PI System for Big Data in the Classroom

Presented by Erica Trump, PhD Gopal GopalKrishnan, PE





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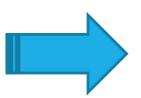
Need for Data Science in Curricula

- The data deluge
 - Companies own terabytes of data
 - Sensor-based data generated rapidly
- Value lies in making data actionable
 - Need for highly skilled employees

Evolving STEM Curricula: Data Education

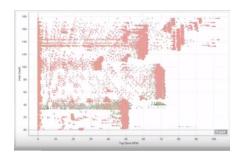
Traditional Approach

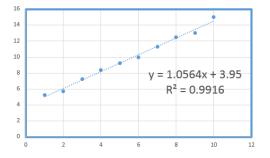
- Problem solving based on models
- Analysis of small datasets using basic statistics
- Simple data visualization



Data Science Approach

- Complex, real-world data
- Advanced analytical tools
- Interactive visualizations that aid in analysis





PI and Data Science



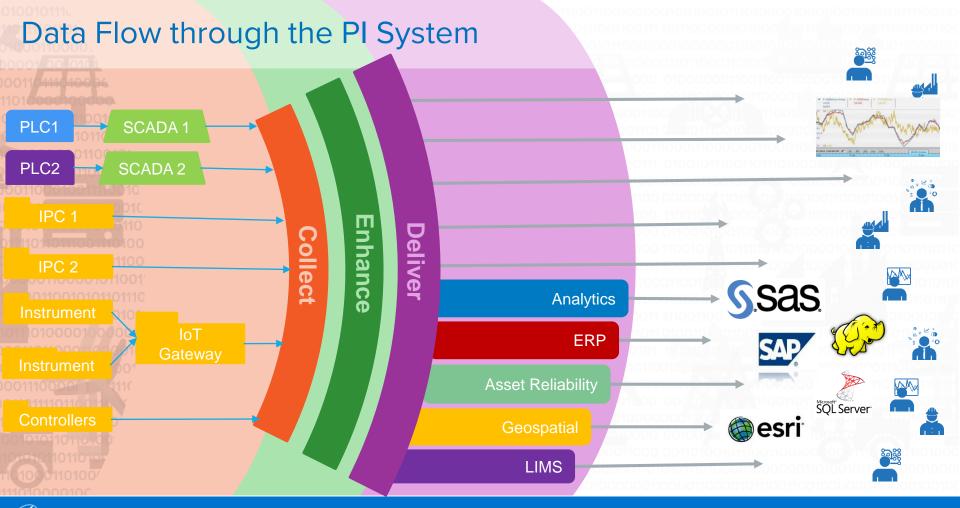




PI to Deliver Time-Series Data

- Live, time-series data seamlessly delivered to students
 - Many data sources on campus
 - Shared services and utilities
 - Buildings
 - IoT and lab-based sensors
 - Collaborations with industry
 - Hosted data and data sharing with other universities





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Toolbox for Data Science



PI Integrator for Business Analytics

• PI System data integrated with sophisticated BI tools

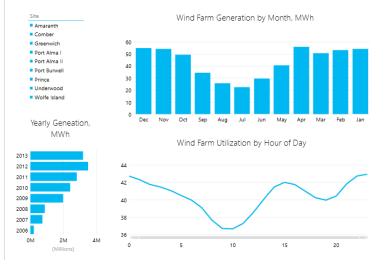




PI Integrator for Business Analytics

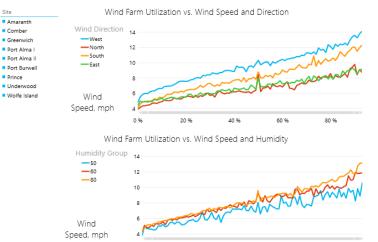
Power BI & wind farm power generation data

Site



Ontario Wind Power Generation

Ontario Weather Effects on Generation



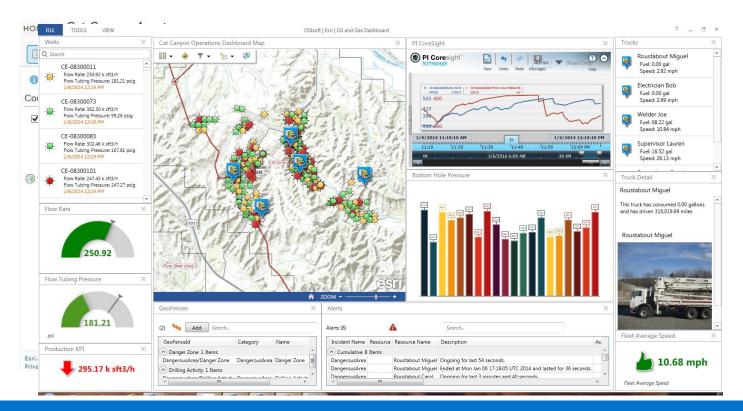
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PI Integrator for Esri ArcGIS



PI Integration with R

- R platform central to Data Science curriculum
 - Free and platform-independent tool
 - Complex statistical analyses and data visualizations accomplished easily
- PI Integrator for BA to bring in historical data
- PI Web API
 - Advantages include complex calculations, real-time deployment, ability to write back to PI



PI Integration with R

 Program developed to quickly pull large amounts of data into R

- We're sharing this as a learning resource
 - Look for it on GitHub with an announcement on PI Square

Data Science Lab



What we'll cover

- OSIsoft Learning Labs
- IIoT sensor data historical and live
- Remote access
- End-to-end machine learning examples
 - Predictive maintenance equipment failure
 - Predict hourly energy usage facility/building

Predict engine failure/remaining useful life

Lab Exercise

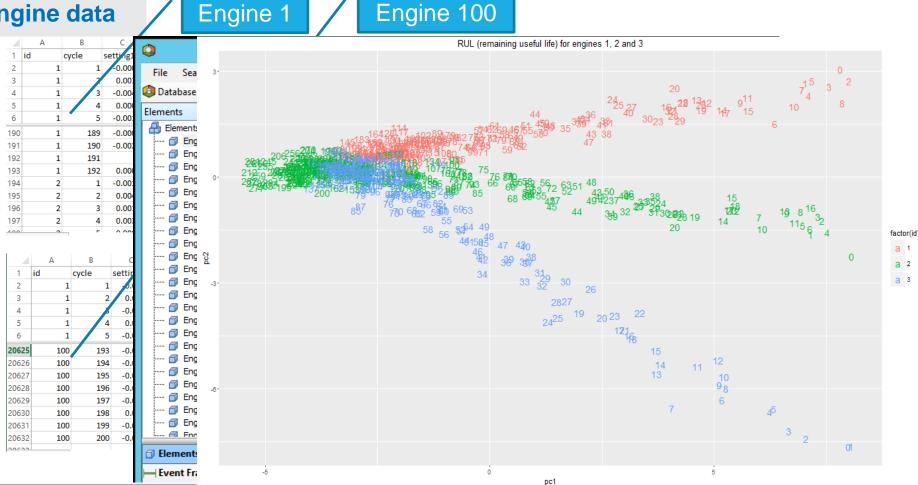
In a deployment with about 100 engines which are similar, sensor data such as rpm, burner fuel/air ratio, pressure at fan inlet, and twenty other measurements plus settings for each engine – for a total of about 2000 tags – are available. On average, an engine fails after 206 cycles, but it varies widely - from about 130 to 360 cycles.

Using an open source tool such as R for machine learning, you will create a multivariate model to predict engine failures within approximately a 10 cycle window *before they fail*. The lab will walk through the end-to-end data science process – preparing the dataset, visually exploring it, partitioning the data for training and testing, validating the models using previously unseen data, and finally deploying the model with AF asset analytics for predictive maintenance.

Level: 300 (familiarity with R will be useful but is not a requirement)

For hands-on experience, please enroll in the TechCon lab – Day3 or Day 4 <u>http://www.osisoft.com/uc2016/sf/day3.html</u> - Use Data Science for Machine Learning and Predictions based on PI System data

Engine data



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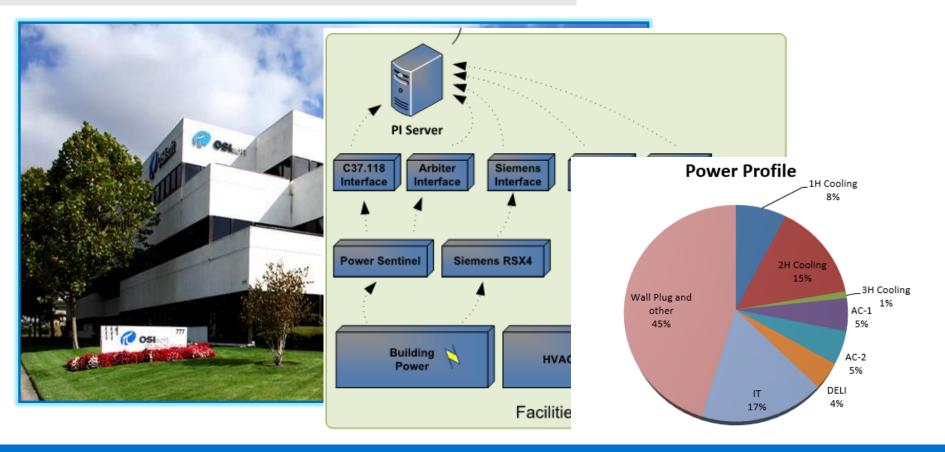
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Engine failure prediction

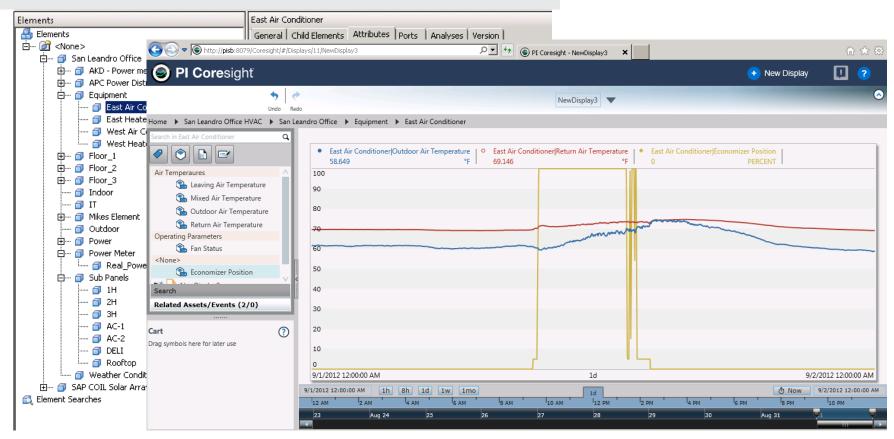
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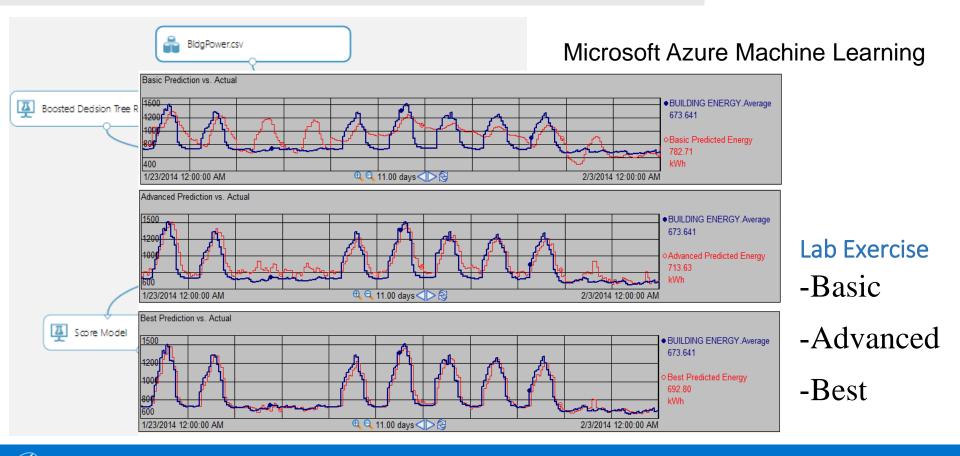
Building/facility – HVAC and Power



Building/facility – HVAC - Economizer



Building/facility - Predict hourly energy use



https://github.com/osisoft

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	PI-Web-API-Programming-Online-Course		★1	jµ 2	
	JavaScript and C# source code for the online course "Programming in PI Web API".				
	Updated on Oct 30, 2015				
	PI-Web-API-Samples Ja	iva Script	★0	12 O 4	
	A collection of example projects that uses the PI Web API				
	Updated on Oct 30, 2015				



Call to Action + Q&A

- Think about how these tools fit into your curriculum
- To discuss your course syllabus, contact Erica Trump

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谢谢 감사합니다 Danke Gracias Merci **Thank You** ありがとう Спасибо Obrigado



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