ELEMENT ANALYTICS™

Machine Learning

Unlocking predictive insights from data

Presented by: **Sameer Kalwani, Founder & VP of Product, Element Analytics**

October 12, 2016 – Houston, TX

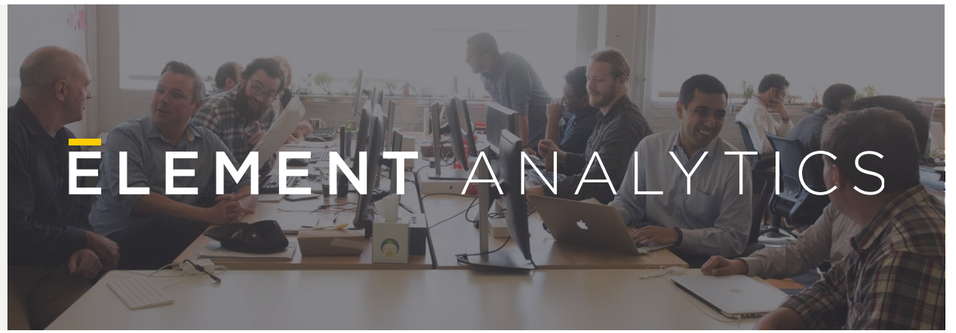
What's in This Presentation

- Introduction to Machine Learning
- ML Use Cases for Industrial Companies
- 4 Steps to Unlocking ML for Analytics

ABOUT US

Based in SF, we're an industrial analytics software company that transforms data into actionable insight.
Our partners:

OSIsoft. Microsoft

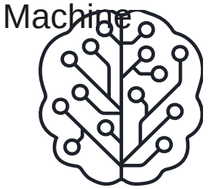


Machine Learning

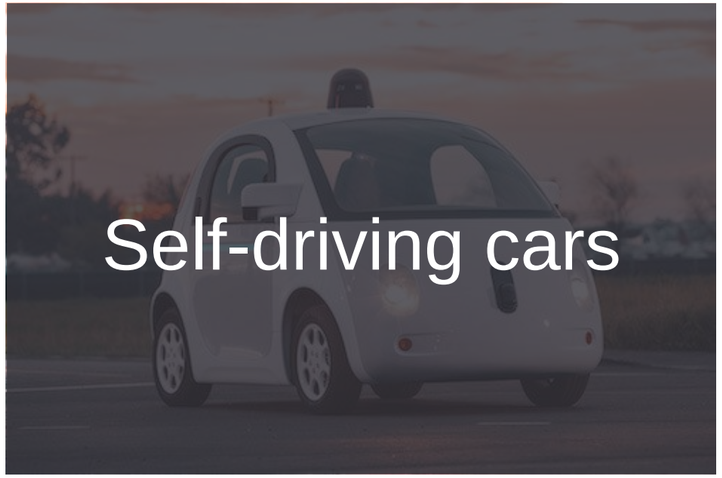
- Autonomously adapts to change
- “Re-learns”
- Enables faster computation
- Predicts in real time
- Fuels business growth

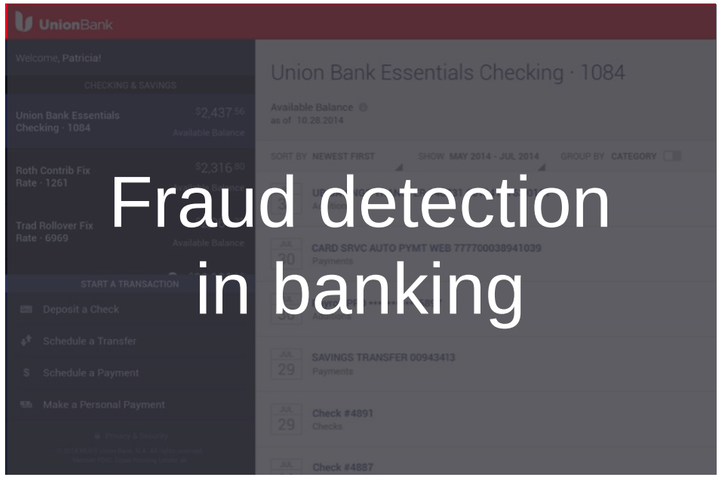
> “Machine learning… gives computers the ability to learn without being explicitly programmed

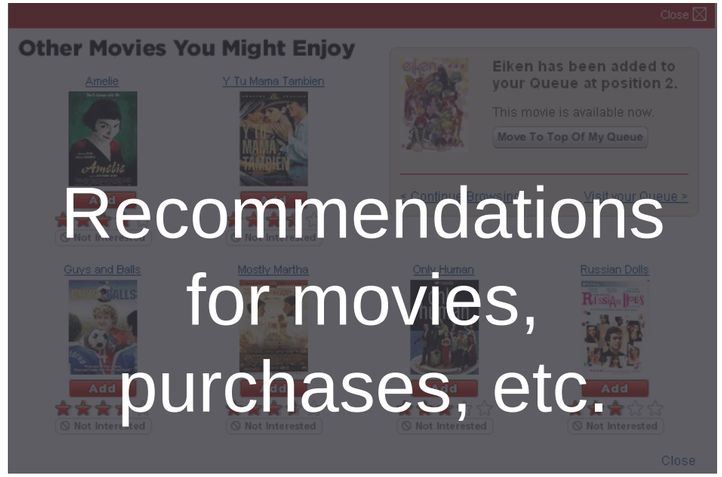
- **Arthur Samuels**
  Pioneer in AI and Machine Learning
  c. 1959



Machine Learning in Our World Today





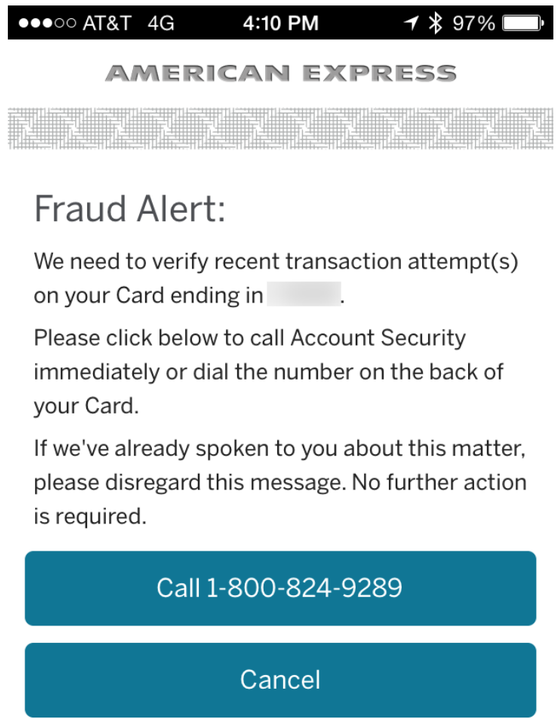


To name a few…

ML Analogy: Quick Case Study on Fraud Detection in Financial Services[1]

- US Credit and Debit Card issuers lost $2.4 billion due to fraud in 2011[2]

- Implemented **Machine Learning** and **Stream Computing**



Impact

15%	50%	60%
increase in fraud detection	reduction in false alarms	increase in total savings

[1] IBM Research, 2014
[2] Consumer Reports June 2011: House of cards

Industrial Use Cases of Machine Learning & Predictive Analytics

Failure Prevention

Equipment failure predictions enable predictive maintenance, which can **save maintenance costs by 50%.**

JP Morgan, 2014

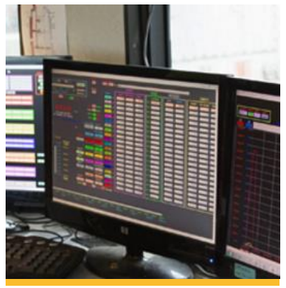
Greater Worker Safety

Predict issues such as pipe corrosion and line bursts for better logistics planning and hazard control (e.g., explosions, fire, leaks), **saving $millions in insurance, reducing incident rate by 67% within 18 months.**

Reliable Asset Management

Diagnostics across assets, processes, and sites enable greater visibility and more proactive operations to **boost productivity by 25%.**

IBM, 2015



Revenue Growth

Analyze and model performance, determine root cause of issues, identify under-performing assets to **optimize performance for greater revenue capture with an ROI of 250%.**

IDC, 2012

Smooth Workforce Transition

Preserve knowledge in data models, make data-guided decisions, reducing human error when **50% of O&G workers will retire** in the next 5-7 years and next-gen workforce is 35 and younger.

Forbes, 2015

Machine Learning Case Study: Failure Prediction for Pumps (ESPs)

A Fortune 10 oil & gas company with global operations.

Challenge

- **Revenue loss** due to well downtime after ESP failures.
- Pumps take **30 days to replace**.
- Lack of time to failure insight from remote monitoring services.
- Shrink downtime via advanced warning of pump failure.

Solution

- **Semi-automatically mapped 74,000+ tags in 3.5 hours** (previously took months)
- Created predictive model to **predict ESP failures 60 days in advance** across 1,100 wells in a single production unit.

Results

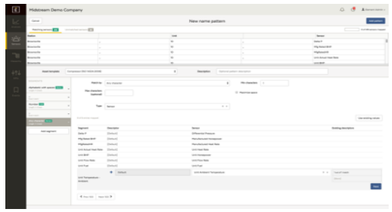
- Failure predictions enabled targeted maintenance scheduling.
- **Reduced outage from 30 to 21 days**, avoiding hundreds of down days, **recapturing $Millions** in annual revenue.

How do we get there?
4 Steps to Unlock ML for Advanced Analytics

Overview: Transforming Data into Actionable Insight

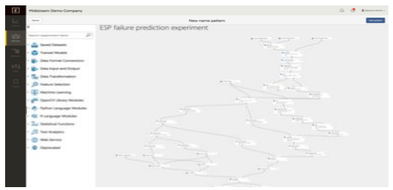
Raw, collected data

2. Prepare Data



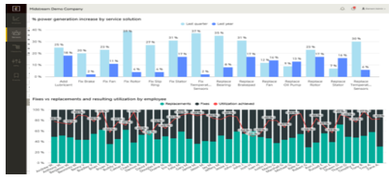
PI System data as well as external data

3. Model Data



Advanced modeling with machine learning

4. Visualize Insights

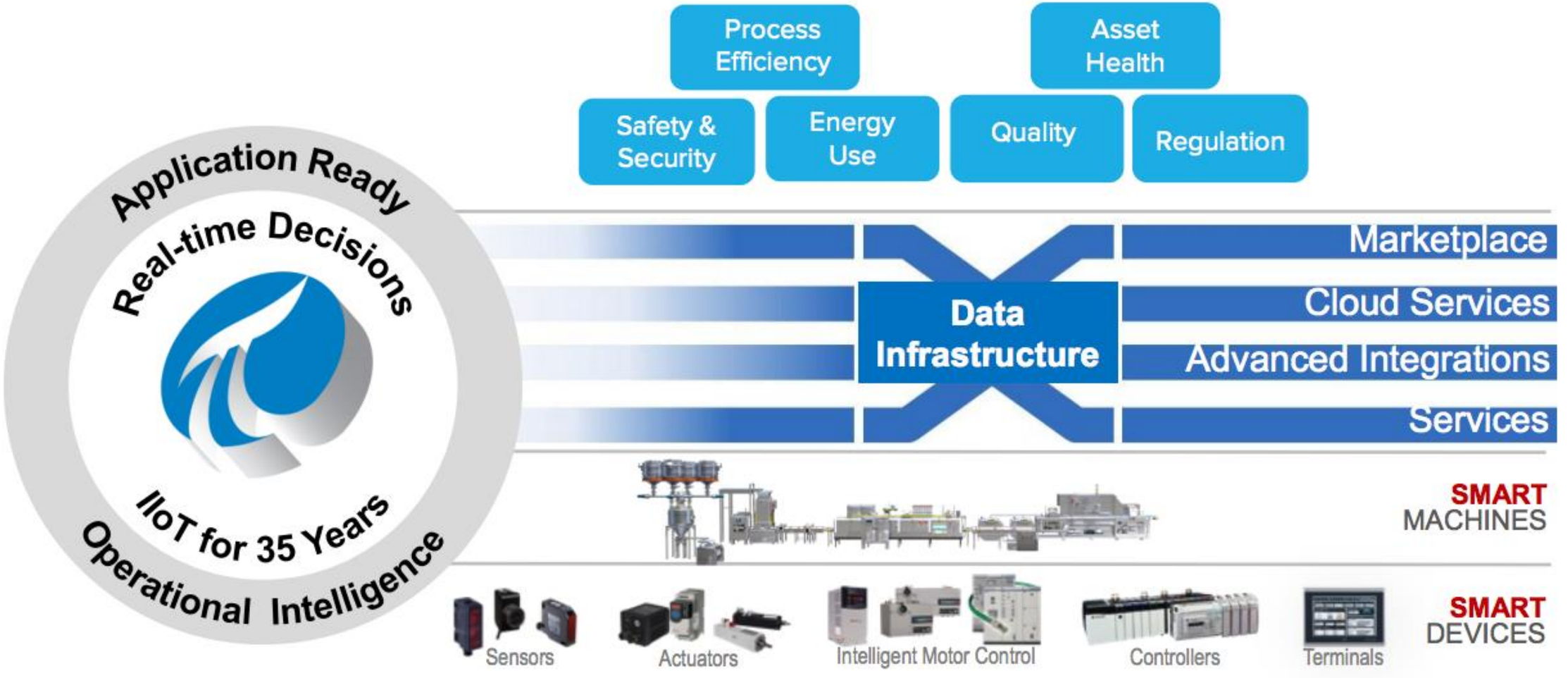


e.g., Time to failure, performance forecasts

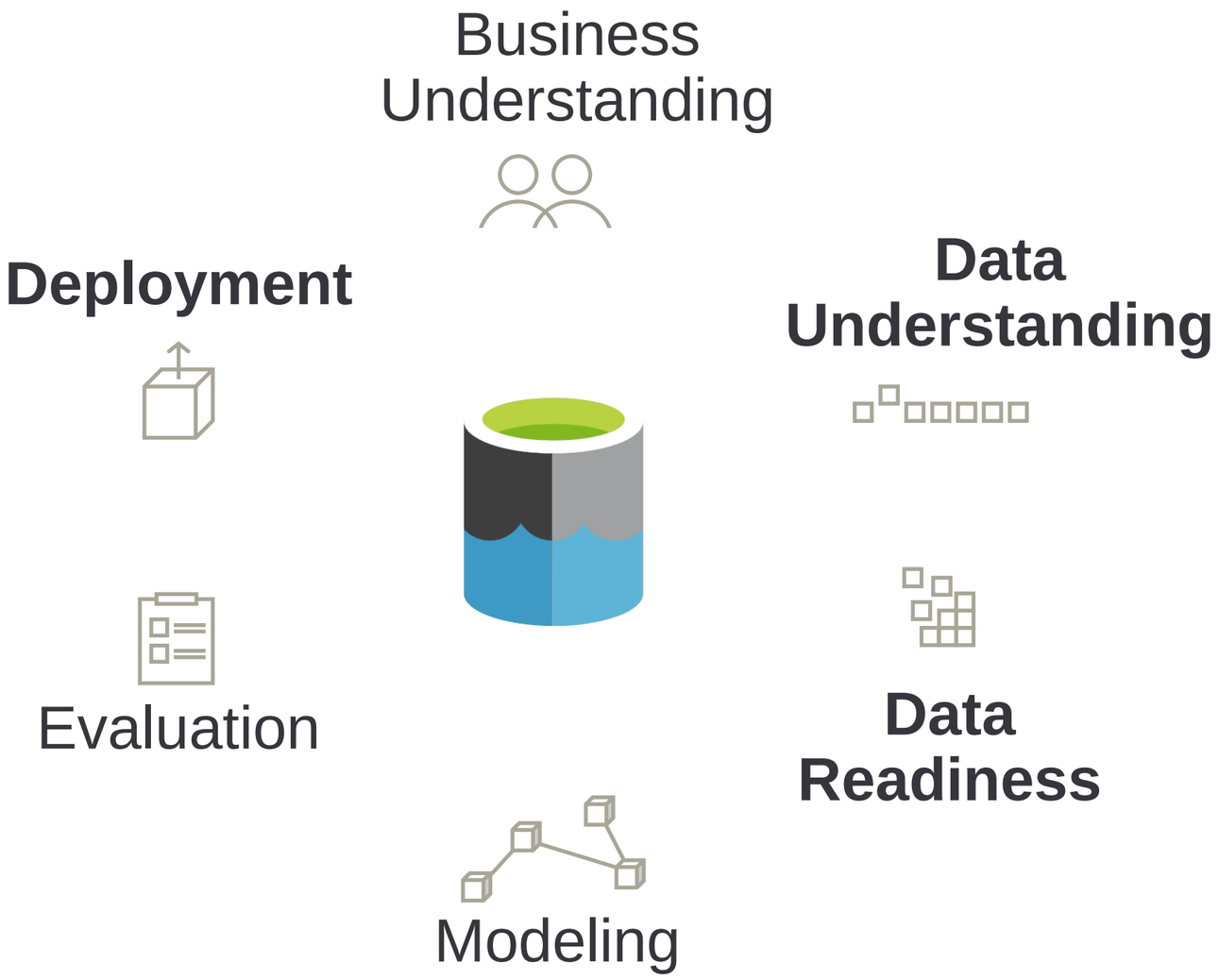
Data-guided decisions for greater operational efficiency and business profit

1 OSIsoft PI System on Microsoft Azure

Step 1: ML Requires PI System's Robust Enterprise Data Infrastructure



Machine Learning at Scale

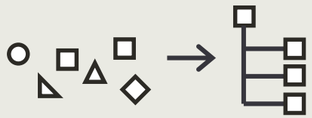


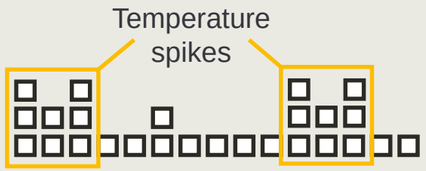
- Advanced Analytics requires 6 steps
- Can’t scale if each step needs to be repeated for a new problem or retraining
- Element Analytics automates the **repeatable steps**
  (People do the other 3)

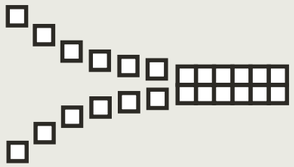
Step 2: Data Readiness

In order to use data for analytics and ML, we need **Data Readiness:**

Data Standardization	Data Contextualization	Data Trust	Data Joining
Organize PI System data into **Asset Frameworks** (build your own AFs or leverage existing AFs).	Identify data patterns and label them as **Event Frames**.	Fix data and sensor issues to ensure data is high quality & reliable for analytics.	PI System data needs to be joined with metadata, ensuring full context required for ML.



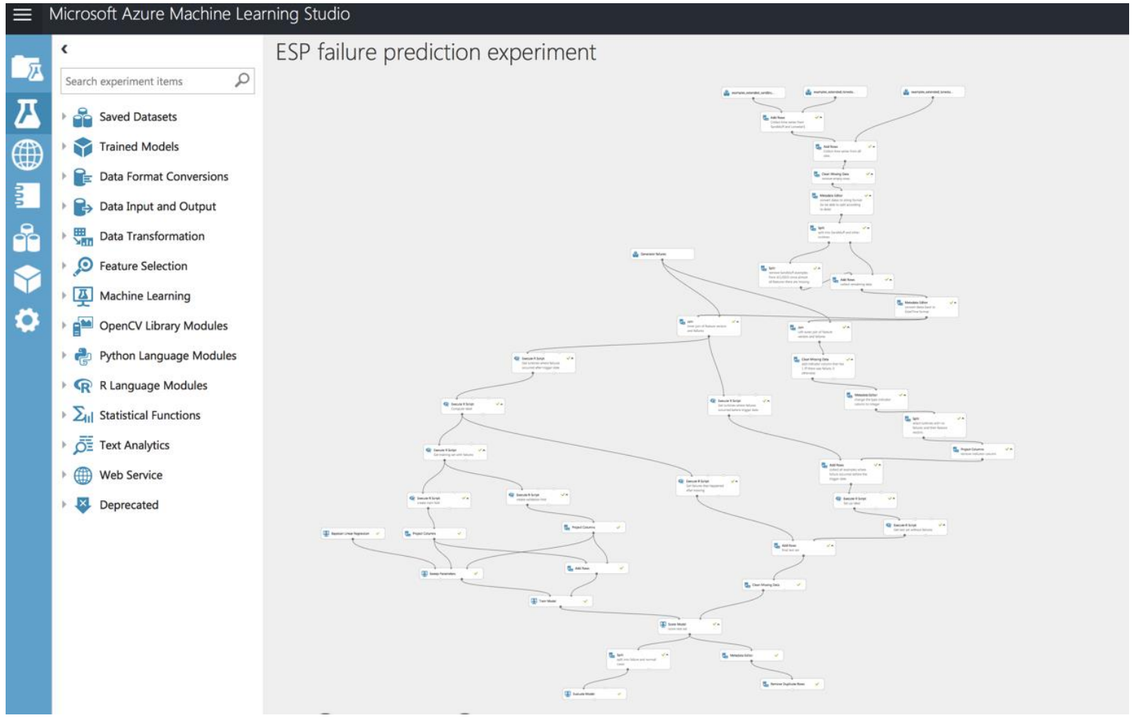




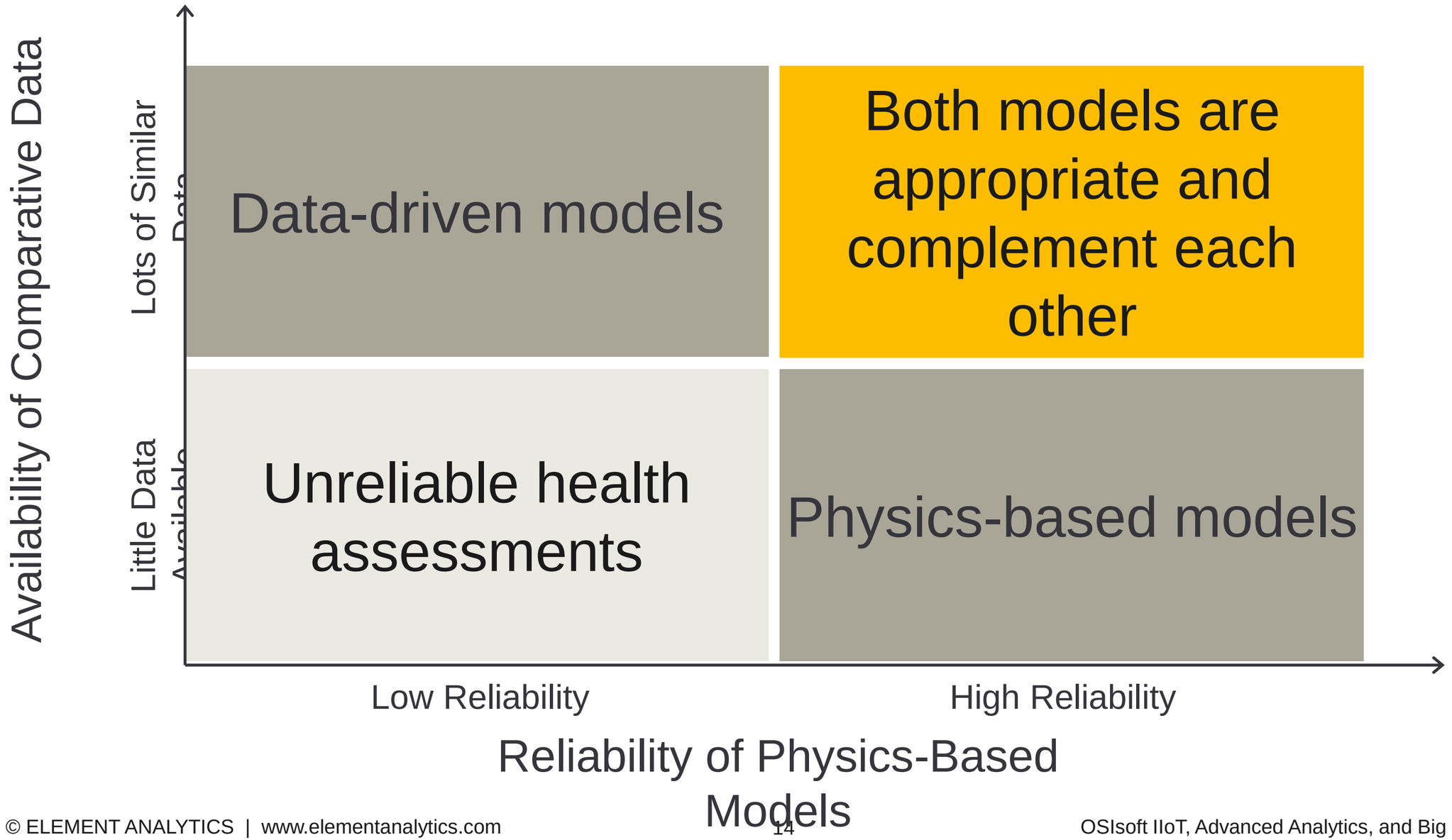
Step 3: Predictive Model Building

- Models can be built and deployed in Microsoft Azure ML

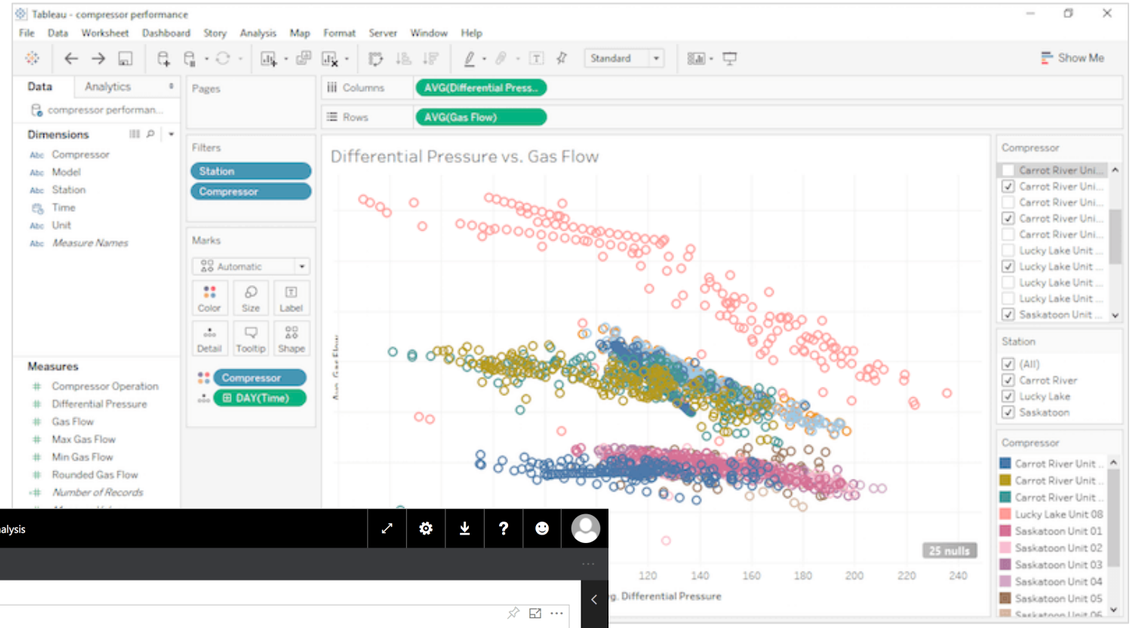
  - Identify the problem
  - Build machine learning features
  - Train model
  - Operationalize and maintain model
  - Library of models

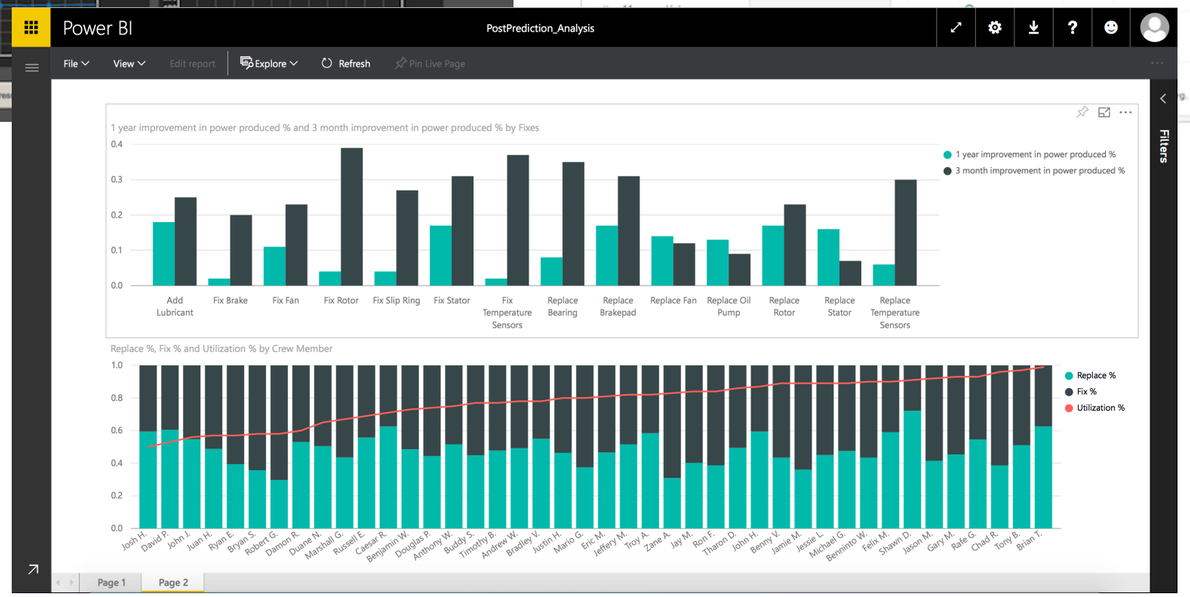


Step 3: Data-Driven Models or Physics-Based Models? We Need BOTH



Step 4: Visualizations - Examples of Actionable Insight



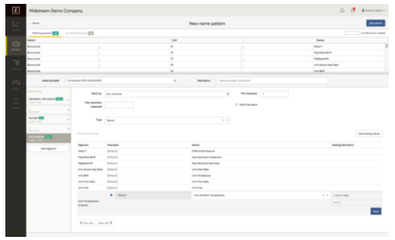


Bringing it all together

Overview: Transforming Data into Actionable Insight

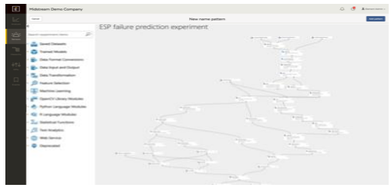
Raw, collected data

2. Prepare Data



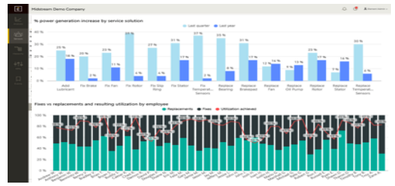
PI System data as well as external data

3. Model Data



Advanced modeling with machine learning

4. Visualize Insights



e.g., Time to failure, performance forecasts

Data-guided decisions for greater operational efficiency and business profit

1 OSIsoft PI System on Microsoft Azure

How Element Analytics Complements PI System

PI System users **without** existing Asset Framework

1. Rapidly create an AF with standardized asset naming and hierarchy.
2. Contextualize data patterns into Event Frames.
3. Fix data & sensor issues.
4. Join with external data.

PI System users **with** existing Asset Framework

1. Leverage existing AF.
2. Contextualize data patterns into Event Frames.
3. Fix data & sensor issues.
4. Join with external data.

This is done **continuously at scale** so your AF is always up to date with the most relevant context for analyzing maintenance issues and activities.

Summary

- Machine learning and predictive analytics can help industrial organizations **increase operational efficiency and uncover new revenue opportunities.**

- Must bring together **Enterprise Data Infrastructure, Data Readiness, and Data Science** for industrial analytics – the PI System is foundational to all 3.

- Data readiness is a **continuous data supply chain** process that keeps up-to-date as data evolves or degrades. This makes analytics fast, repeatable, and scalable.

- **Oil & Gas use cases** for machine learning include:
  - Predicting pump, compressor, turbine failure
  - Cooling tower corrosion forecast
  - Heat exchange fouling forecast
  - Pipeline corrosion forecast
  - Sensor drift and sensor failure detection

Thank You

Contact: Sameer Kalwani, **sameer@elementanalytics.com**