

AVEVA PI WORLD

Decentralized Industrial Analytics using PI Suite of Products

Cloud Quality Insights Without Moving Data

Presented By: Dr. Paritosh Ramanan

AVEVA



Dr. Paritosh Ramanan

Postdoctoral Fellow, School of Industrial & Systems Engineering, Georgia Tech

- Expertise in:
 - Decentralized, distributed machine learning applications.
 - Optimization, analytics and planning for energy and manufacturing.
 - Cybersecurity for industrial control systems (ICS)



JOHN DEERE

SIEMENS
energy

AVEVA



Dr. Nagi Gebraeel

Professor, School of Industrial & Systems Engineering, Georgia Tech

- 20+ years of research expertise in
 - Statistical Machine Learning and optimization for the industrial sector.
 - Predictive analytics for industrial applications in the manufacturing & energy domains.
 - Maintenance optimization and scheduling.
 - Analytics-driven spare parts logistics.



Our Focus is on....

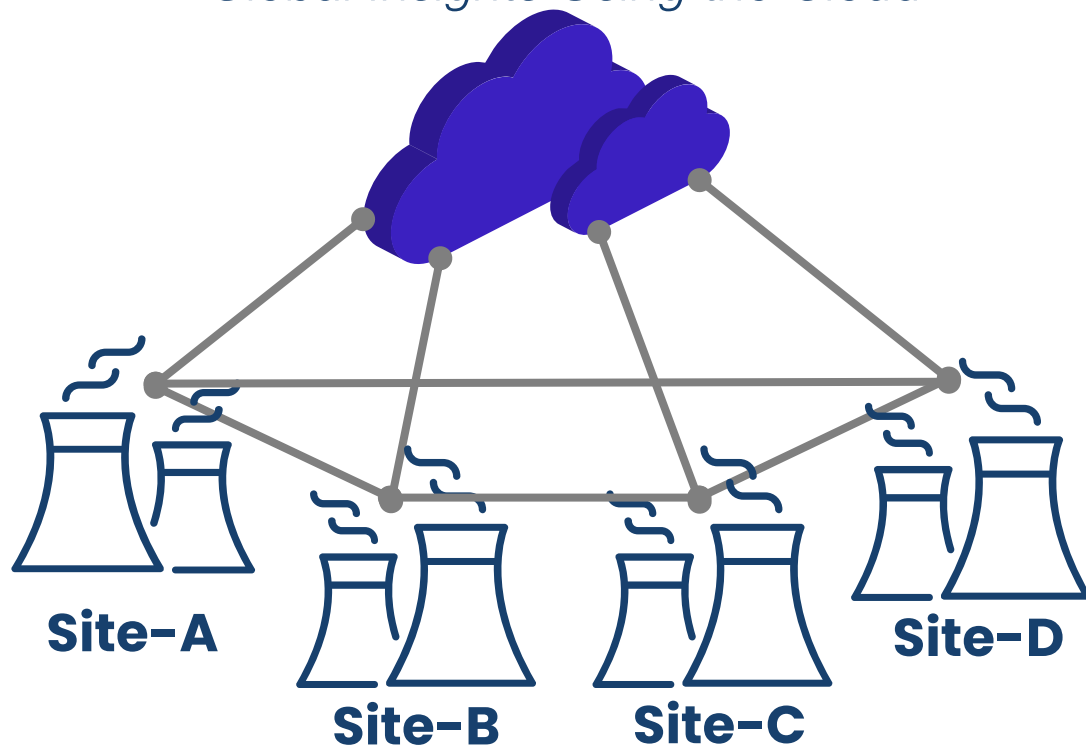
- **Decentralized Peer-to-Peer Industrial Analytics**
 - Simplifies adoption of analytics, ML and AI
 - Reduces operational costs
 - Does not require data migration
 - Reduces risks along digital transformation journey
 - Accelerates ROI
- **Empowers Data Scientists**
 - Provide easy-to-use analytic apps
 - Easy deployment of new analytics
- **Enriches OT Insights**
 - By asset class, across plants, across the enterprise
 - Real-time insights to improve operations and product quality, optimize energy consumption, and reduce downtime
- **Transforms IT**
 - From commodity provider to business enabler
 - Enables integration IT & OT
 - Improve efficiency of IT staff

CONVENTIONAL CLOUD ANALYTICS

THE CURRENT STATE-OF-THE-ART in IoT ANALYTICS?

Cloud Analytics

Global Insights Using the Cloud



Conventional Approach

Migrate to data lake for performing centralized analytics.

■ Architecture

Requires a **complex** analytics pipeline and often involves some infrastructure upgrades (broadband, streaming, etc.).

■ Data Issues

- (1) Long, laborious, and costly **data migration** efforts that often result in explosion of “compressed” data.
- (2) Growing **privacy and ownership concerns**.

■ Compute Costs

Storage is affordable, compute is not. Need for frequent OT insights adds **significant costs**.

■ Latency

High latency due to batching of analytic tasks and communication back-forth to the cloud.

■ Support & Platform Maintenance

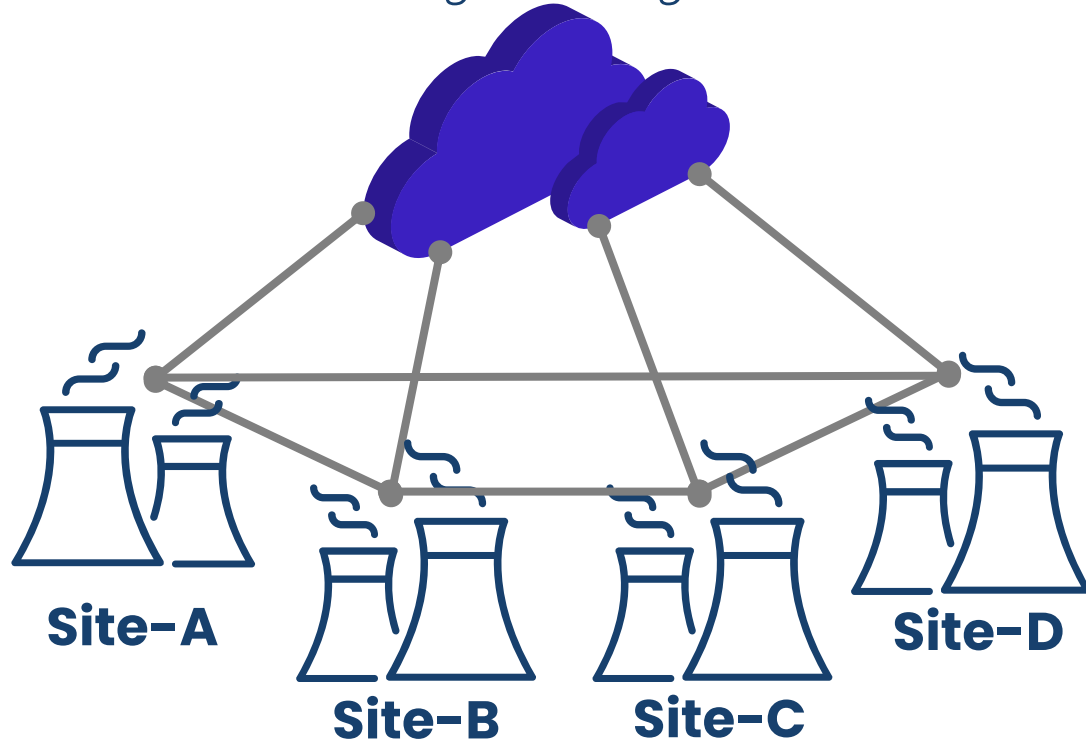
Requires a **large staff pool** of highly-skilled cloud architects, devops engineers, specialized data scientists, etc.

A NEW ANALYTICS PARADIGM

THE CURRENT STATE-OF-THE-ART in IoT ANALYTICS?

Cloud Analytics

Global Insights Using the Cloud

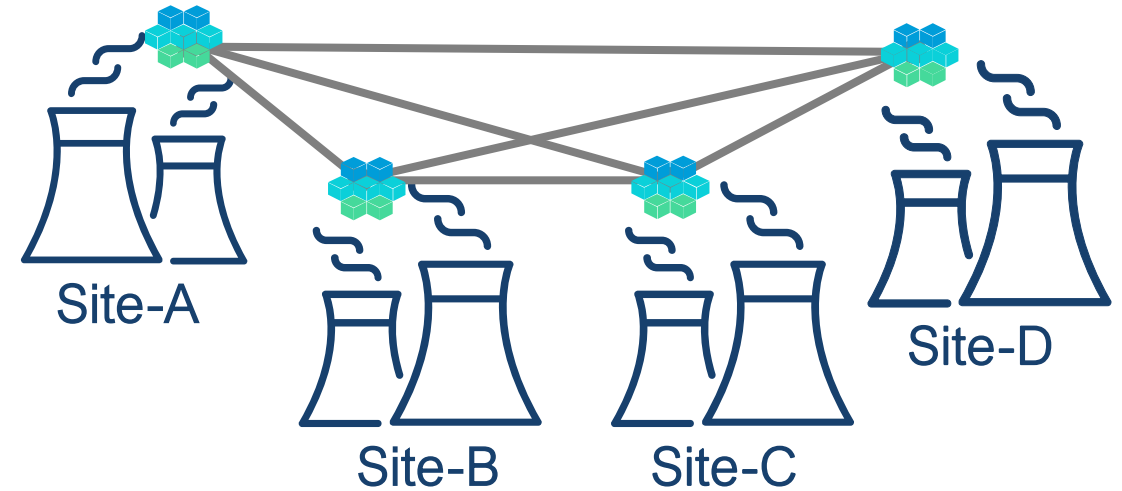


Conventional Approach

Migrate to data lake for performing centralized analytics.

Hyper-Connected Edge Analytics

*Global Insights **without** the Cloud*



New approach

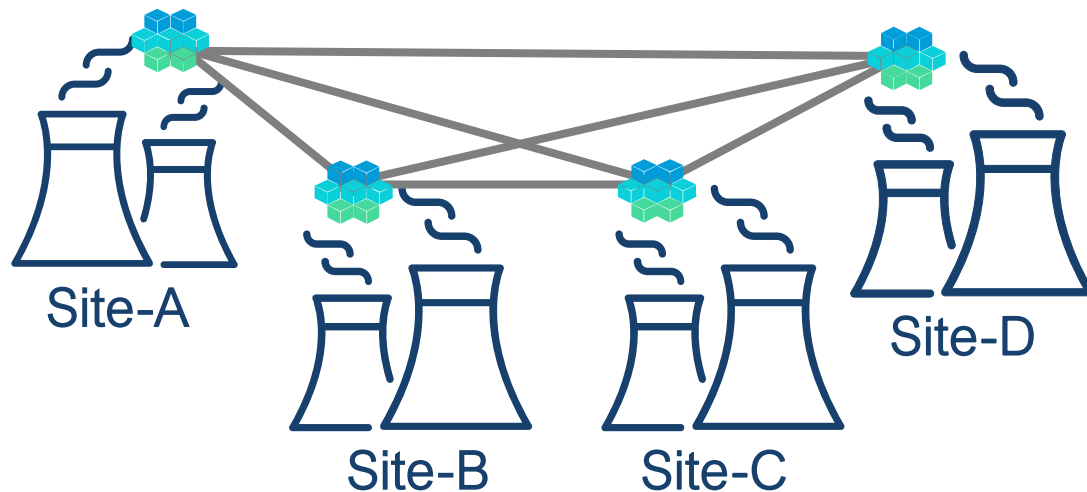
Decentralized, peer-to-peer using a private network.

HYPER-CONNECTED EDGE ANALYTICS

HOW DOES THE OUR PLATFORM WORK AND WHAT ARE ITS BENEFITS?

Hyper-Connected Edge Analytics

*Global Insights **without** the Cloud*



Patent pending technology leverages the PI suite of products

- **Simple and scalable architecture**

Easy to install, maintain, and scale across multiple plants and business units.

- **No cloud migration required**

Does not require moving data to the cloud.

- **Lower compute costs**

Lowers cloud compute costs by 40% to 60%.

- **Drives real-time insights**

Short latencies by leveraging local compute resources.

- **Little support requirements**

Can be maintained by a small IT team.

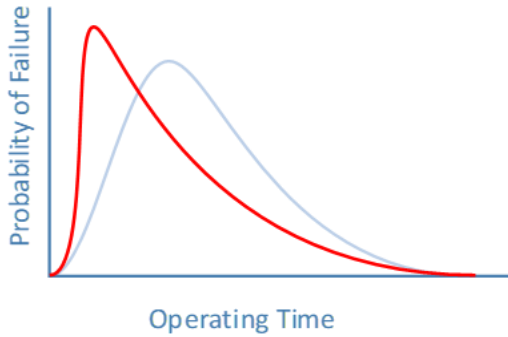
- **Enable continuous improvement**

“Citizen” data scientists quickly respond to new and evolving analytics needs at scale.

WHAT ARE THE PLATFORM CAPABILITIES?

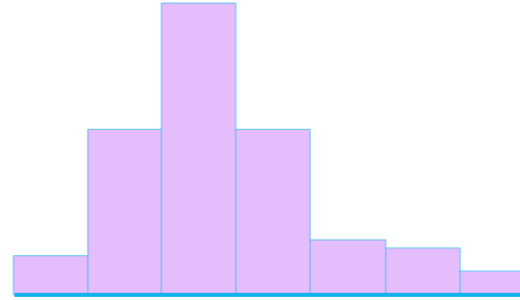
WHAT VALUE CAN DECENTRALIZATION PROVIDE?

Asset Operator



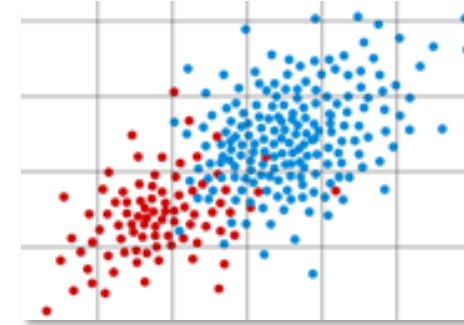
Diagnostics & Prognostics

Plant Manager

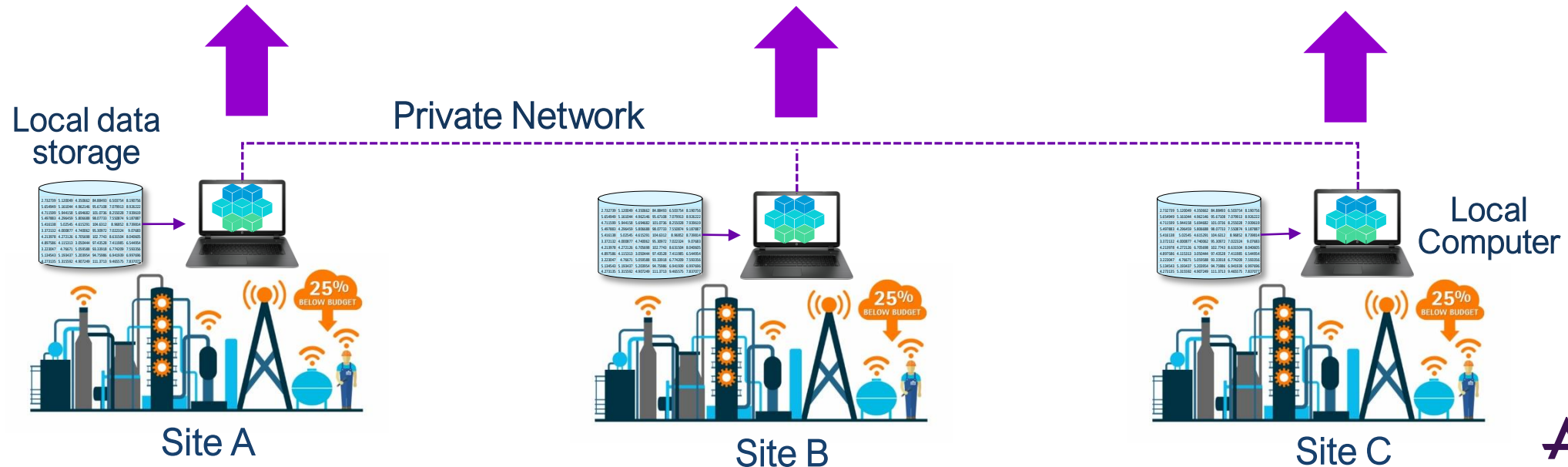


Multi-Plant Insights

Enterprise Team



Enterprise-wide ML/AI training



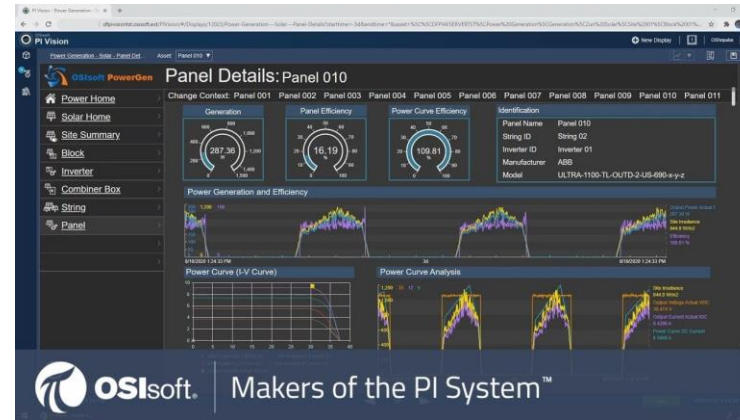
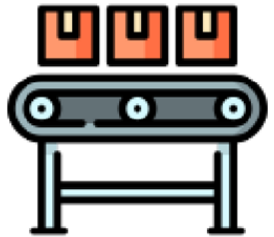
DETAILS OF INTEGRATING WITH "PI"

Extend what you can
do with your PI system



Inside the Plant

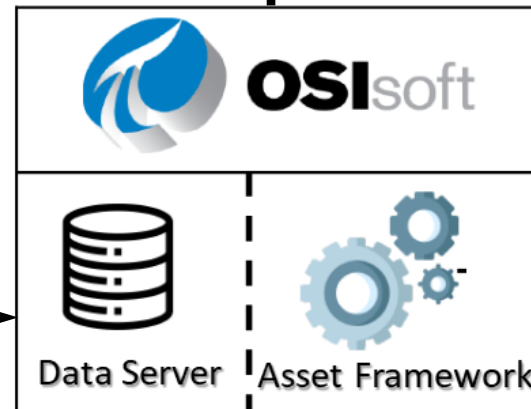
Plant Asset/Process



Data Visualization
& Basic Monitoring

Global Analytic Insights
from other sites

Local (Edge)
Analytic Insights



Plant Computer



Hyper-connected
"Edge Node"



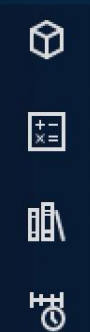
AVEVA



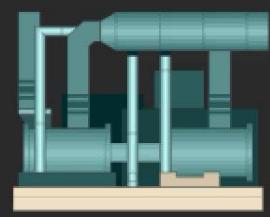
Case Studies

Thanks to Dr. Erica Trump and Jim O'Rourke for facilitating our PI Licenses!





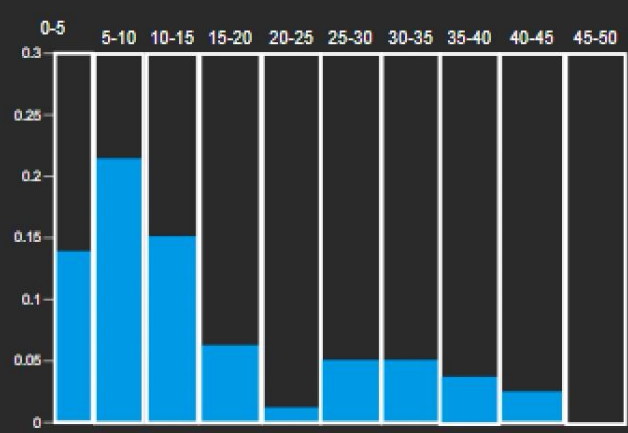
MultiPlantInsights



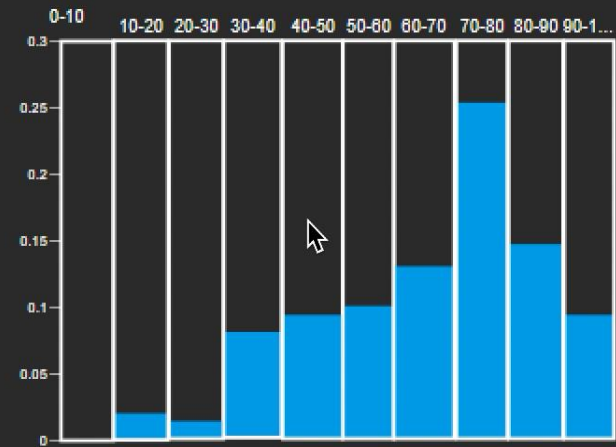
Multi-plant insights by Asset Class

Obtain Asset Class Insights across multiple facilities and plants

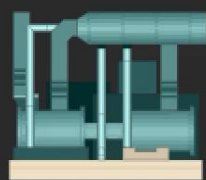
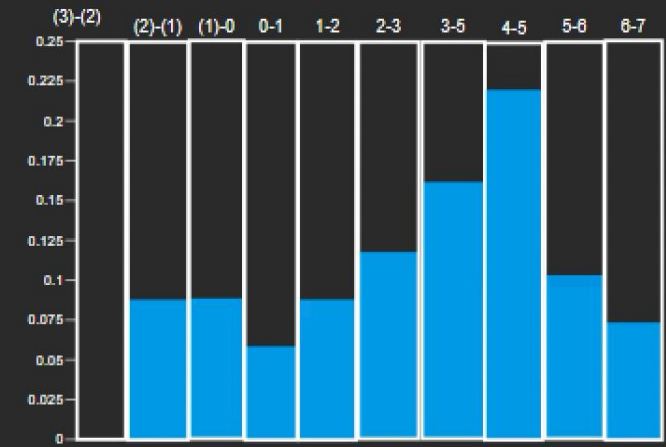
Throughput Rate



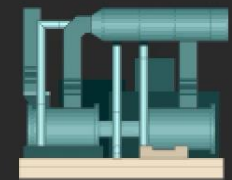
Energy Efficiency (kWhr)



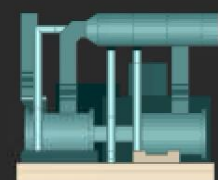
Failure Rate Analysis



Plant A Clarendon, SC



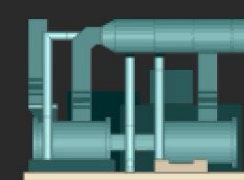
Plant B Savannah, GA



Plant C Springfield, OR



Plant D Newport, IN



Plant E Henderson, KY



Plant F Valliant, OK



ProcessOptimization



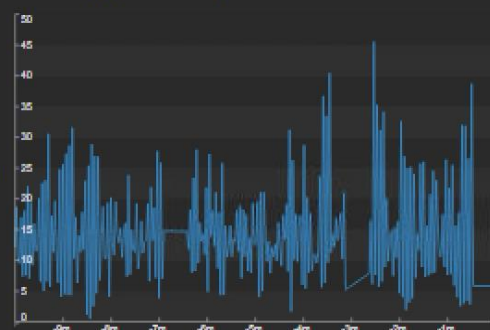
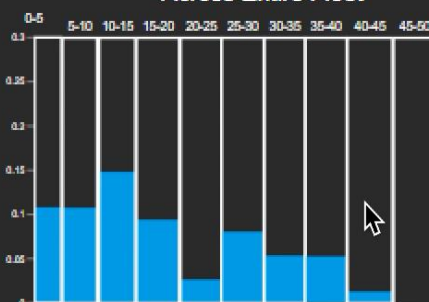
Process Parameter Optimization

This dashboard depicts the results of decentralized analytics and aggregation
Across PI Servers and Edge Data Stores that are geographically distributed

Throughput



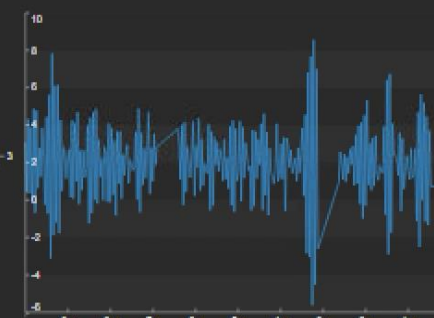
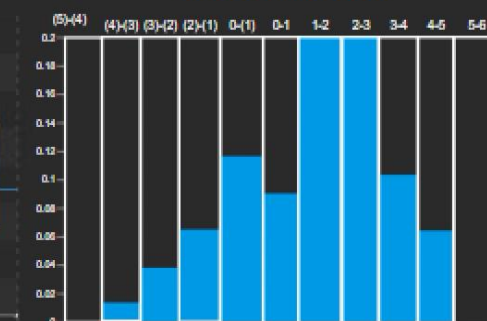
Throughput History at Local Site

Throughput Probability Distribution
Across Entire Fleet

Roll Speed



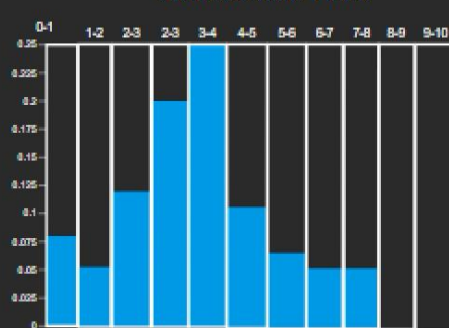
Roll Speed Local History

Roll Speed Probability Distribution
Across Entire Fleet

Surface Pressure



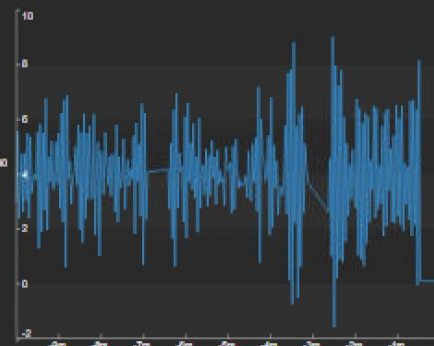
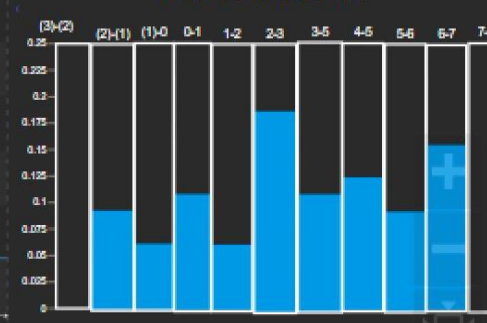
Surface Pressure Local History

Surface Pressure Probability Distribution
Across Entire Fleet

Feed Rate



Feed Rate Local History

Feed Rate Probability Distribution
Across Entire Fleet

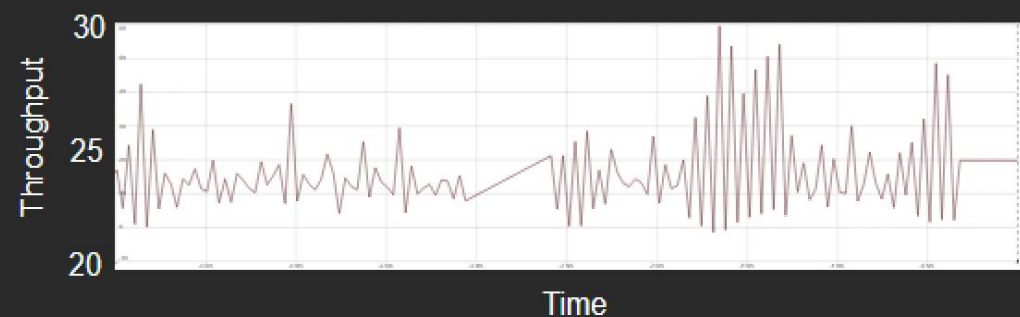
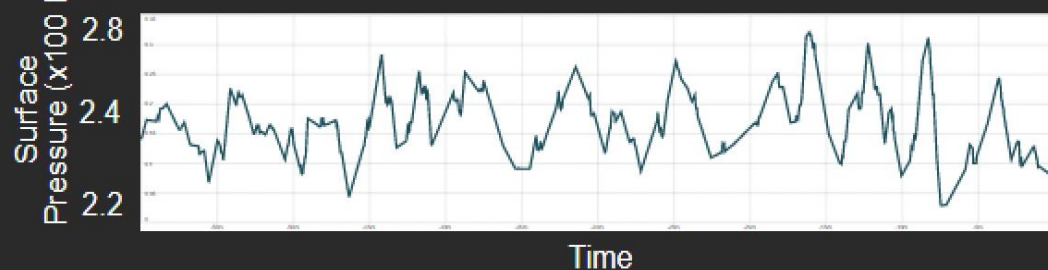
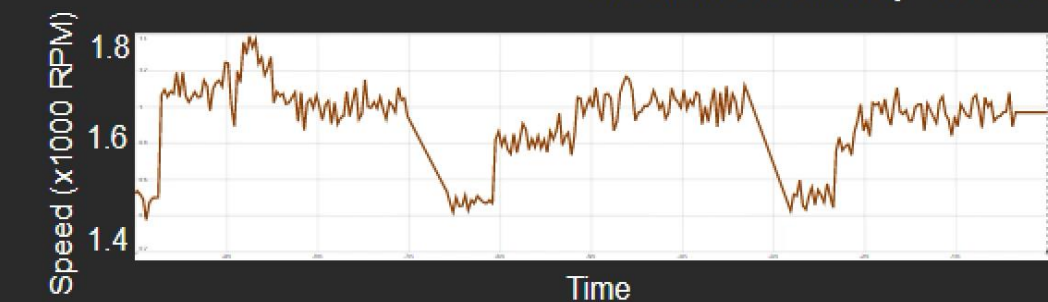
AnomalyDetection



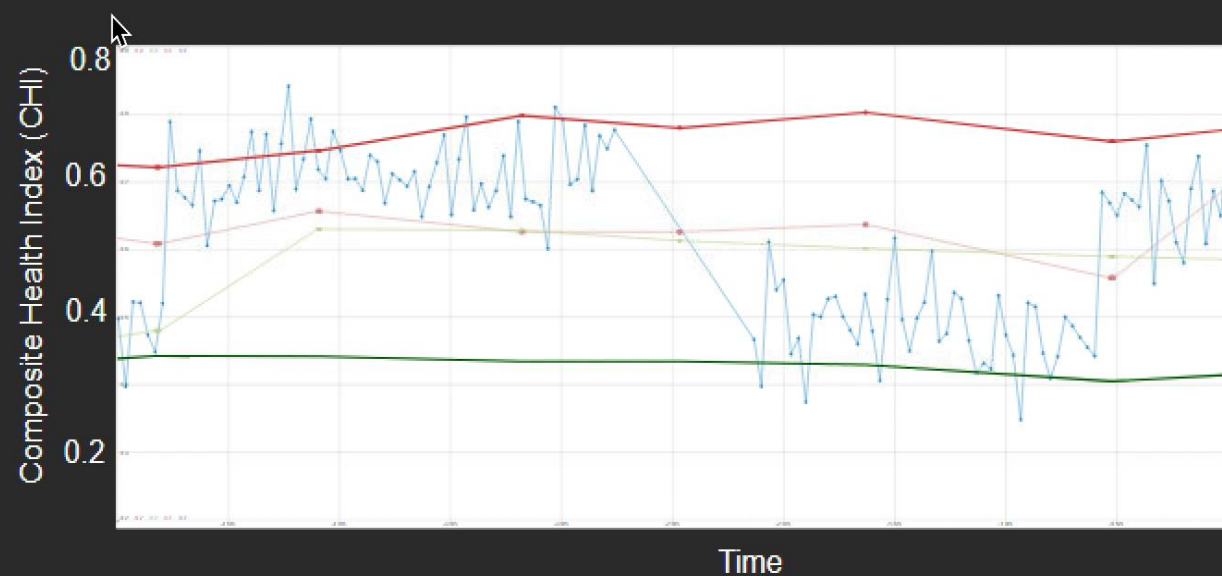
Predictive Analytics Suite

Composite Health Index (CHI) obtained through data fusion from multiple sensor

The CHI based anomaly detection model running local has been trained on data from all plants



Remaining Operational Life



PRACTICAL COMPARISON

- Consider a company that installed 4000 vibration sensors across 5 plant sites to monitor machine vibrations and detect anomalies “only”.

Cloud-based Analytics	Hyper-connected Edge Analytics
Aggregation of high-resolution frequency data (RMS & Peak Vibration)	Analytics model trained “locally” on high-resolution (frequency) data
ML analytics model loses key diagnostic insights	Global model provides key diagnostic insights
Cloud compute cost \$400,000 to \$600,000/year Cloud storage \$40,000 to \$60,000 /year	\$0 (no cloud compute required) [optional] Cloud storage \$40,000 to \$60,000 /year
Analytics team 6 to 10	Analytics team 2 to 4

PILOT OUR TECHNOLOGY

- Ideal Project Scope
 - Identical assets spread out across multiple plants/sites.
 - Each plant/site has a local “PI” server.
- Technical Requirements
 - “Desktop Class” machine at each plant with a private enterprise network.
 - Linux/ Windows 10 support. (WSL v2 or higher on Windows 10).
 - Docker or OCI based Podman support on each machine.
- Industrial Sectors
 - **Discrete manufacturing, Process Manufacturing** (chemical, pulp and paper, wood products, etc.), **Power Generation** (fossil fuel, nuclear, and wind), **Oil and Gas, Mining, Wastewater Management, Smart Buildings** (heating, ventilation and air conditioning).
- Resource Requirements:
 - Dedicated team for support.
 - Executive sponsor.
 - Available funding.

For pilots please reach out to me:

Dr. Paritosh Ramanan paritoshpr@gatech.edu

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