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Predictive Analytics Approach with Time Series Data using Machine Learning

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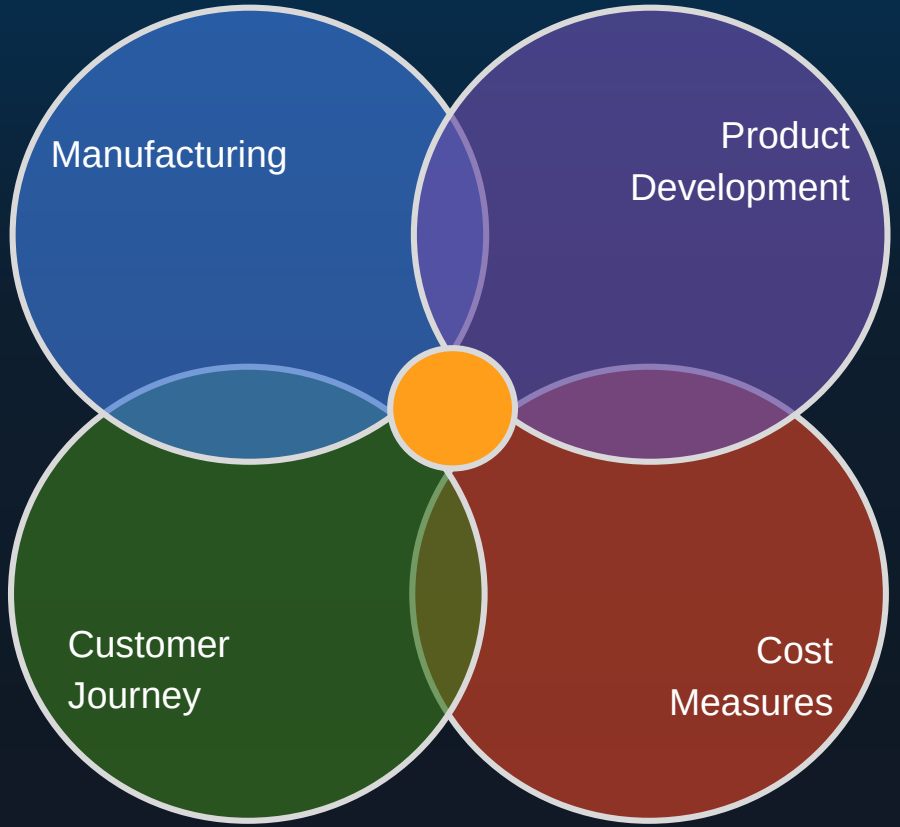
20% Productivity Rise* From Digital Analytics

Improvements seen across key business vectors



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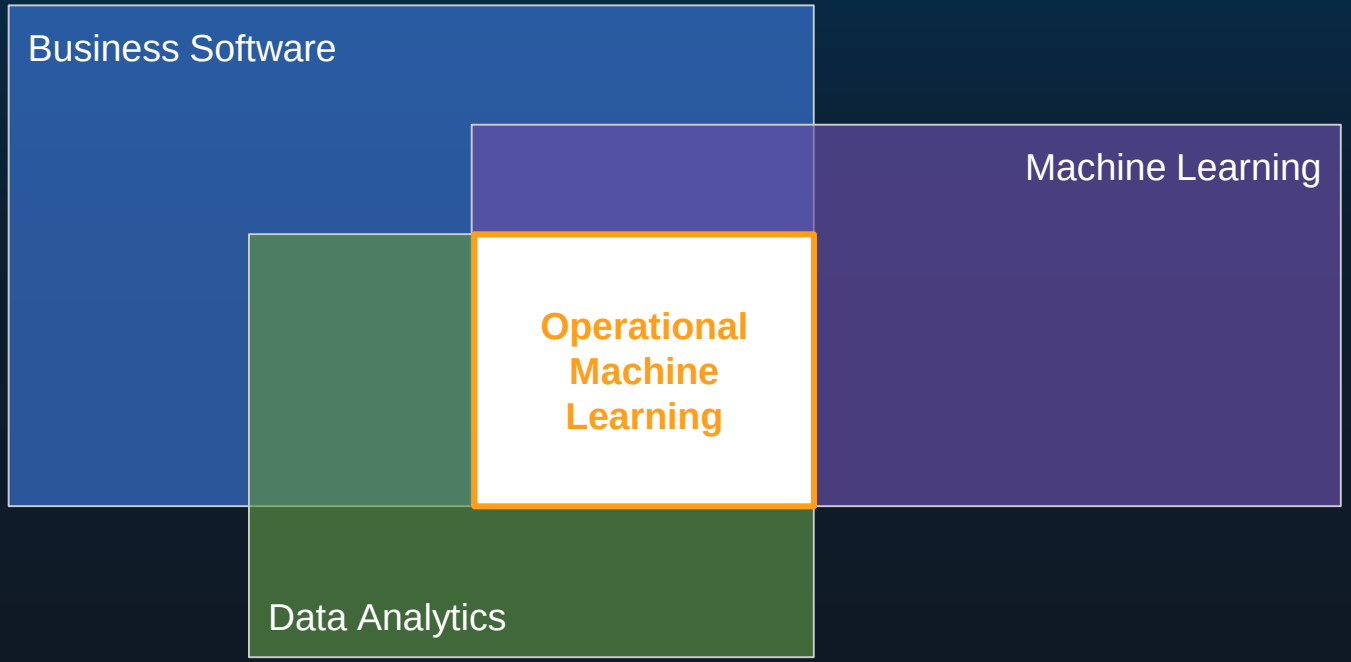
source: McKinsey & Company - Ops 4.0: Fueling the next 20% Productivity Rise with Digital Analytics (2017)

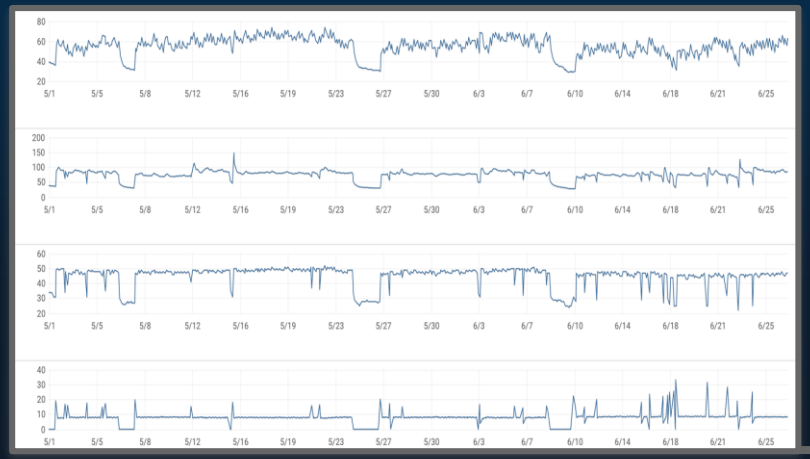
Operational Machine Learning

New market category to address massive data wave



Time Series: The Dark Data Within Operations

Ubiquitous, but underutilized, insight-rich data in industrial operations



Machine Learning

Dark, proprietary data

- Already generated in machinery
- No long term benefit
- Proprietary and restricted access

Operation throughput, quality, safety

- Discover unanticipated behaviors
- Find early warning signs
- Create reliable alarms

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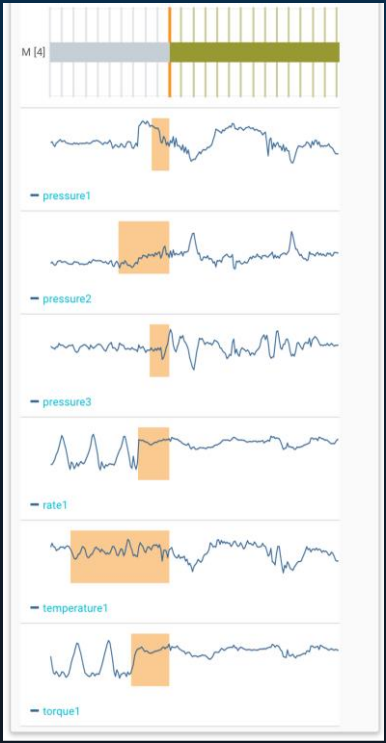
Patterns Provide Insight But Need To Be Discovered

Multiple challenges for conventional machine learning / deep learning approaches



Patterns are very complex

- Temporal patterns appear over windows of time - NOT in single snapshot

Behavior of interest are not adequately labeled

- Very few occurrences to learn from
- Need to support BOTH unsupervised and semi-supervised learning

Limitations of traditional approaches

- Traditional approaches require data scientists and do not scale or adapt to conditions

Real-time data is not perfect

- Standard analytics middleware do not handle synchronization or gaps in data

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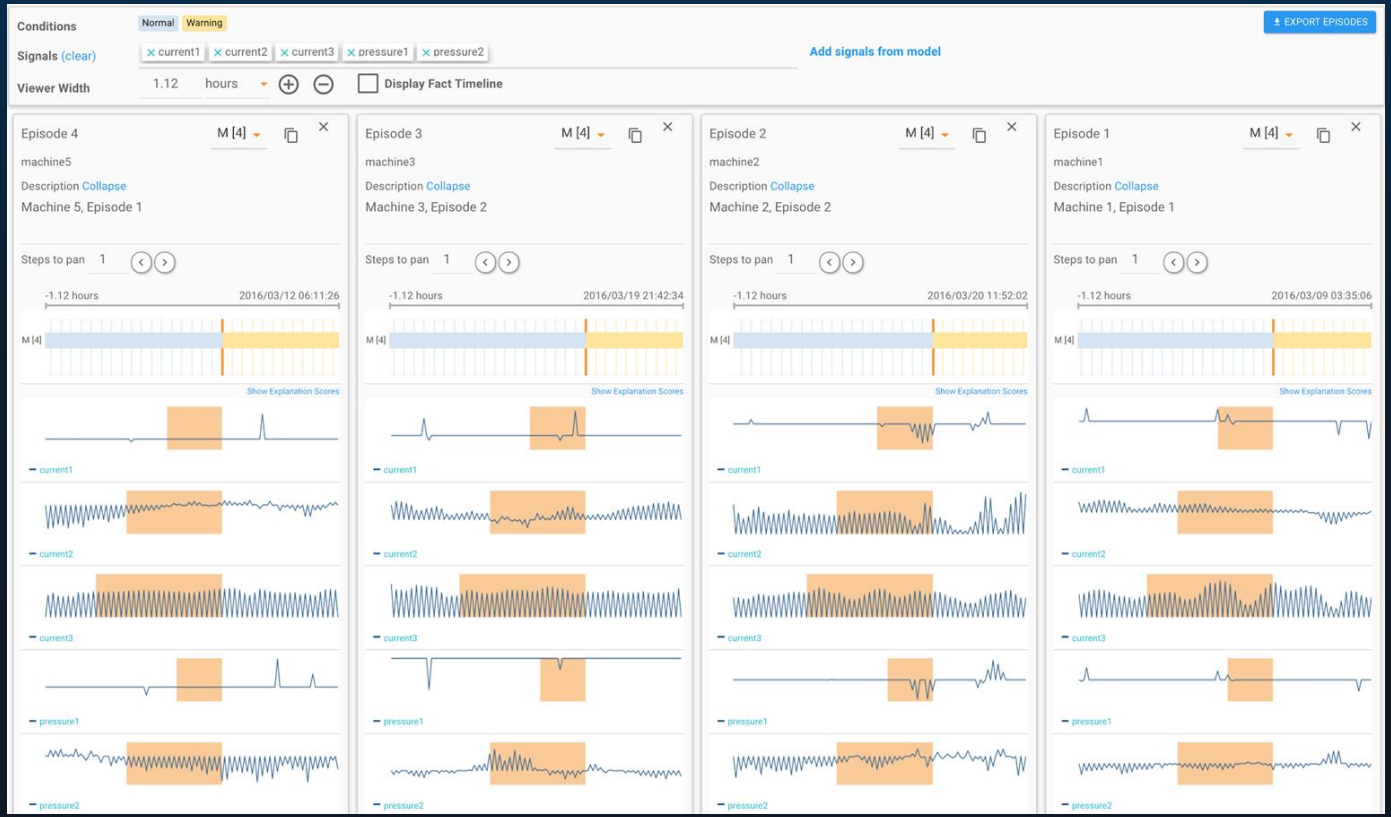
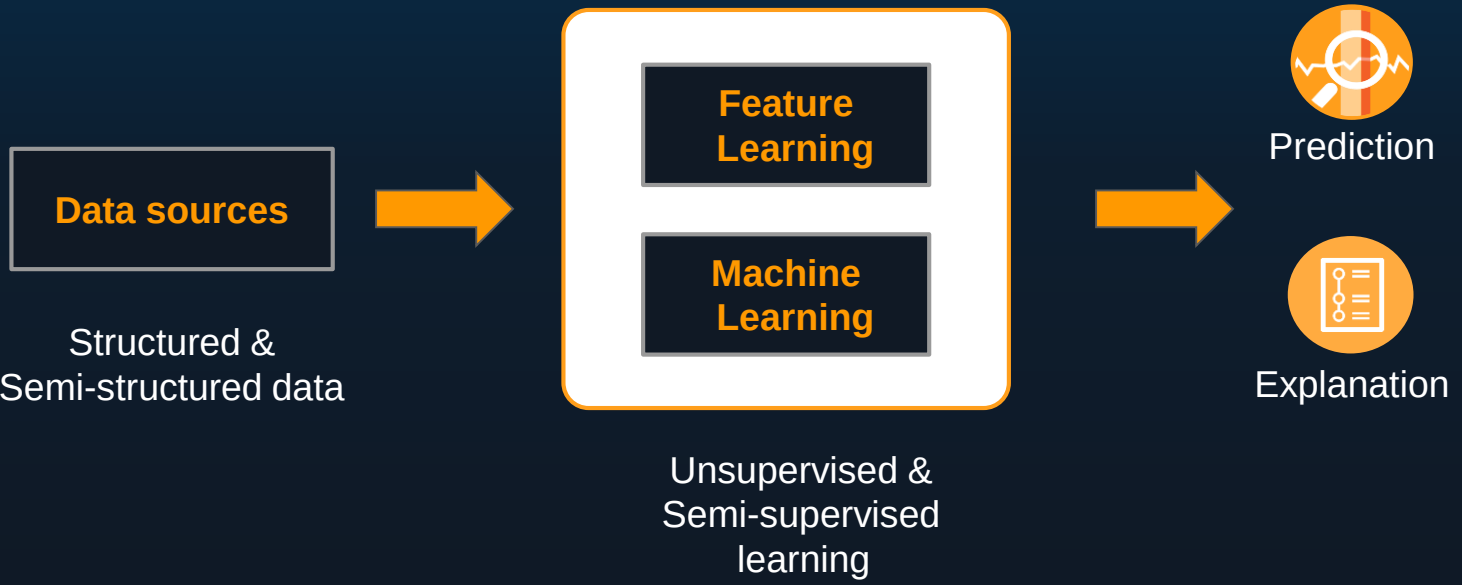
Visualizing Key Patterns in Important Signals

Patterns are not all the same to human observer



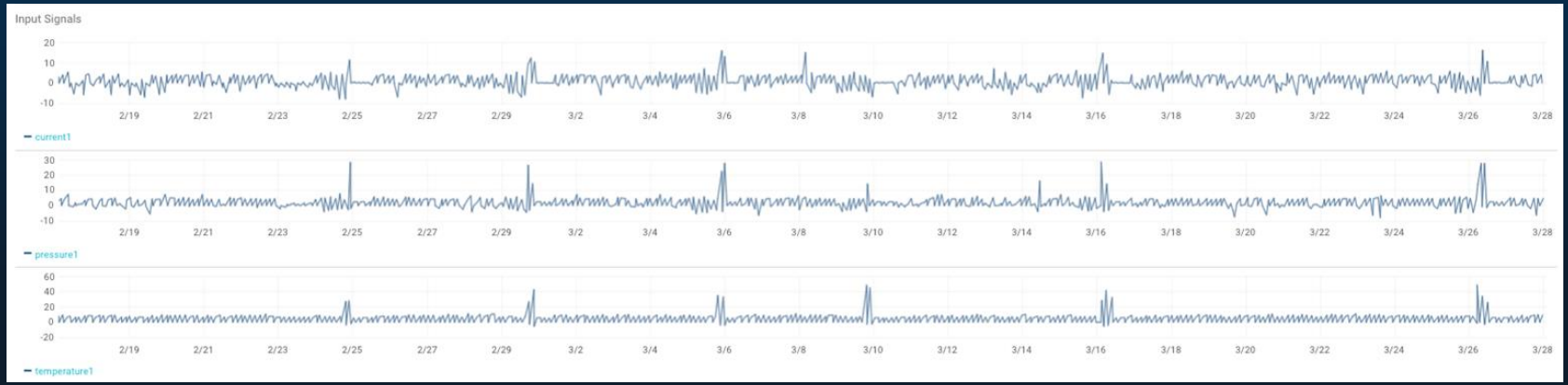
Emerging Understanding of “Data Scientist In a Box”

Essential for the industrial subject matter experts to self-service machine learning



Unsupervised Learning of Patterns

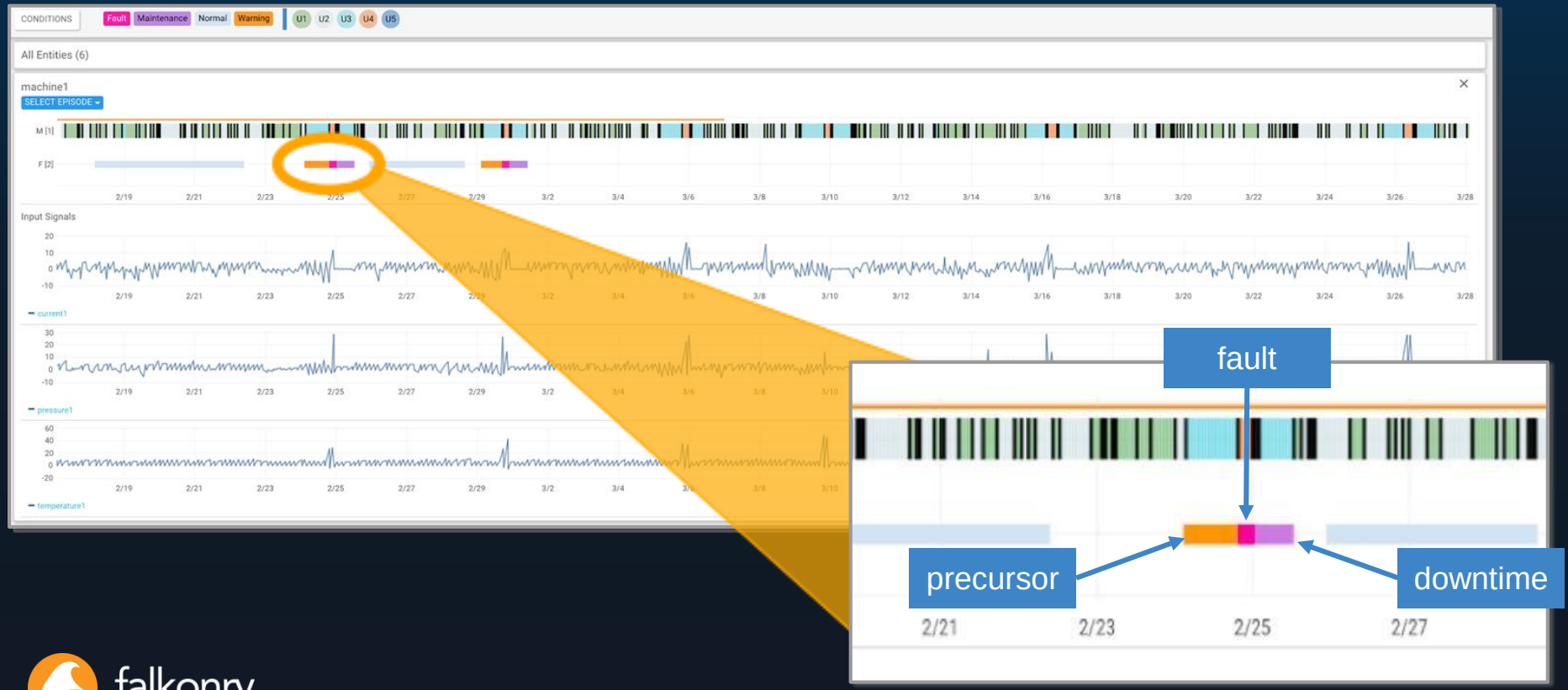
Learning on partial data



Falkonry LRS picks out different patterns including the fault and its precursor.

Semi-Supervised Learning of Patterns

Adding “facts” to learn patterns



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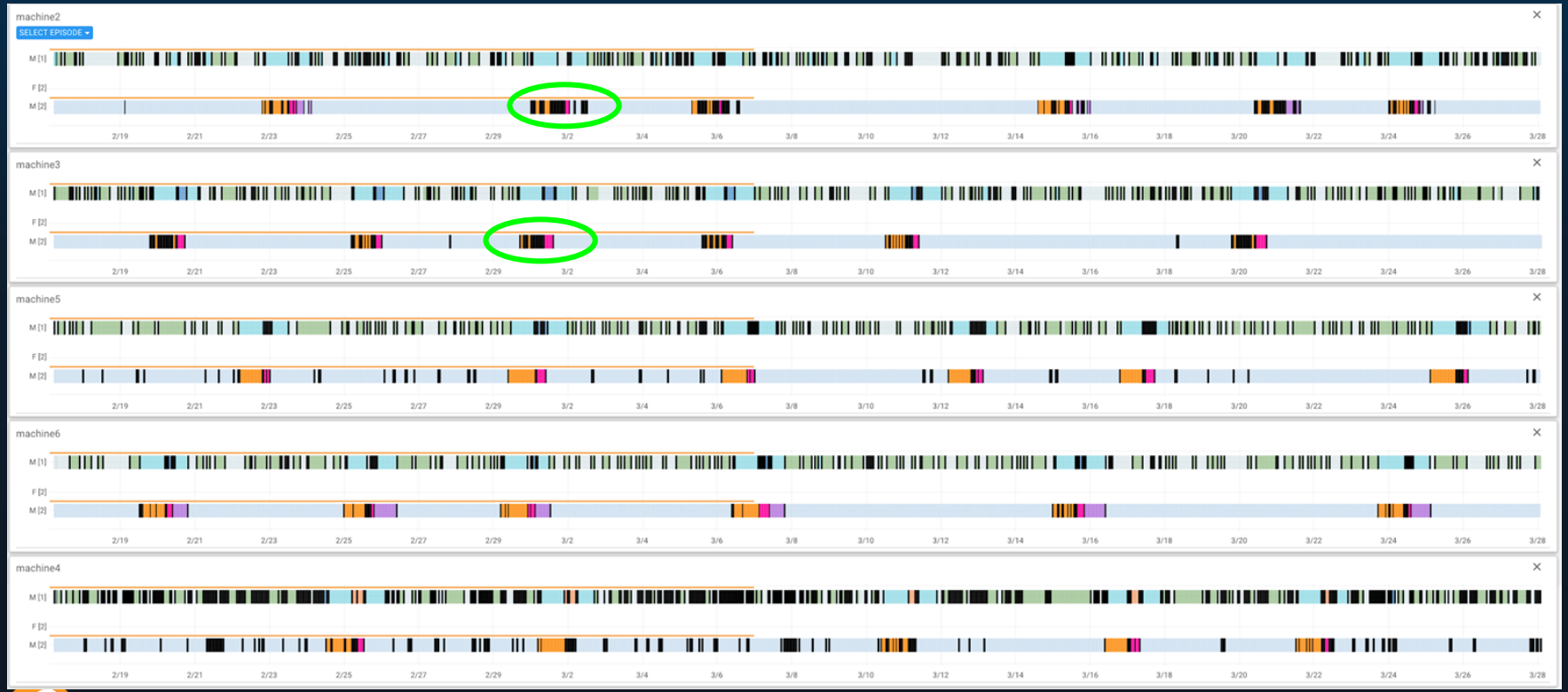
Issues Mapping Initial Model to Other Machines

Some confusion on categorizing Machine # 2



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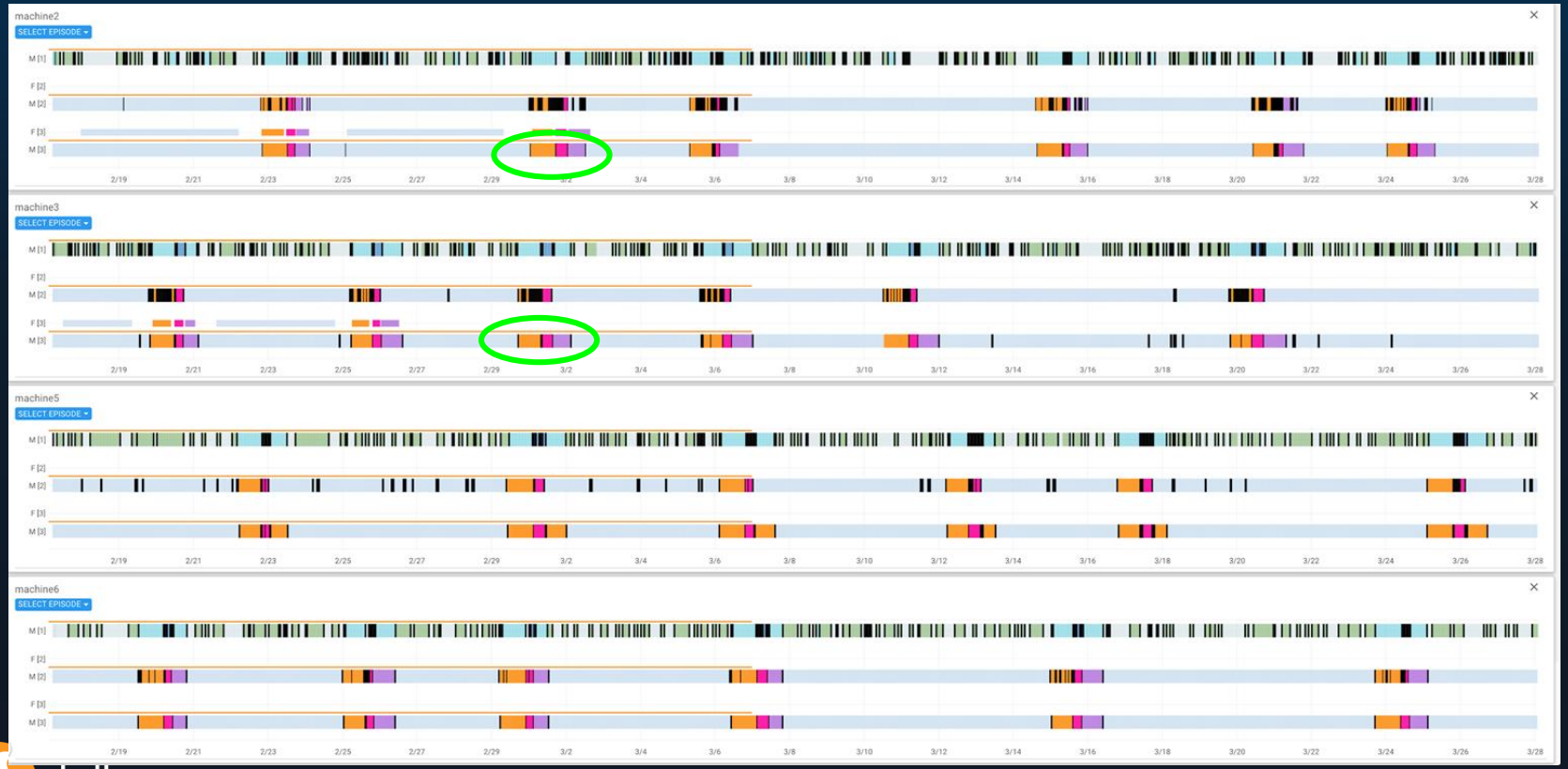
Easily Addressed With A Few Additional Facts

Adding data from Machine #2 improves the prediction for all remaining machines

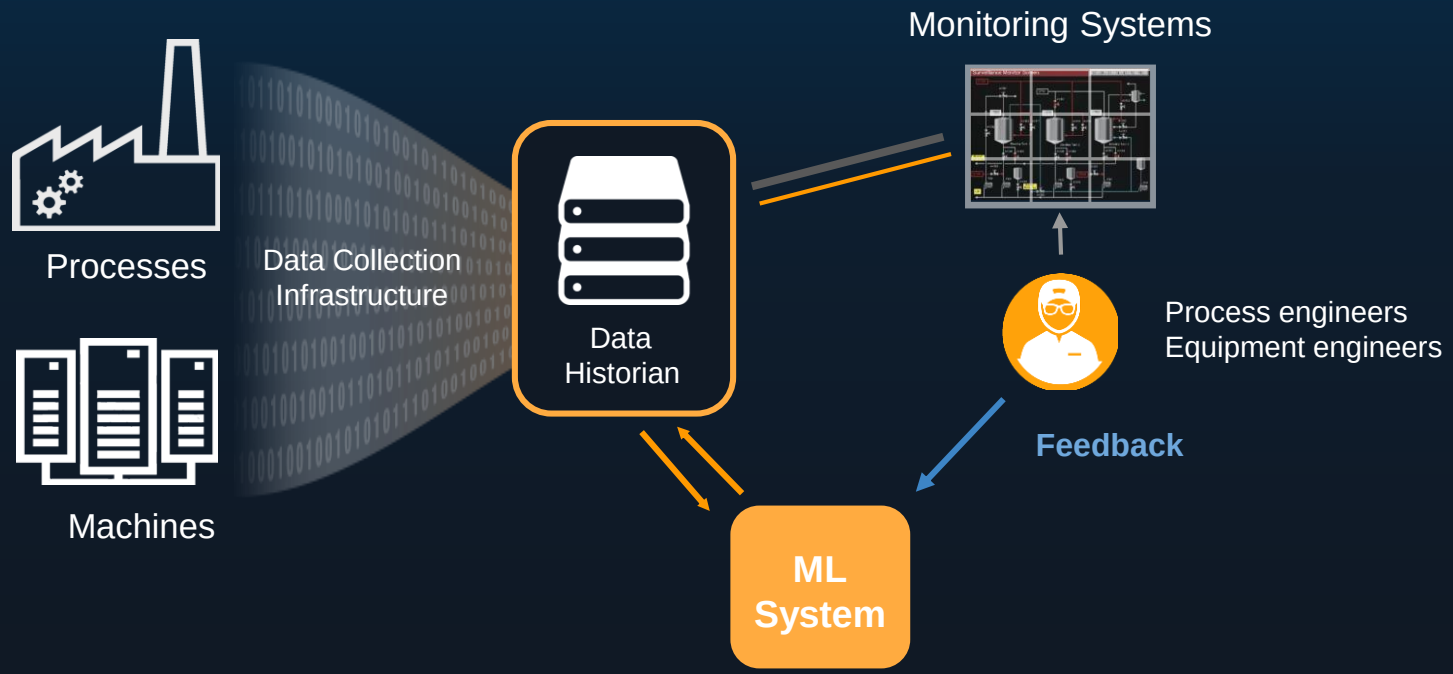


Episode Comparison to Study Patterns

Distinct transition from normal operation to warning condition

Condition Monitoring with Predictive Analytics

Smart manufacturing and Smart factory



Use Cases Across Industries

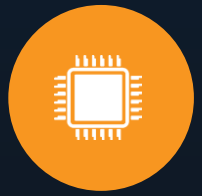
Production optimization: throughput, quality, safety, and yield improvements

Oil & Gas Operations

- Detect pre-shutdown patterns
- Real-time alerts for uncontrolled emissions

Power & Energy Operations

- Fault classification of power electronics
- Distributed asset monitoring



Semiconductor Manufacturing

- Predictive maintenance of equipment
- Optimize machine utilization

Mining & Metals Production

- Discover equipment downtime patterns
- Real-time production throughput adjustment

Automotive Manufacturing

- Detect deviations in discrete manufacturing
- Real-time quality estimation of welding

Chemical Manufacturing

- Quality estimation of batch process
- Monitor machine health

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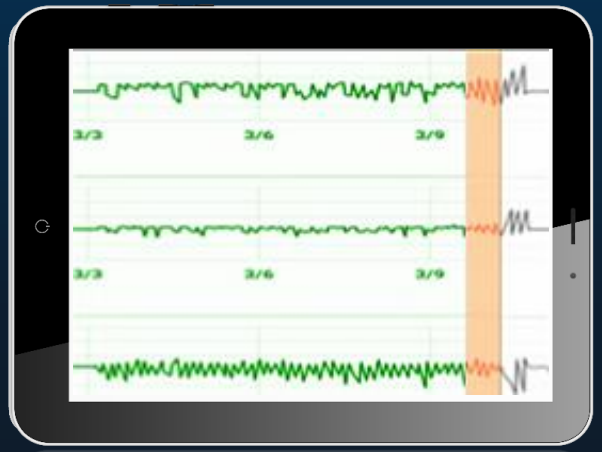
A strategic approach to digital operations transformation

- No data scientists required
- High value information from time series data
- Discover invisible patterns in minutes
- Ready-to-use machine learning is a strategic tool



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