What's new with the OSIsoft Academic Hub

Dr. Erica Trump, Program Manager, OSIsoft

Dr. David Henthorn, Associate Professor, Rose-Hulman

Industry Trends: Data-Driven Systems

ASSET HEALTH

ENERGY EFFICIENCY

PROCESS OPTIMIZATION

QUALITY TRACKING

REGULATORY COMPLIANCE

SAFETY

Talent Pipeline and Skill Gap

Key skills needed in today's industry:

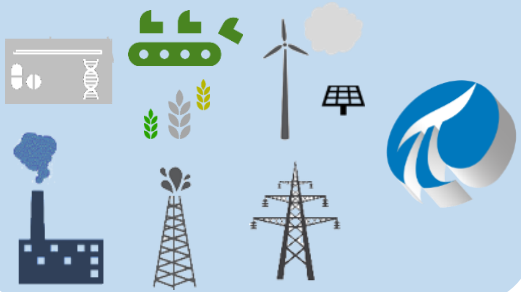
- Conceptual Knowledge
- Strong Math Skills
- Comfort with Large Data Sets
- Coding Ability
- Data Engineering Capability
- Communicate Information through Visualization
- Data Integrator

TransCanada

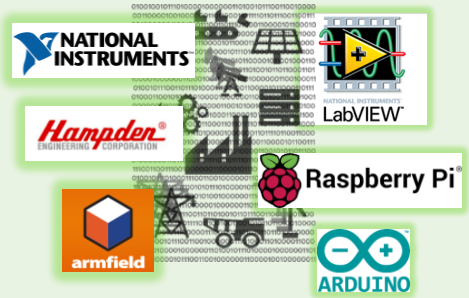
OSIsoft Academic Hub

Empowering the workforce of tomorrow with data-focused skills that industry needs

Industrial Process or Equipment



University Lab or Classroom



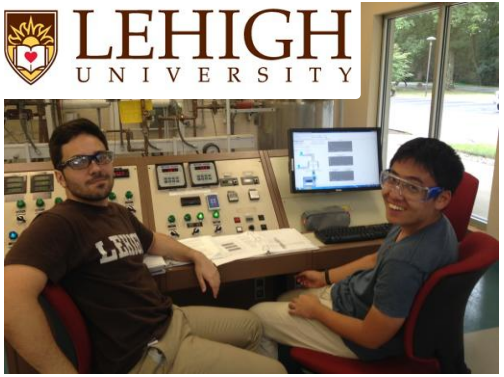
OSIsoft Academic Hub

Students access data anywhere, from any device

Engineering Lab-based Courses

- ✓ Bridge the gap between theory and **practice**
- ✓ Build skills in **data analysis** and **communication**
- ✓ **Industry-oriented approach** to experimental design
- ✓ Promote teamwork and **informed decision-making**

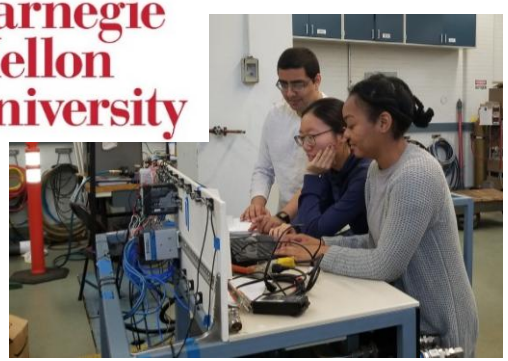
LEHIGH UNIVERSITY



Massachusetts Institute of Technology

ASU Arizona State University

Carnegie Mellon University



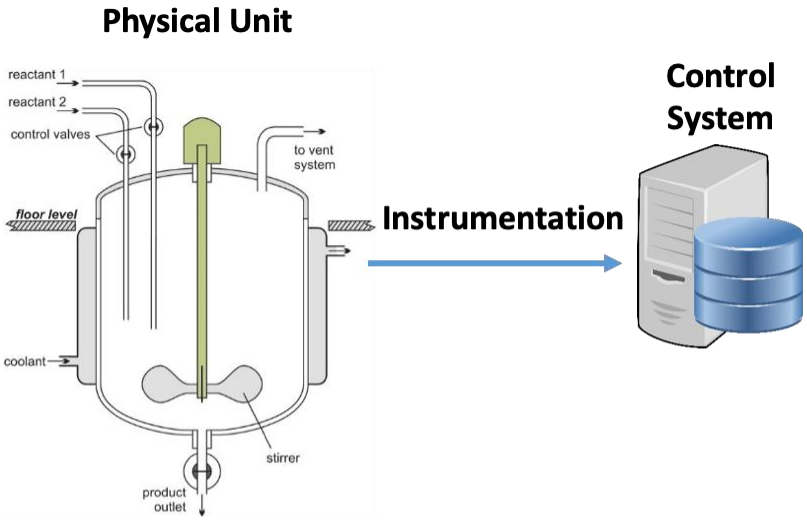
Academic Hub in the Unit Operations Lab at Rose-Hulman

David Henthorn
Chemical Engineering Department

Our lab…

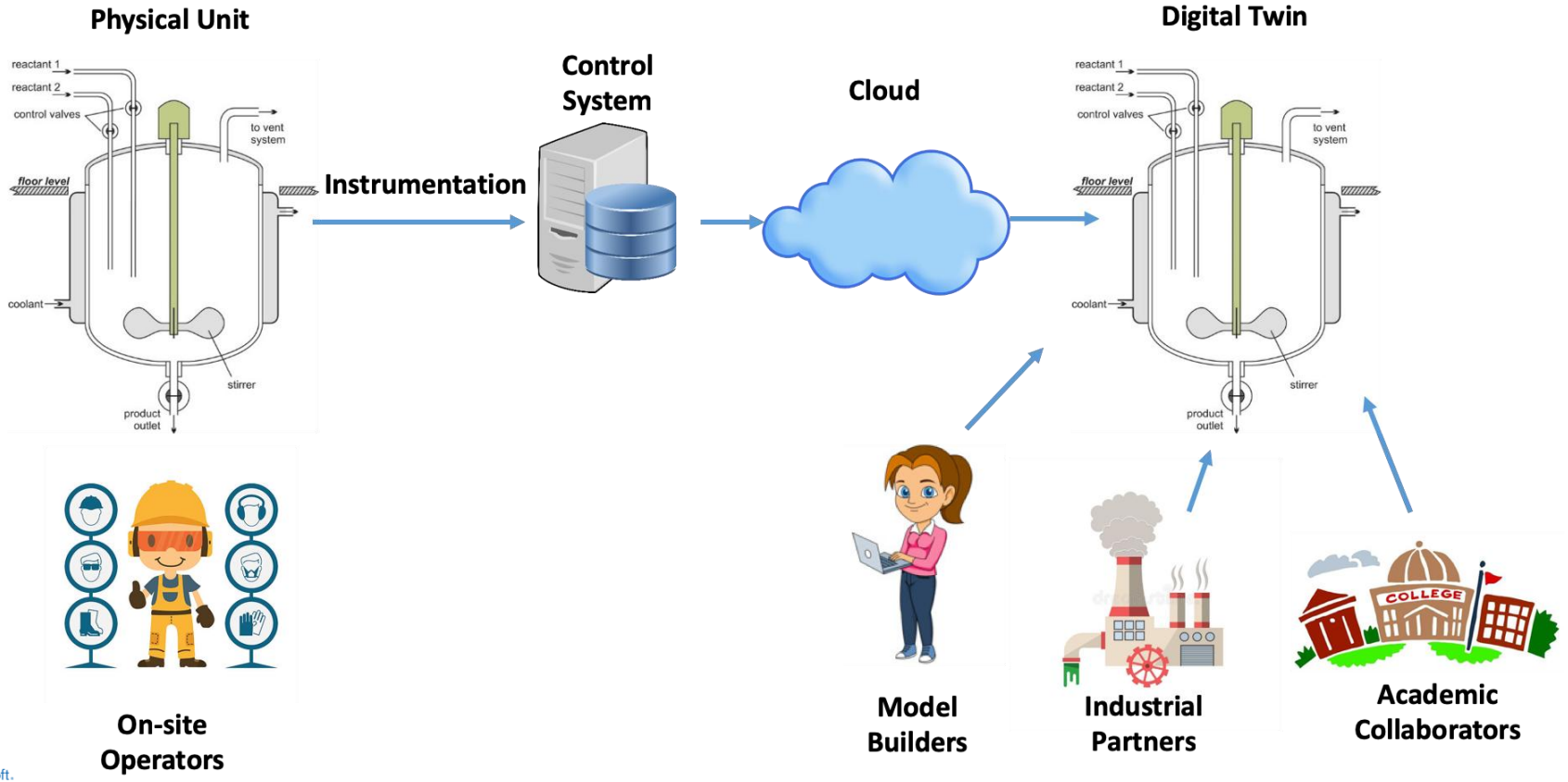
- Roughly 250 tags between our two ICS's
  - Production environment for lab – focus on learning Chem Eng. Fundamentals with secondary emphasis on seeing automation and control
  - Development system for advanced topics in controls – focus on ICS, instrumentation, and process strategies
- Great collaboration with industrial partners in the Midwest
- Students spend two afternoons per week in lab on experiments, roughly 7 hours per week

Where we were last year…



- Downloading the data after their lab day is done required **nineteen** steps
- Students often missed lab mistakes because they didn't process the data until after they were out of the lab

Where we are hoping to go…



On-Premise vs. In the Cloud

- We're trying both at the moment
  - PI AF and DA as part of our control network
    - Students interacting with it through Excel when in lab
  - Academic Hub
    - Managed service where the data lives
    - Accessible at any time
    - Data as a Service (Daas)

What OSIsoft Academic Hub does for us…

- Helps us focus more on education and less on infrastructure
  - We built our own cloud-based infrastructure for this (exciting!) but then of course have to maintain it (not as exciting)
- We are focused on experiential learning, and this gives students new experiences

Our students are changing

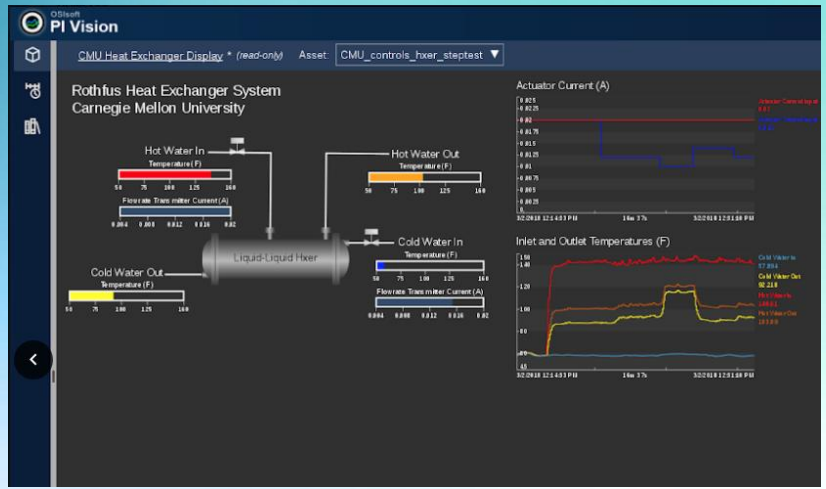
- Increasing number of our students are studying Chemical Engineering along with
  - Double major: CS or Software Engineering
  - Minors in Data Science, CS/SE, Computational Science, Internet of Things
- Our students have the interest in expanding what we can do in Chemical Engineering… just need the tools to make it happen
- Also connecting with more colleagues than ever through interdisciplinary projects with these students

Current Projects involving Academic Hub

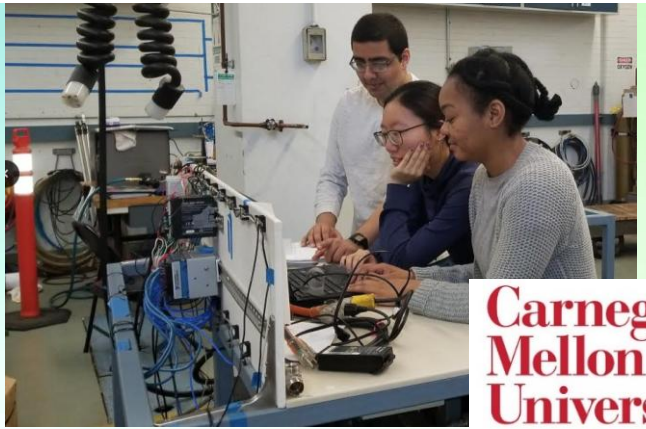
- Students interacting with it through the CSV appliance
  - Colab notebooks through Google (Python) right into cloud ML
  - Matlab for data science courses

- PI Web API calls
  - Unity 3D for augmented reality
  - Amazon Sumerian for a virtual laboratory with real live data
  - Serverless functions (AWS Lambda, etc.)

Student Exercise: Heat Exchanger Design & Modeling



Students follow industrial process in parallel with their HX project



Carnegie Mellon University

Control project carried out by 76 students in teams (~ 4students per team)

- **Session 1:** Collect data, transfer to MATLAB, design and simulate closed loop.
- **Session 2:** Run closed loop control test, collect data and analyze

CMU design team at work

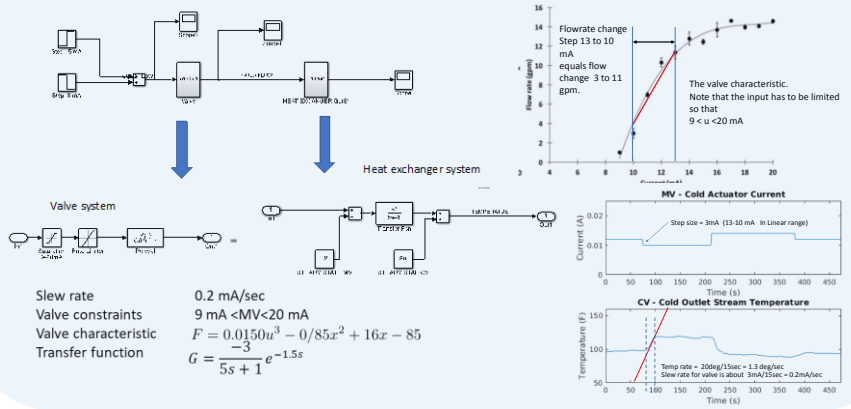
- Praveer Vyas
- Chrystear (Sicong) Liu
- Diane Ngounou

Student Exercise: Heat Exchanger Design & Modeling

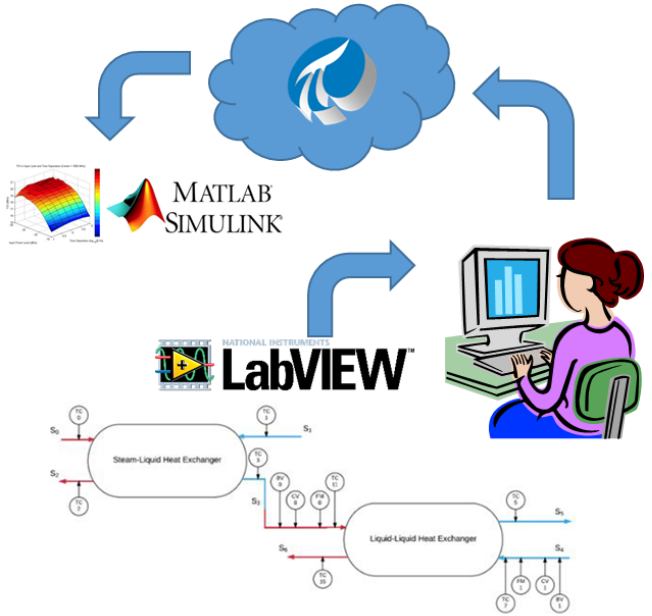
Objectives:

- ✓ Collect and visualize data using PI System
- ✓ Model step-response experiment using Simulink
- ✓ Implement and tune PID controllers on a real system

Simulink model of HX from lab data



Slew rate	0.2 mA/sec
Valve constraints	9 mA <MV<20 mA
Valve characteristic	$F = 0.0150u^3 - 0/85x^2 + 16x - 85$
Transfer function	$G = \frac{-3}{5s+1}e^{-1.5s}$

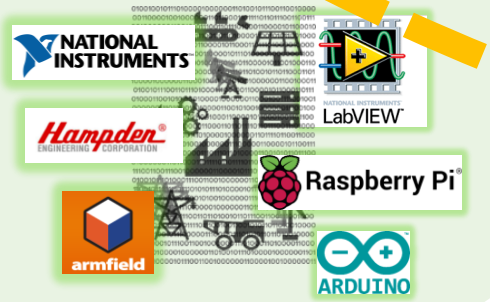


CMU equipment, two coupled heat exchangers

- Steam to generate hot water
- Hot water, cold water

Industrial Process or Equipment

University Lab or Classroom



OSIsoft Academic Hub

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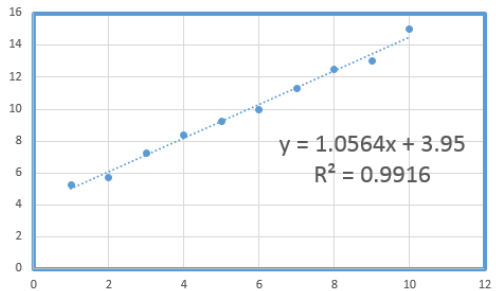
Evolving STEM Curricula: Data Education

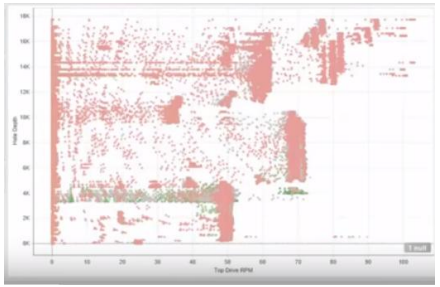
Traditional Approach

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



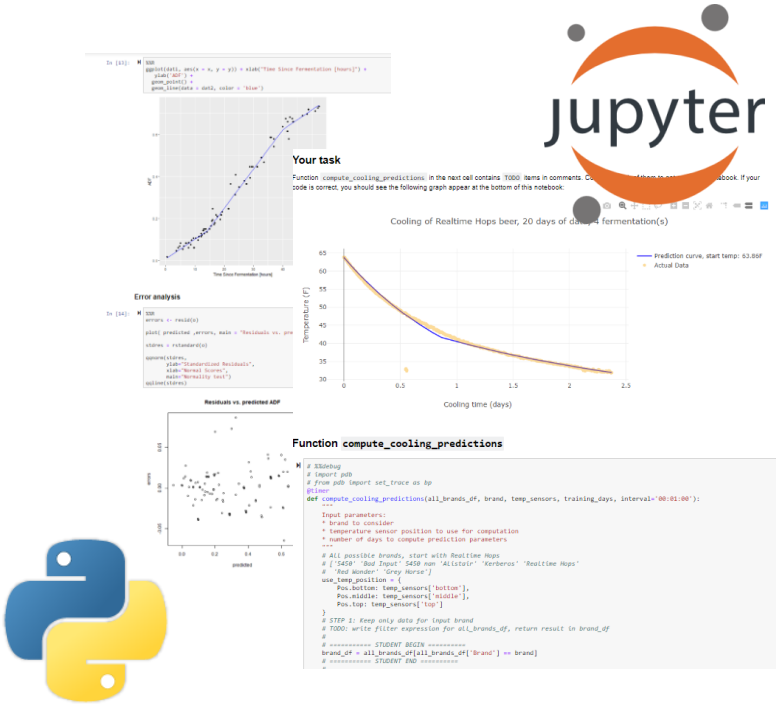
Data Science Approach

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



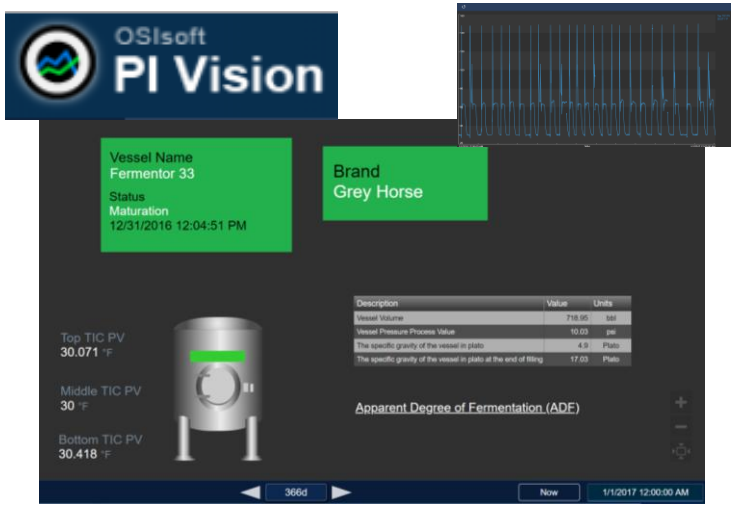
Data Science Modules with Real-world Datasets

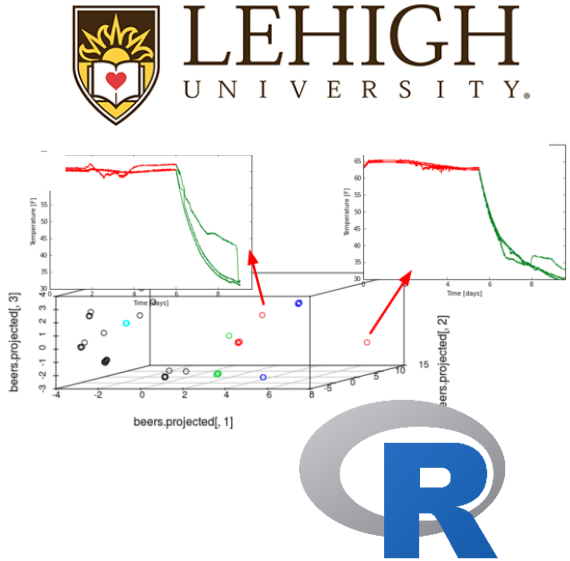
- End-to-End Exercises
  - ✓Introduction to business challenges
  - ✓Curated industrial data sets
  - ✓Data access from cloud server using web service calls
  - ✓Data cleansing and preparation
  - ✓Data exploration and visual analysis
  - ✓Application of analytical techniques using R, Python, or MATLAB



Data Science Modules and Real-world Datasets

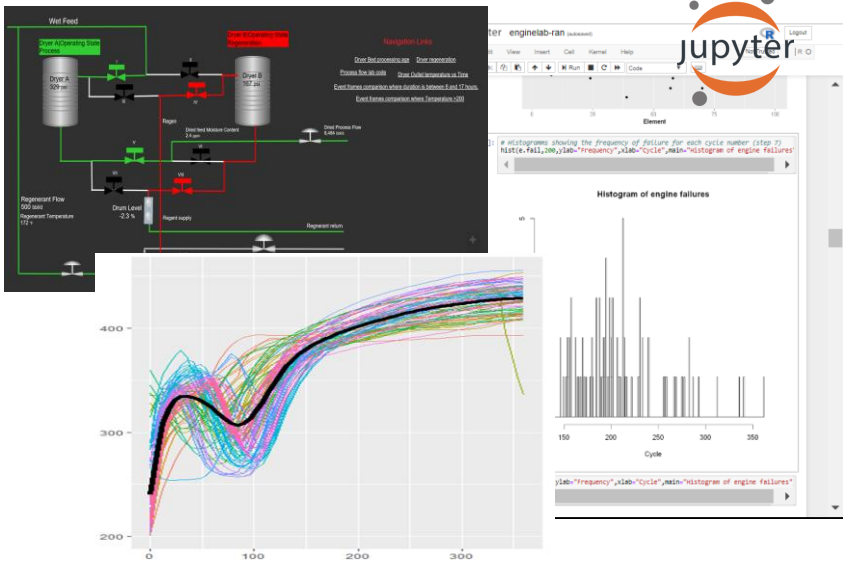
- ✓ PI Vision, Data Science Exercises, Jupyter Notebooks
- ✓ Brewery dataset – fermentation vessels, bright tanks, other processing equipment



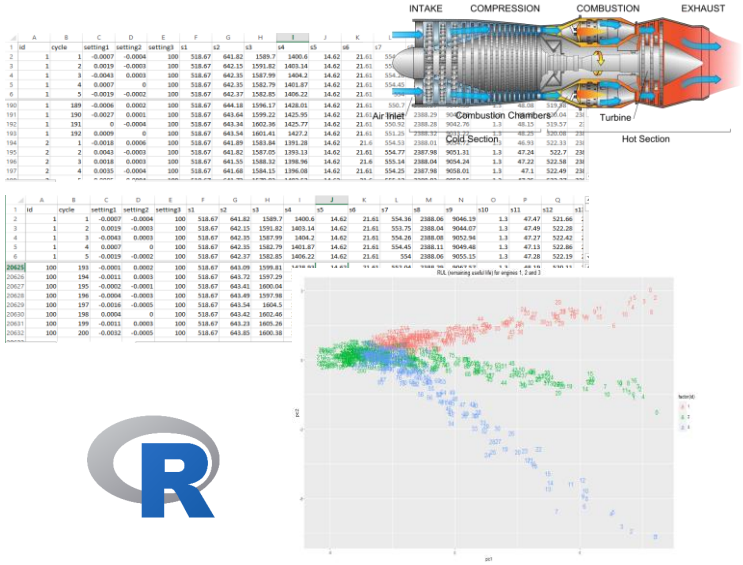


Data Science Modules: Oil & Gas, Predictive Maintenance

Oil & Gas:
Golden run for alkylation process feed dryer

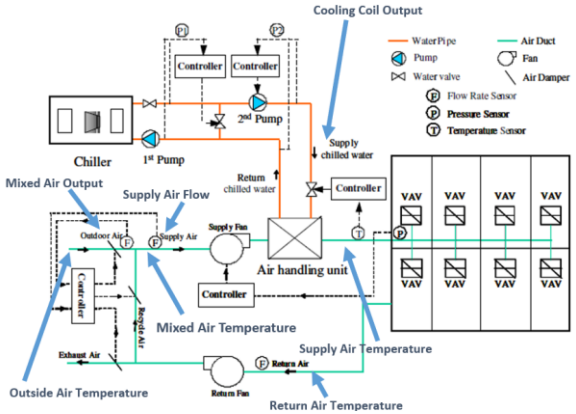


Predictive Maintenance:
Engine failure dataset to calculate remaining useful life



Buildings and Facilities Module

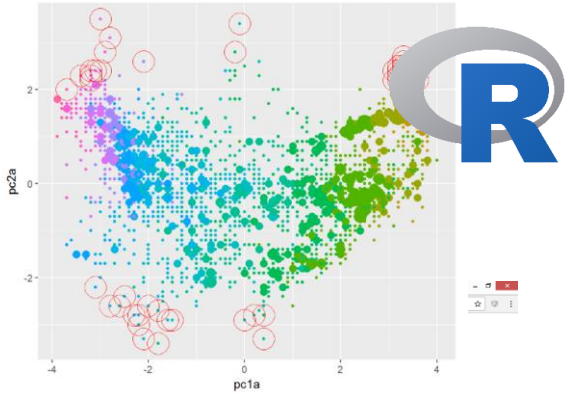
Buildings and Facilities:
Air Handler Unit - data visualization and anomaly detection



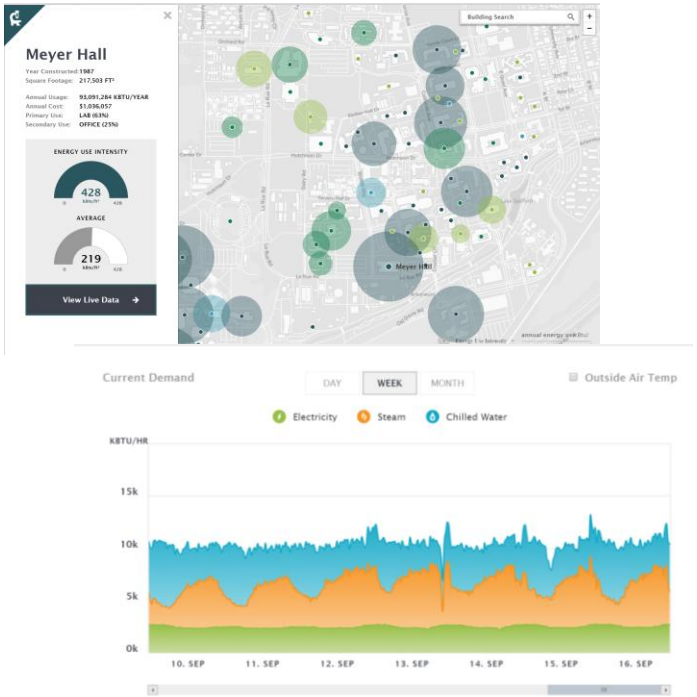
- Outside air temperature
- Relative Humidity
- Mixed air temperature
- Supply air temperature
- Damper position
- Chilled water flow
- Supply air flow
- Supply air fan power
- …

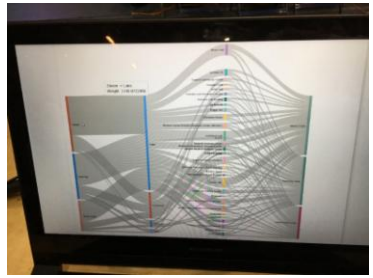
Principal Components

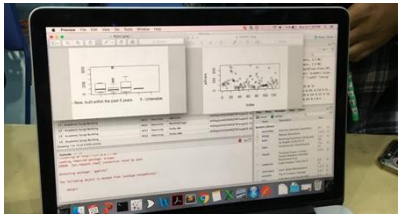
2D projection

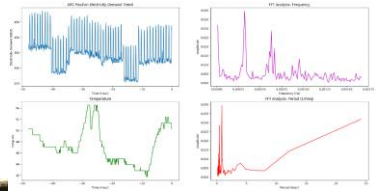


Campus Utilities Module (Work in Progress)



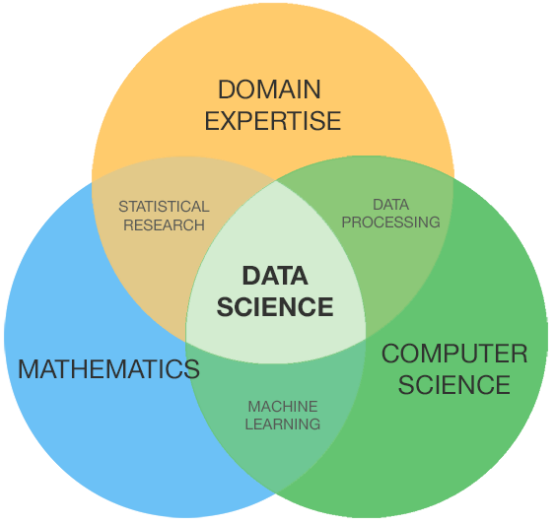






Why Share Real-world Data with Students?

- Improve student education!
  - Modern real-world problems are great motivators for students
  - Help them understand complex and dirty real-world data
- Educate students about your data science problems
  - Industry needs are often different from academic research
  - They will know what you care about, and can jump in when hired
- Increase your brand's visibility to students



PI World 2018 Keynote from Academia: Revamping Student Education with Real-World Data

Questions?

Please wait for the **microphone**

State your **name & company**

Please remember