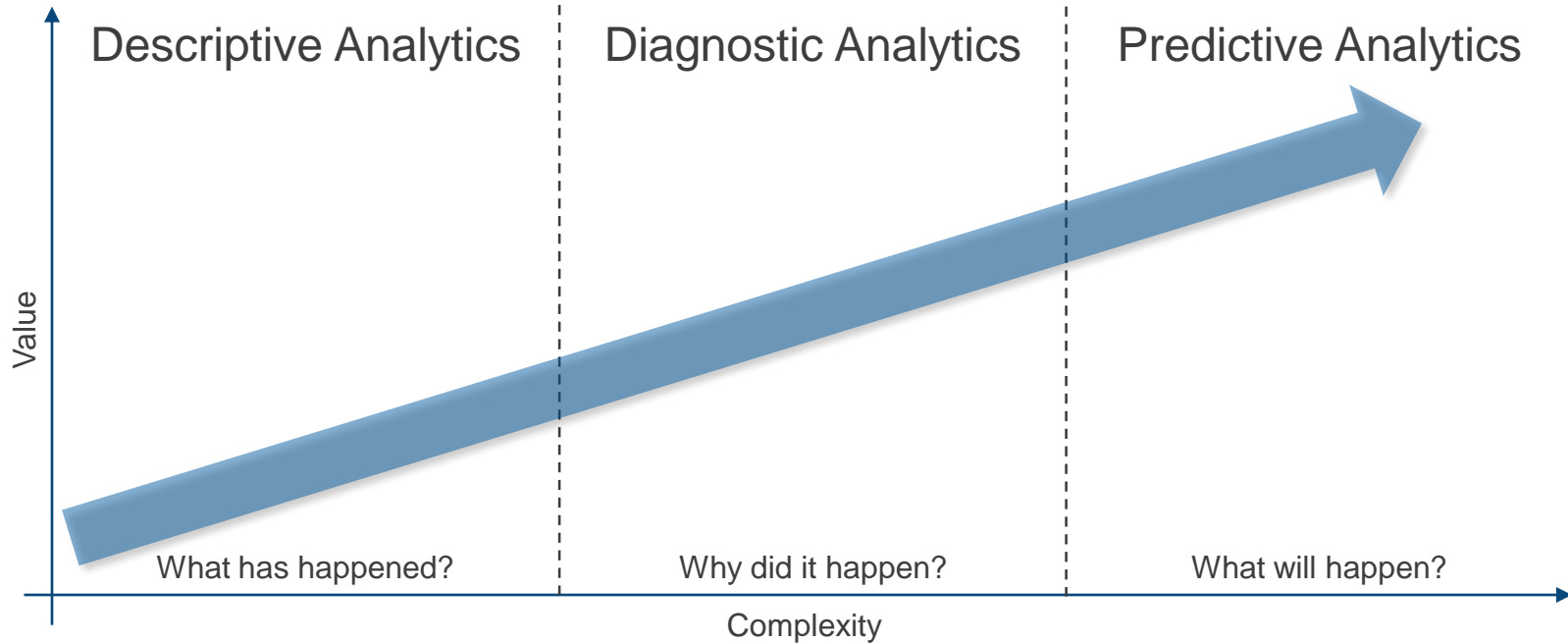
Challenge With Industrial Analytics



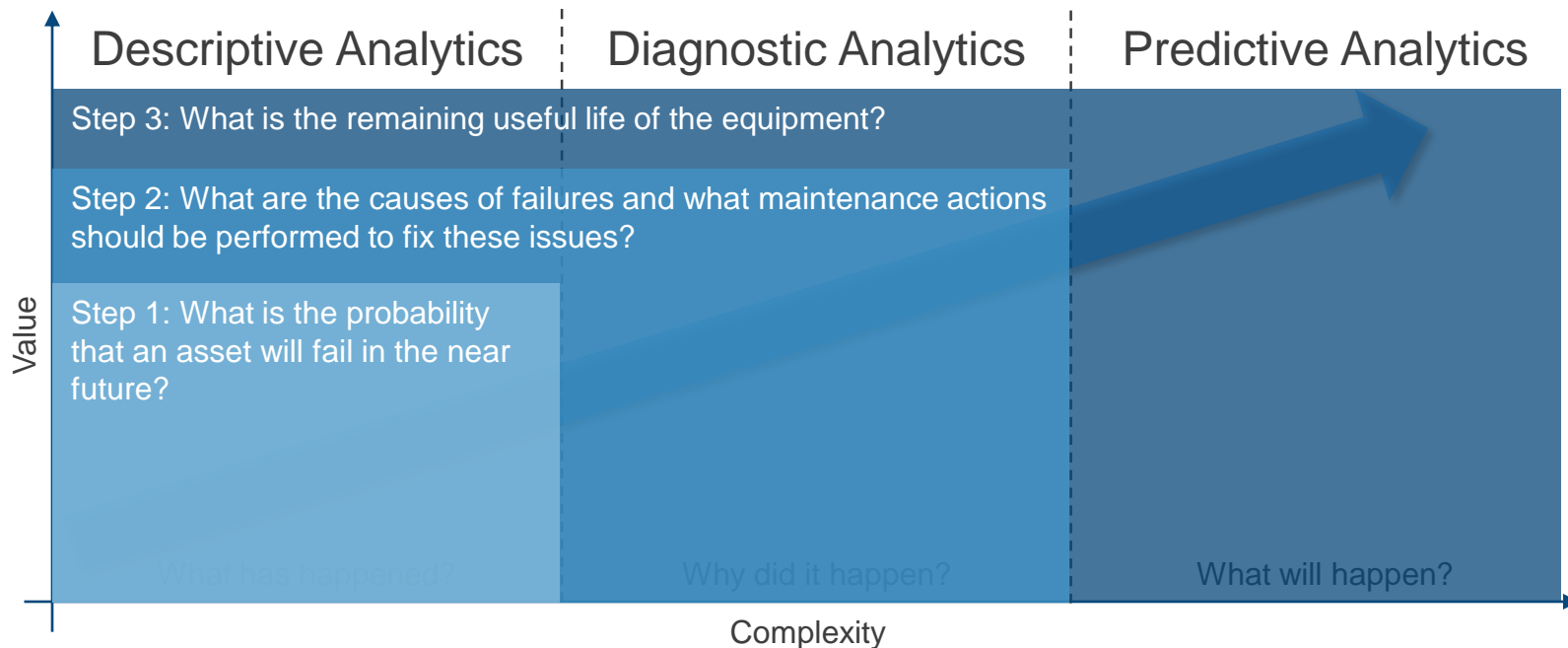
Machine Learning Key Words

- Large amount of data
- Mathematical optimization
- Meaningful hidden patterns

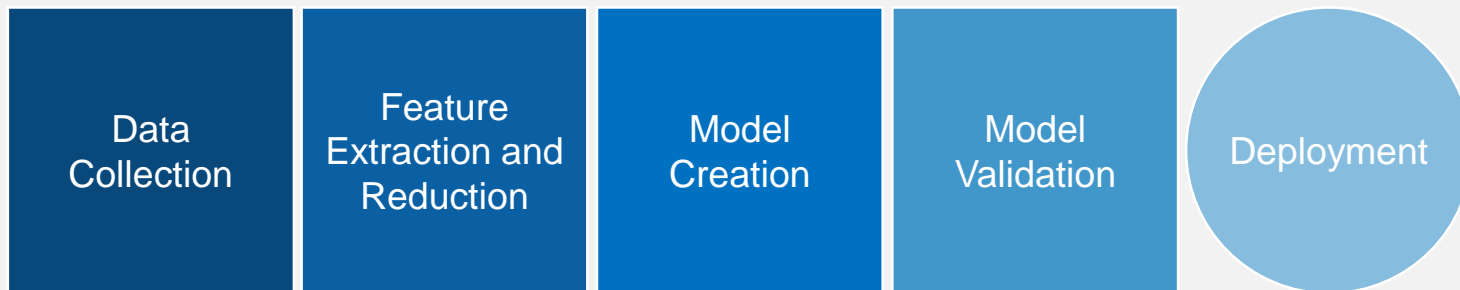
Condition Monitoring: Maximizing Uptime and Reducing Maintenance Costs



Condition Monitoring: Maximizing Uptime and Reducing Maintenance Costs

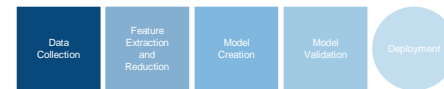


Industrial Analytics Process

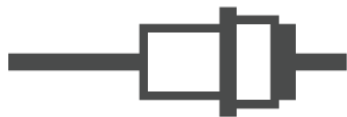


Best Practices for Predictive Analytics

What Data Sources Do I Need?



Sensors



Industrial I/O Modules
(C Series)

Controllers



Industrial Protocols
(OPC UA, Modbus, etc.)

Data Storage



NI InsightCM™, Database
Connectivity Toolkit, AWS
Toolkit

Getting the Right Mix of Data Is Challenging

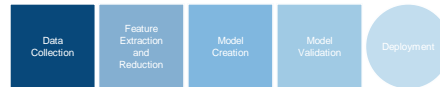
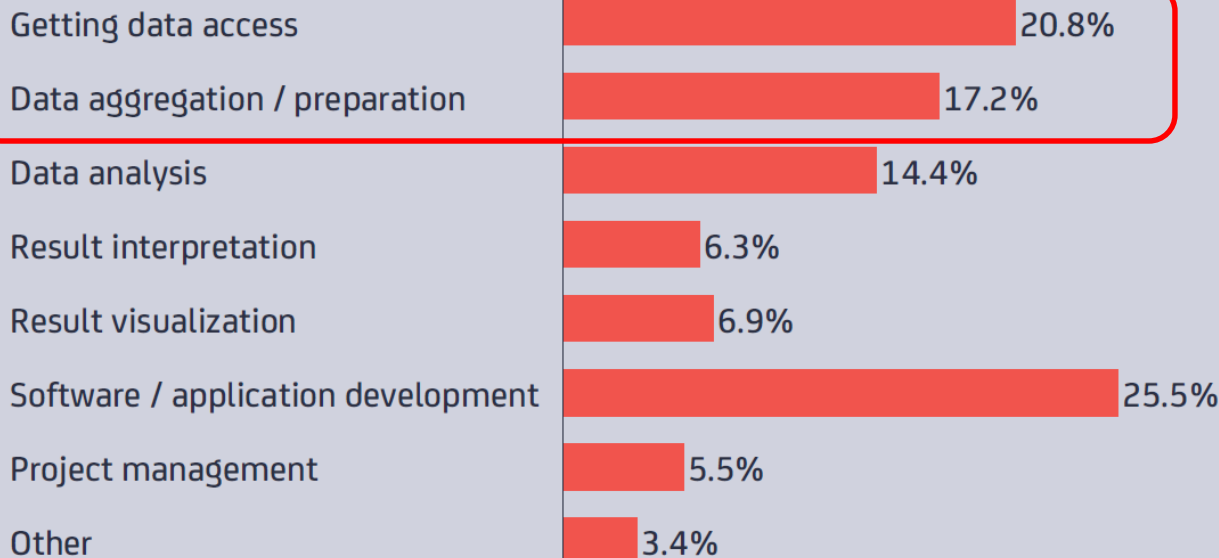


EXHIBIT 18: Most Industrial Analytics related costs in software and application development

Question: *What percentage (%) of the industrial data analytics project budget goes to the following?*

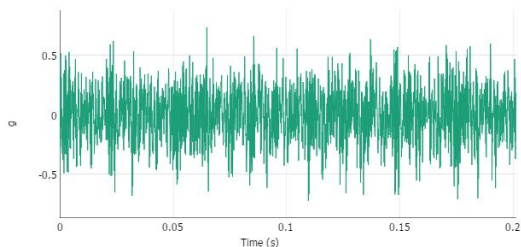


Source – [industrial analytics 2016/2017 - Digital Analytics Association Germany](#)

Calculating Features in the NI Platform

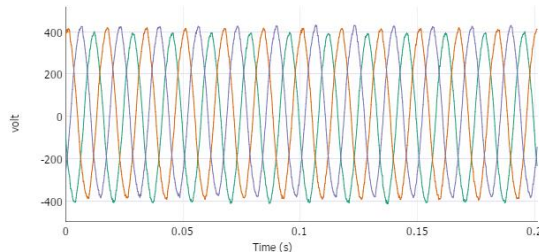


Thousands of Built-In Functions



Vibration

Sound and Vibration Measurement Suite



Electric Power

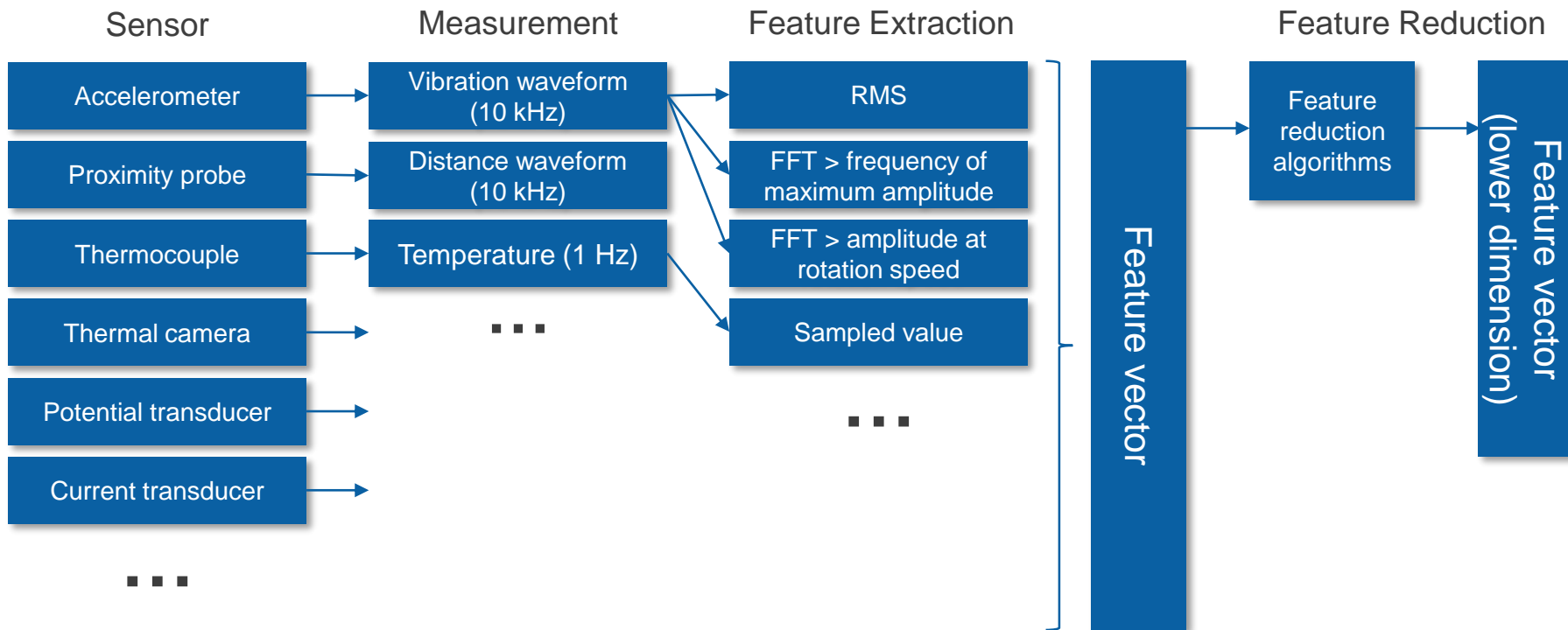
Electrical Power Toolkit



Imaging

Vision Development Module

Feature Engineering: Reduce Dimensions



Machine Learning Algorithm Types



Discover
Structure

Clustering

Separate data points
into similar groups

Predict
Categories

Classification

Identify categories new
information belongs in

Find
Unusual
Values

Anomaly Detection

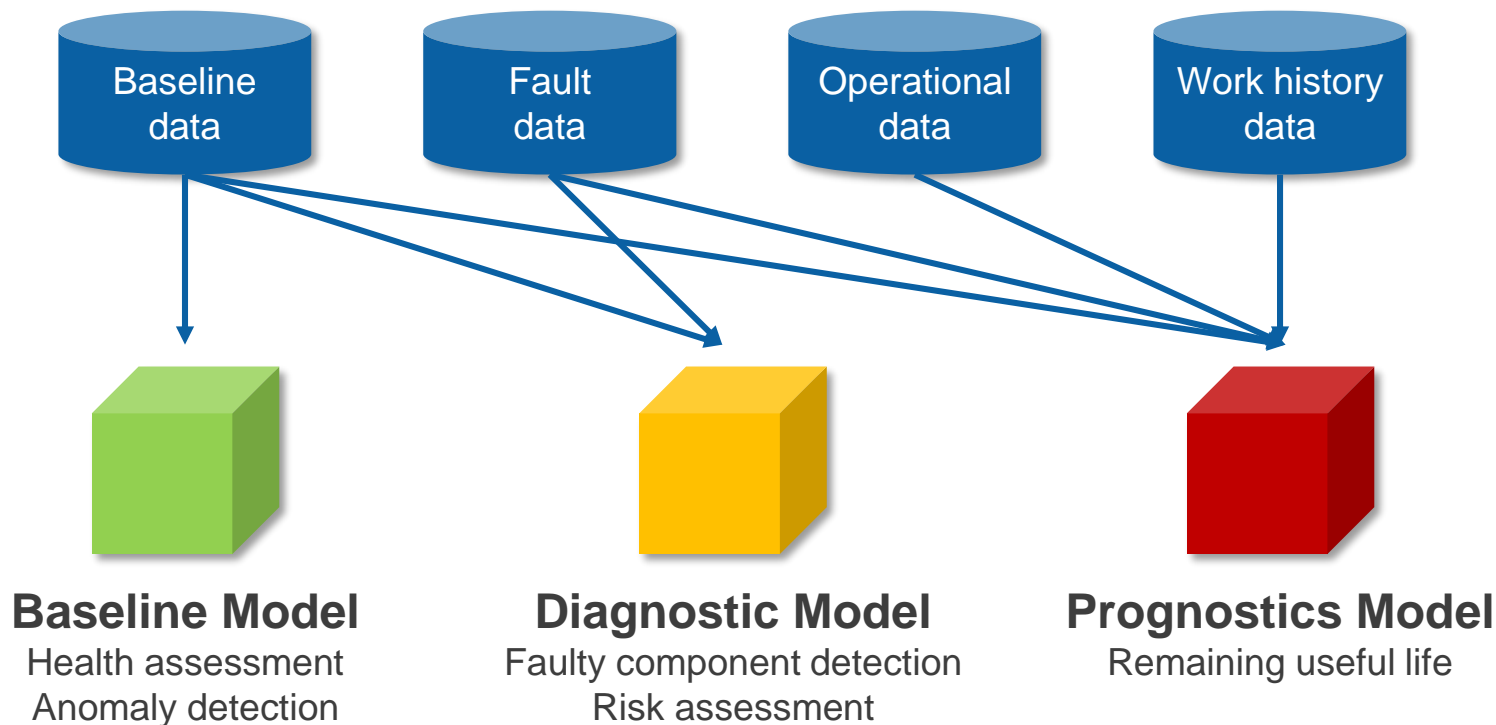
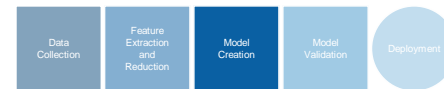
Identify and predict
unusual data points

Predict
Values

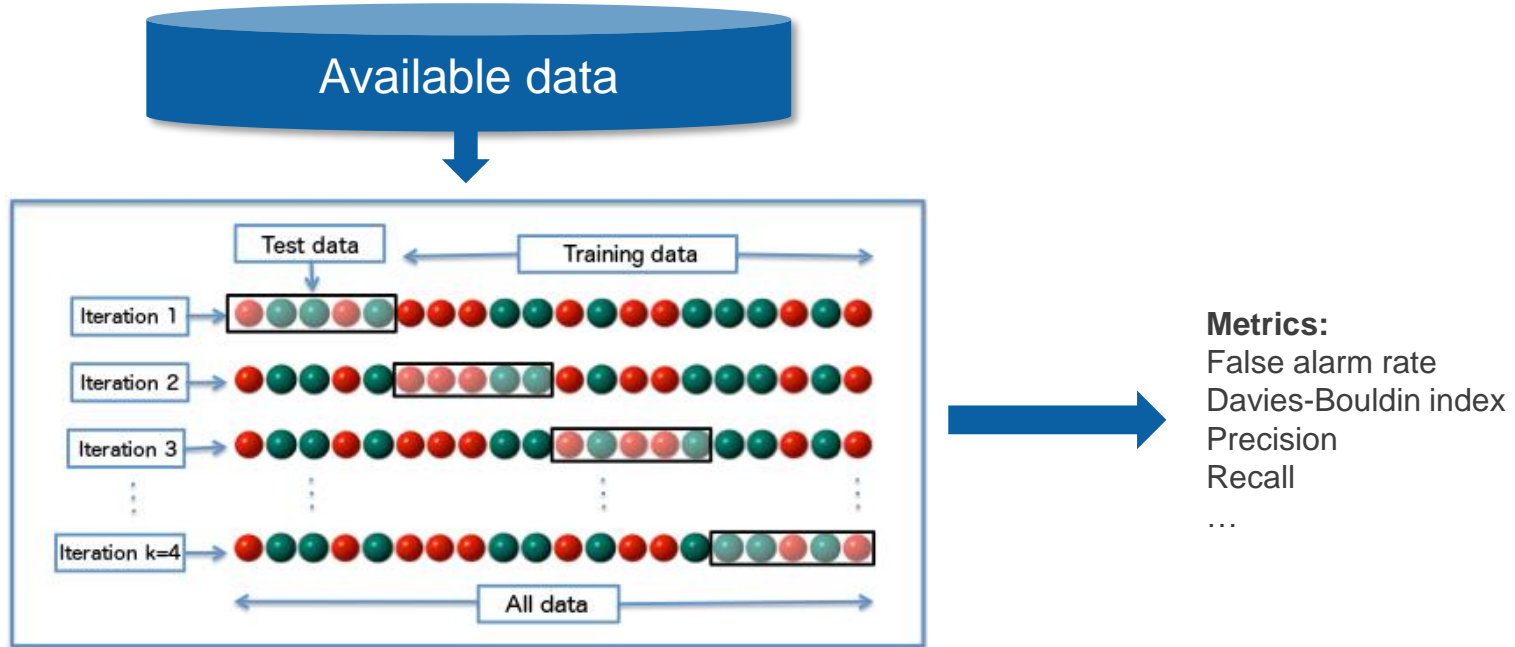
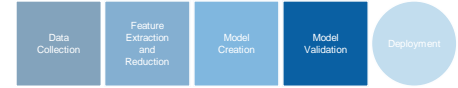
Regression

Forecast future by
understanding
relationships

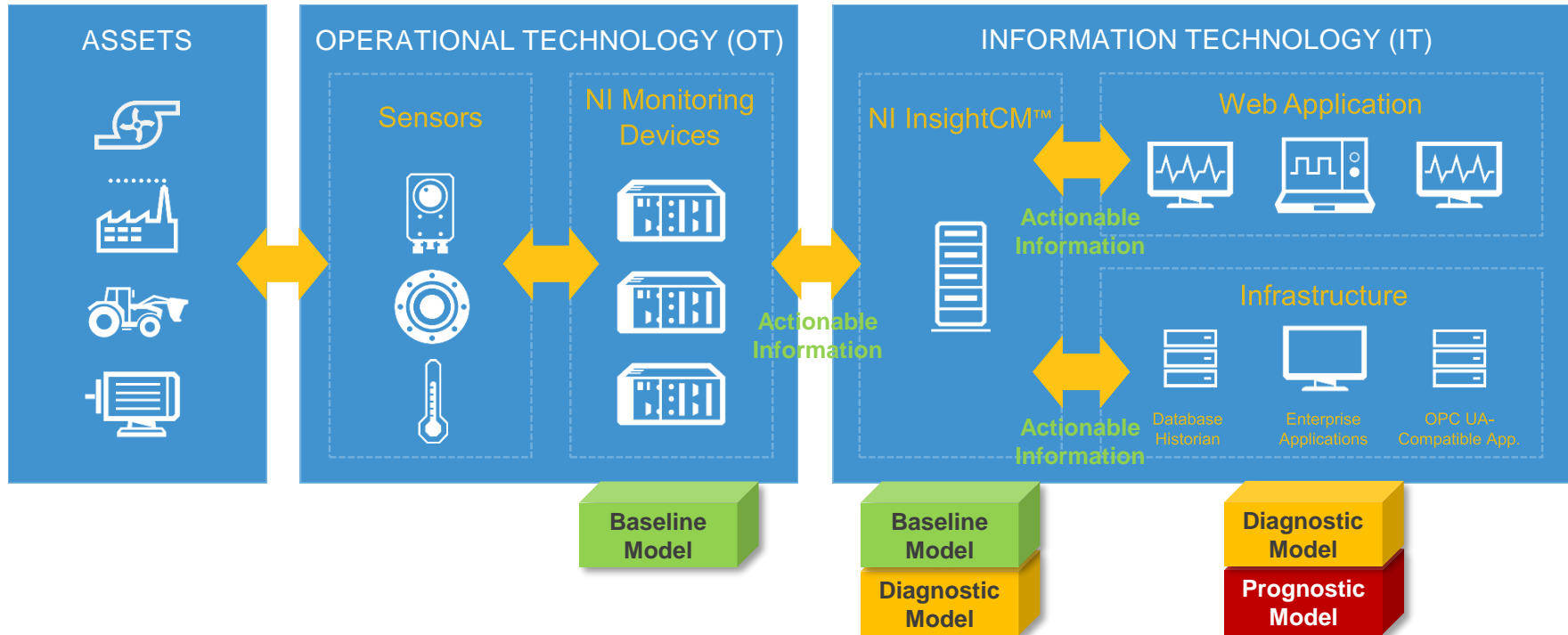
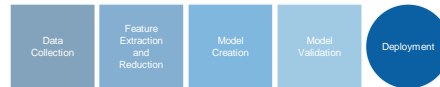
Different Model Types Exist



Getting a “Good Enough” Model



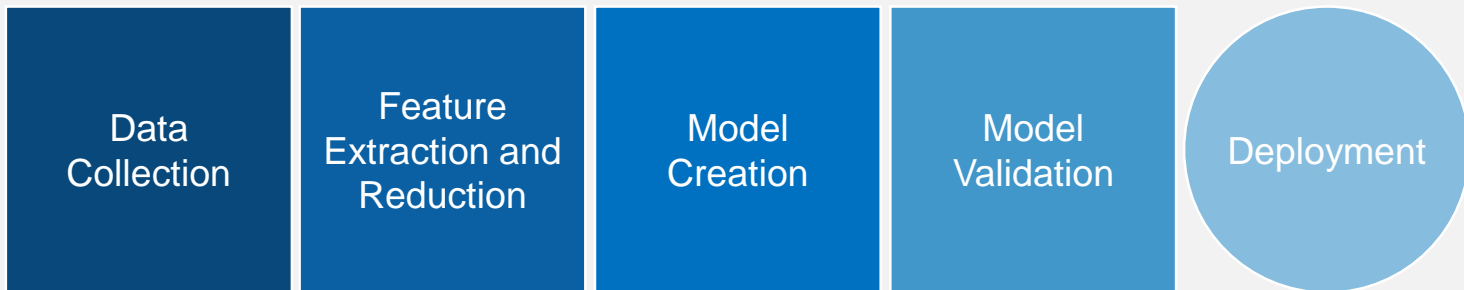
Model Deployment Options



LabVIEW Analytics and Machine Learning Toolkit

Integrate predictive analytics and machine learning algorithms in LabVIEW

- Algorithms for feature reduction, anomaly detection, clustering, and classification
- Train, test, and deploy models
- Targeted toward condition monitoring and predictive maintenance applications
- Includes getting-started and real-world examples



Case Study

Anomaly Detection in NI's Central Plant

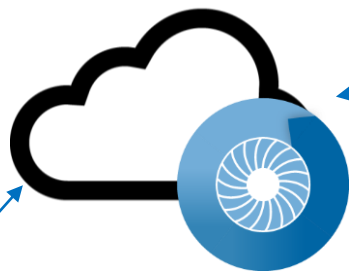


Data Collection



NI Monitoring Devices
installed at NI

62 features extracted per pump
(vibration and temperature)



NI InsightCM™
hosted in the cloud

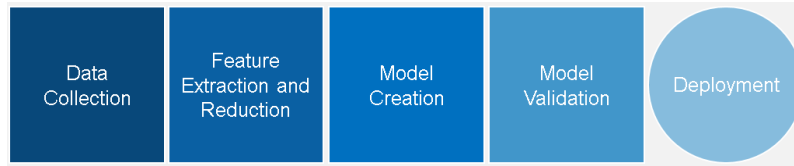


Web UI

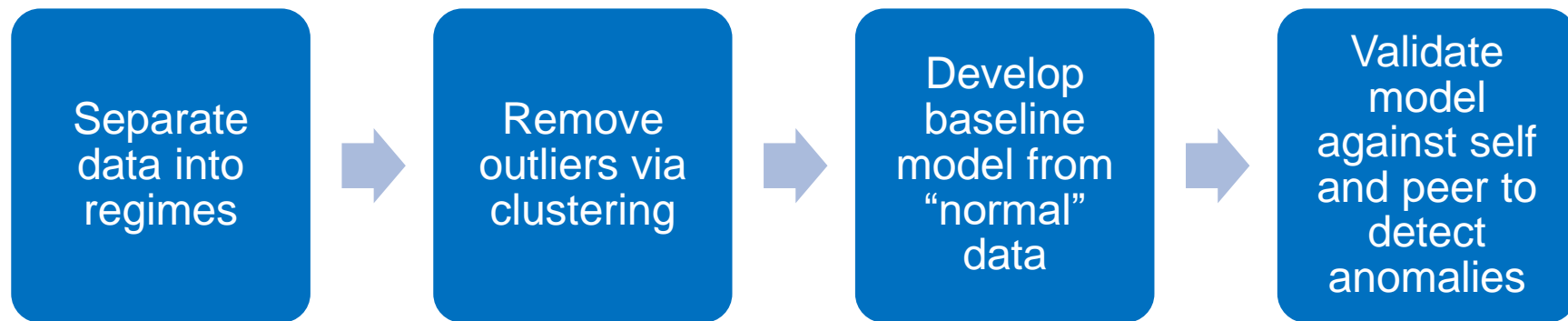


LabVIEW™

Analytics and Machine Learning Toolkit

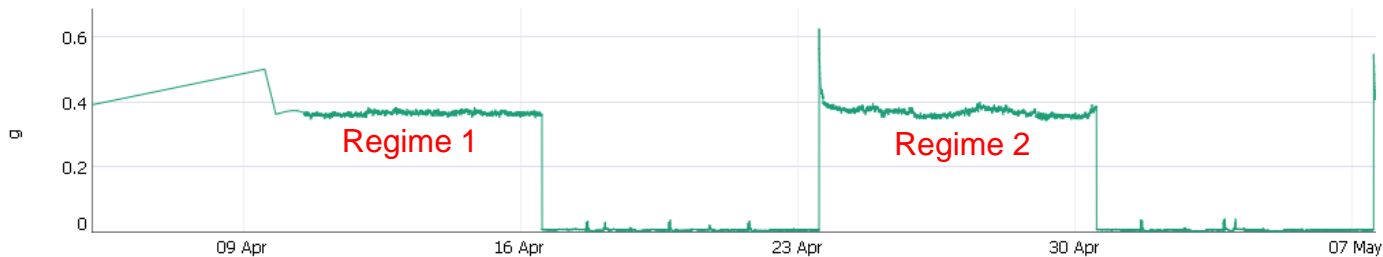


Model Development Process

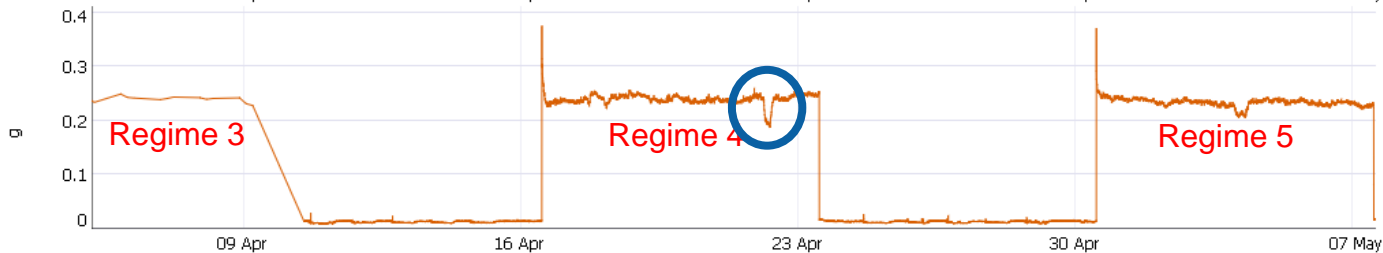


Is the Pump Normal?

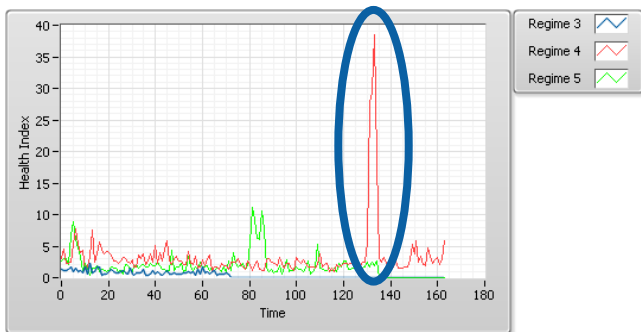
Chilled Water Pump 1



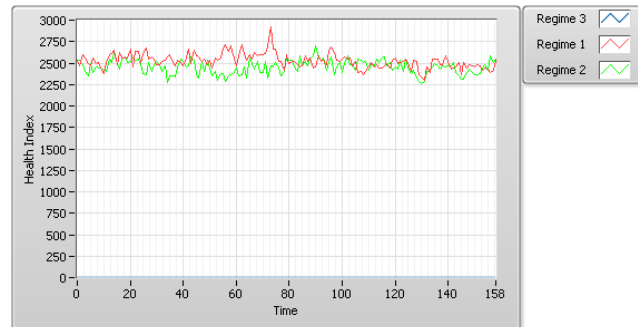
Chilled Water Pump 2



Self Comparison



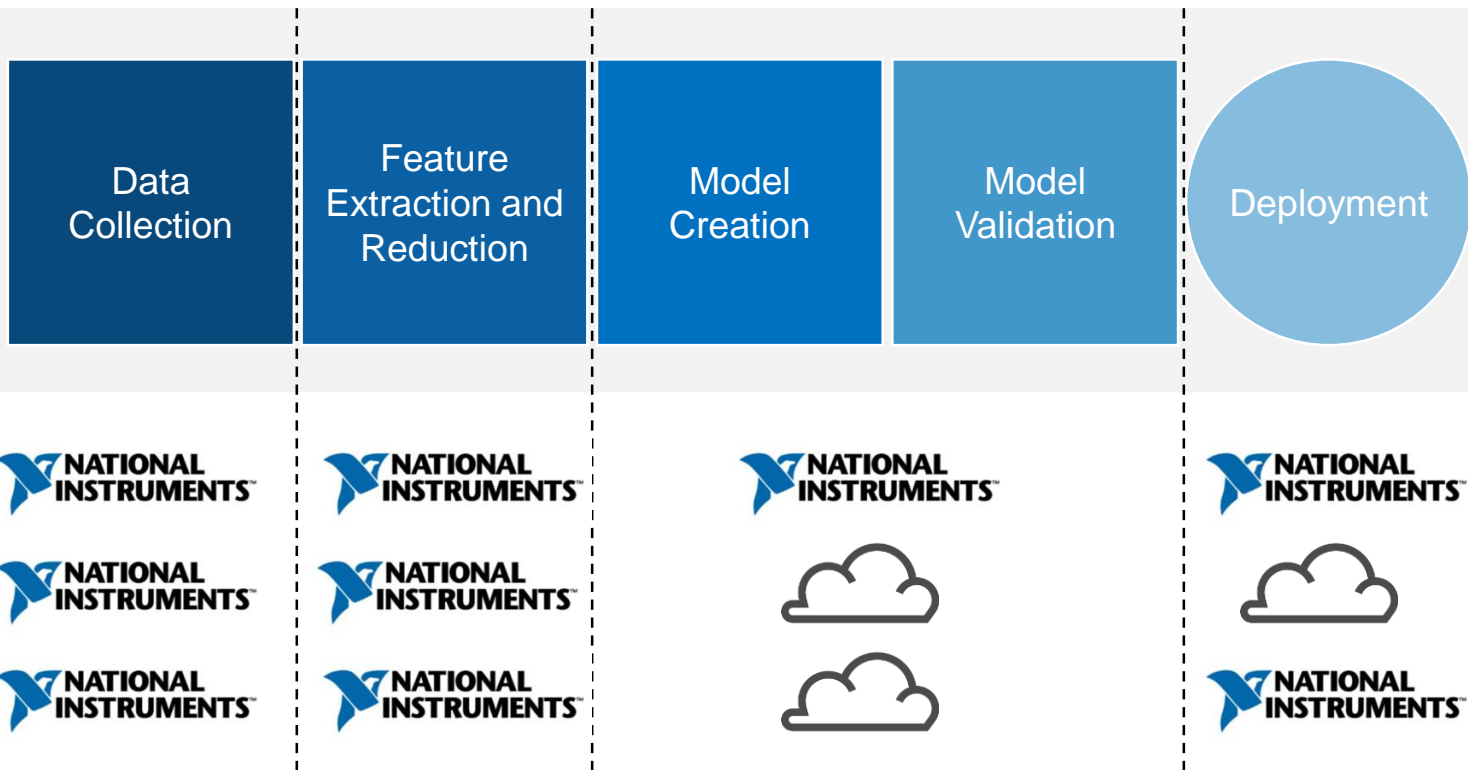
Peer-Peer Comparison



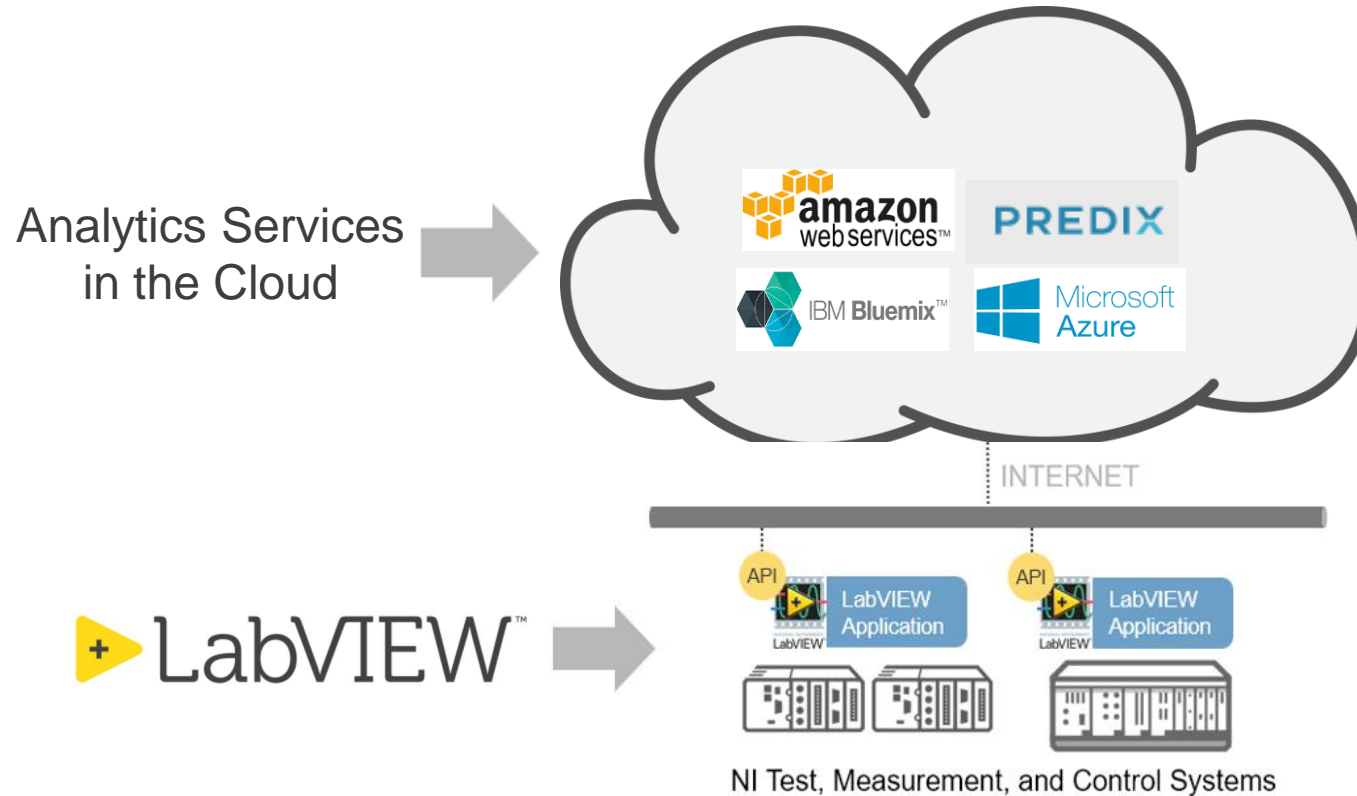
Improving Results

- Add more features
 - Exterior environmental conditions (e.g., temperature)
 - Electrical signals
 - Features aligned with faults (e.g., bearing fault frequencies)
- Incorporate operational and maintenance history
- Iterate on model as new data becomes available

Different Analytics Workflow and Deployment Types



Working With the Cloud



Summary

- Machine learning holds the promise of extracting actionable information from large amounts of data.
- The NI platform is the best solution for feature extraction and communicating with different data sources.
- The LabVIEW Analytics and Machine Learning Toolkit is an option to develop predictive analytics and machine learning models.

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