OSISOFT ACADEMIC HUB FOR ENABLING STUDENT EDUCATION IN PROCESS DATA ANALYTICS

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Abstract Overview

The OSIsoft Academic Hub is an online service offering for engineering education that empowers the workforce of tomorrow with data-focused skills that are needed industry. The OSIsoft Data Education Community brings together OSIsoft's industry customers and valued partners in academia to inform the design of the service and to develop learning modules based on industry need. Using the Academic Hub, students work with complex, real-world data and the software tools that they will use in industry. Leading universities have integrated OSIsoft Academic Hub with student laboratory-based engineering courses and courses that incorporate the use of real-world data for analytics.

Keywords

Sensor-based data, education, online service, industry-academia partnerships.

Introduction

OSIsoft, LLC, a global leader in operational intelligence, delivers an open infrastructure to connect sensor-based data, operations and people to enable real-time and actionable insights. OSIsoft technologies are used by companies across a range of industries in activities such as exploration, extraction, production, generation, process and discrete manufacturing, to leverage streaming data to optimize and enrich their businesses.

OSIsoft offers the Academic Hub, an online data education platform service based on OSIsoft Cloud Services, to support academic efforts. OSIsoft works with its valued customers and leverages its expertise in industrial data to prepare students for today's industry by instilling time series data literacy. Using the Academic Hub, students work with complex, real-world data and the software tools that they will encounter in industry.

OSIsoft Academic Hub and Lab-based Courses

Engineering departments at leading universities are using the OSIsoft Academic Hub to advance Chemical Engineering Unit Operations, Controls, and other similar courses that incorporate the use of sensor data generated in student learning labs. The online service enables students to bridge gaps between theory and practice, build skills in data analysis and communication, adopt an industry-oriented approach to experimental design, and work collaboratively to promote informed decision making based on real-time data and analytics.

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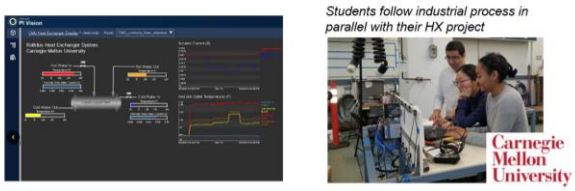


Figure 1. Students using the OSIsoft Academic Hub in Chemical Engineering Unit Operations Courses

OSIsoft Data Science Community and Industry-Academia Partnerships

OSIsoft hosts and provides access to real, industrial datasets. OSIsoft customers in industries including brewing, oil and gas, campus operations, and building management have contributed to the OSIsoft Data Science Community by sharing datasets and details about challenges faced in their operations.

One example that will be presented is from Lehigh University. Lehigh collaborated with Deschutes Brewing to develop learning modules to introduce engineering and computer science students to process data analytics. The modules are available to all users of the OSIsoft Academic Hub. Learning modules include prediction of the apparent degree of fermentation, cooling curve prediction, and PCA for visualization and outlier detection.

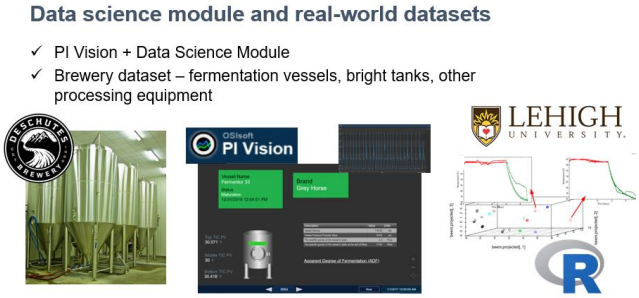


Figure 2. Process Data Analytics Learning Modules Developed by Lehigh University and Deschutes Brewing

Conclusions

OSIsoft offers the Academic Hub to empower the workforce of tomorrow with data-focused skills that are needed in today's industry. Leading universities are currently using the service within engineering lab-based and data science courses. The OSIsoft Data Education Community is supporting academia-industry partnerships to enrich student education by preparing them for careers that involve process data analytics.

OSIsoft Academic Hub

Empowering the workforce of tomorrow with data-focused skills for industry

Erica Trump, John Matranga – OSIsoft, LLC (Presented by John Matranga)

Campus Living Lab Virtuous Cycle

Smarter Campus Operation

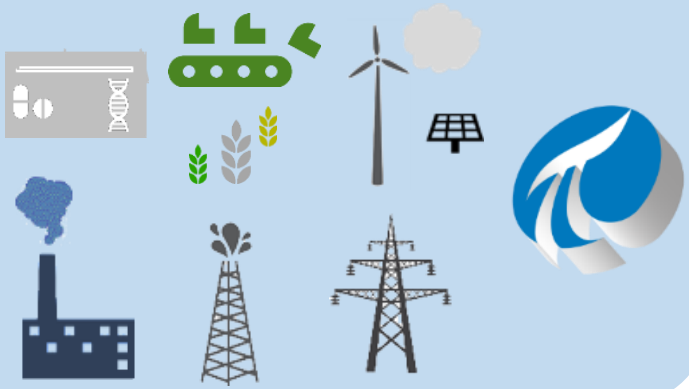
Real-Time Data Literacy

Fundamental Research

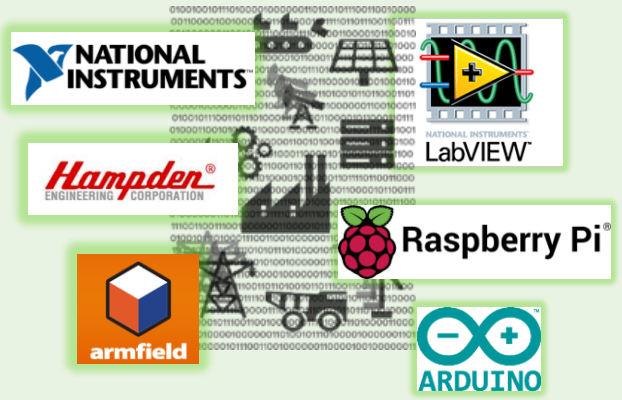
Student Engagement

OSIsoft Academic Hub

Industrial Process or Equipment

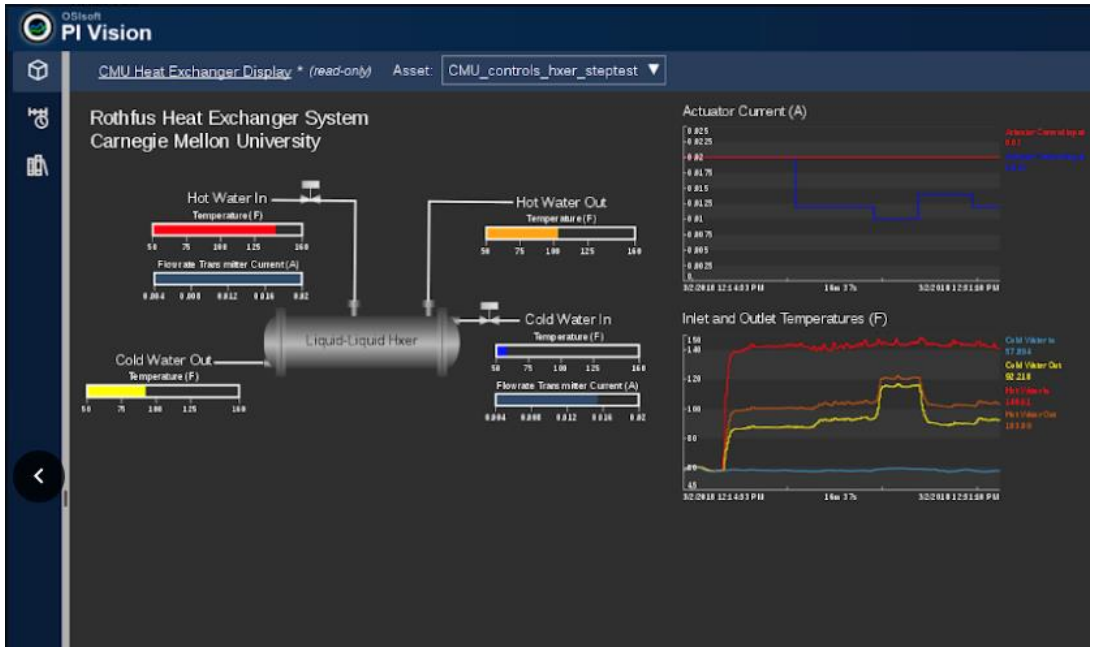


University Lab or Classroom

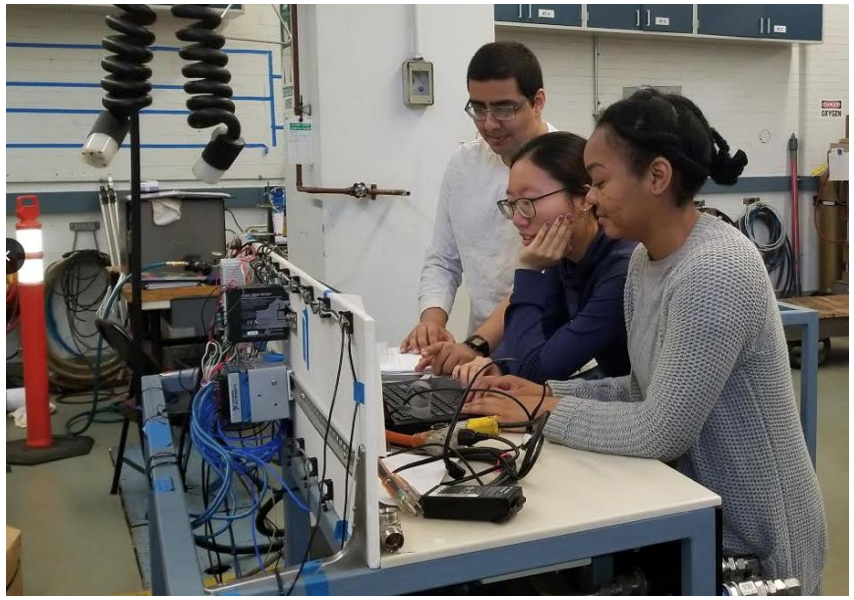


Students access data anywhere, from any device

Heat Exchanger Design & Modeling



Students follow industrial process in parallel with their HX project



Control project carried out by 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

Carnegie Mellon University

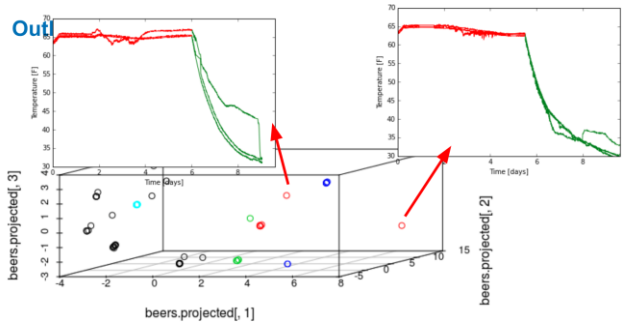
CMU design team at work

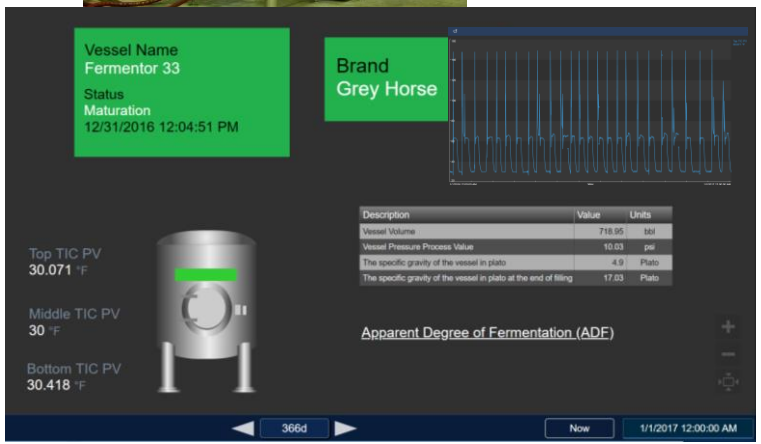
- Praveer Vyas
- Chrystear (Sicong) Liu
- Diane Ngounou

Special Thanks Erik Ydstie

Real-world Datasets

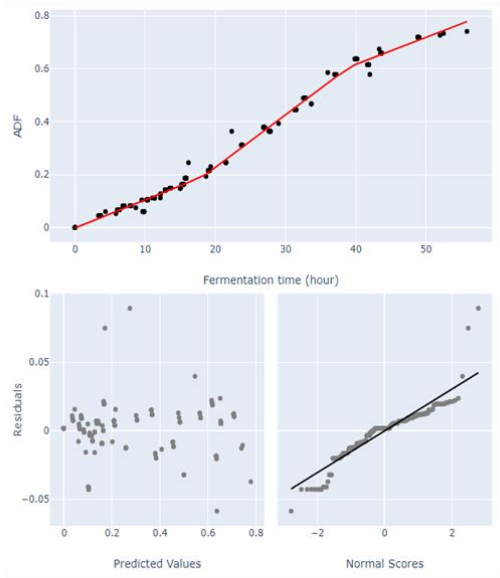
- ✓ PI Vision, Data Science Exercises, Jupyter Notebooks
- ✓ Brewery dataset – fermentation vessels, bright tanks, other processing equipment





LEHIGH UNIVERSITY

$$Y = \begin{cases} \alpha_1 + \beta_1 X + \epsilon, & X \le \gamma_1 \\ \alpha_2 + \beta_2 X + \epsilon, & \gamma_1 \le X \le \gamma_2 \\ \alpha_3 + \beta_3 X + \epsilon, & \gamma_2 \le X \end{cases}$$



Students will fit and evaluate predictive models.

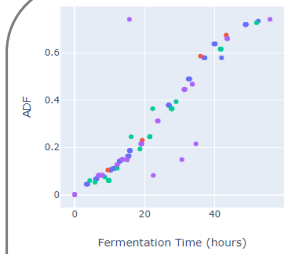
Use **OSIsoft Cloud Services** (OCS) to retrieve process data from Deschutes

```
config = configparser.ConfigParser()
config.read("config.ini")

hub_client = HubClient(
    config.get("Access", "ApiVersion"),
    config.get("Access", "Tenant"),
    config.get("Access", "Resource"),
    config.get("Creadentials", "ClientId"),
    config.get("Credentials", "ClientSecret"),
)

namespace_id = config.get("Configurations", "Namespace")

all_brands_df = hub_client.dataview_interpolated_pd(
    namespace_id, DATAVIEW_ID, START_INDEX, END_INDEX, INTERVAL
)
```

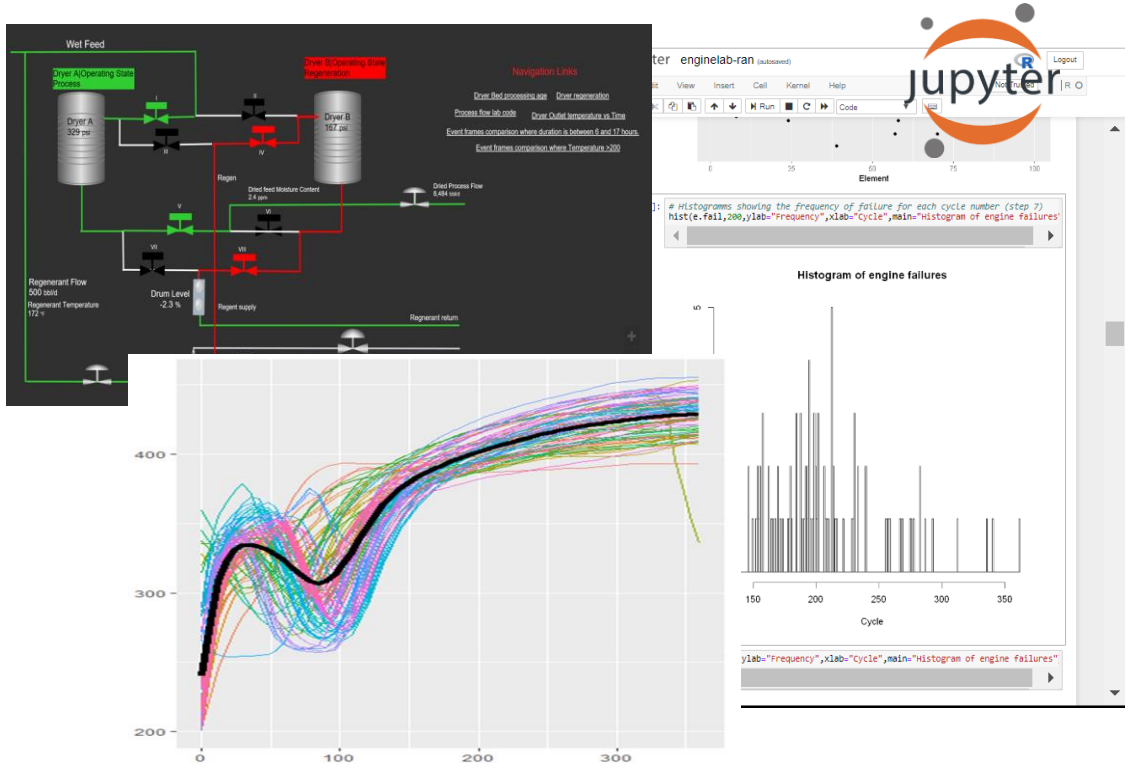



```
# filter out outliers
# TODO: Complete filter expressions.
# ========== STUDENT BEGIN ==========
all_brands_df = all_brands_df[
    ~((all_brands_df["Elapsed"] < 20) &
(all_brands_df["ADF"] > 0.5))
    & @@@ Your code here @@@
    & @@@ Your code here ??? @@@
]
# ========== STUDENT END ==========
```

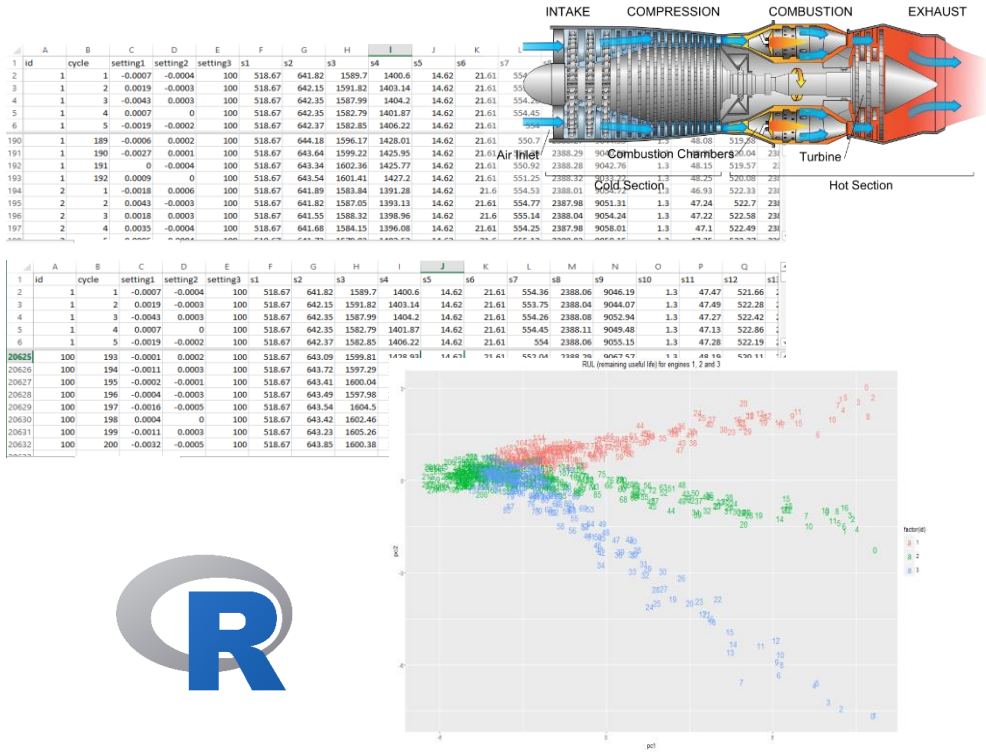
Students will work through examples of how to clean real process data, which are often “dirty”

Data Science Modules: Oil & Gas, Predictive Maintenance

Oil & Gas:
Golden run for alkylation process feed dryer

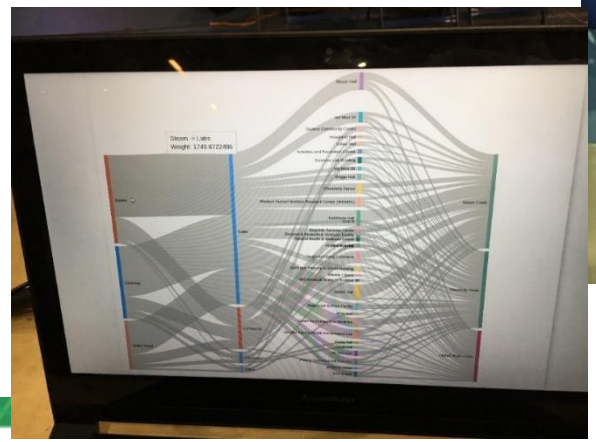


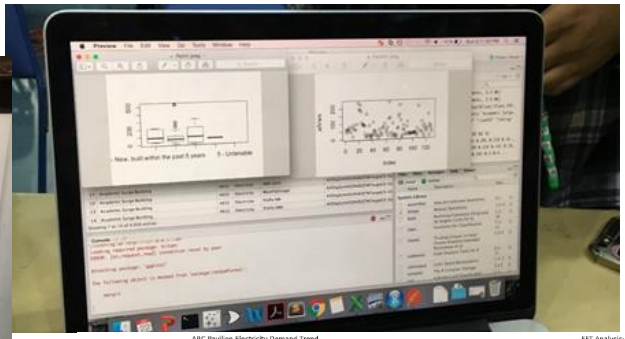
Predictive Maintenance:
Engine failure dataset to calculate remaining useful life

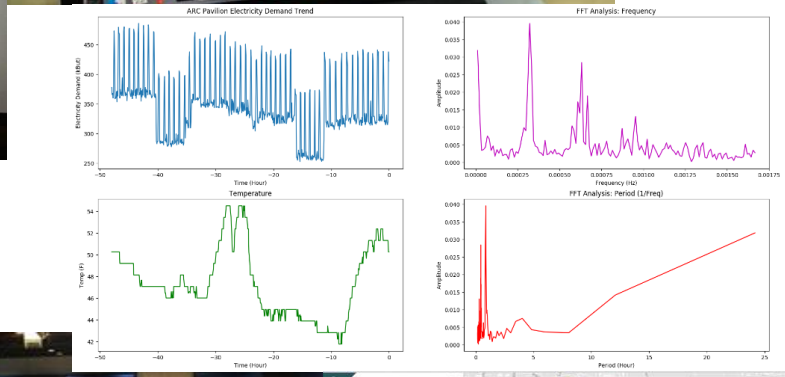


Smart Campus & Utilities Module

- ~3 Years of Data
- ~150 Buildings
  - Power
  - Water
  - Steam
  - Chilled Water
  - Ambient Temperature
  - WiFi Connections

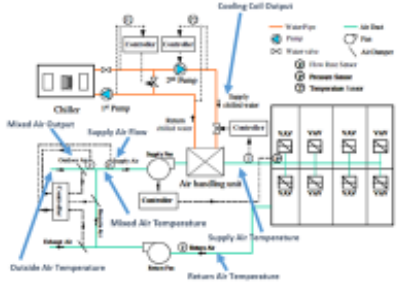






Buildings and Facilities Module

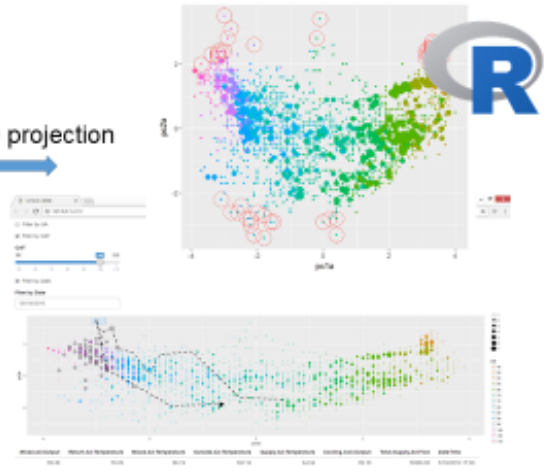
Buildings and Facilities:
Air Handler Unit - data visualization and anomaly detection

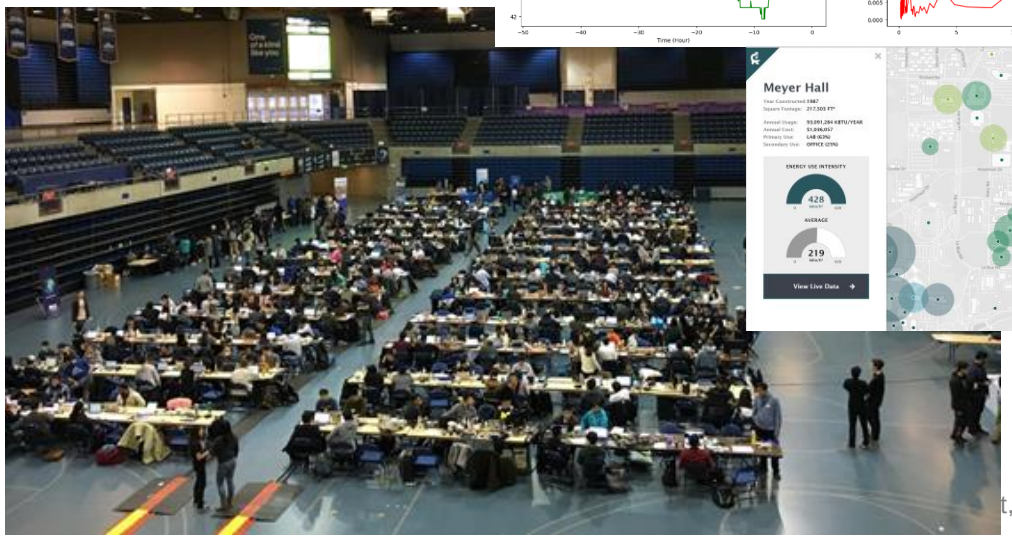


- Outside air temperature
- Relative Humidity
- Mixed air temperature
- Supply air temperature
- Damper position
- Chilled water flow
- Supply air flow
- Supply air fan power
- ...

Principal Components

2D projection





How Can You Help?

- Industry
  - Data Sets
    - Pilot Plants
    - Heat Exchangers
    - Pumps
    - ….
  - Motivation
  - Short Course
- Academia
  - Unit Operations
  - Learning Modules
    - Data Science
    - Model & Control
    - Design
    - Advanced Concepts
  - Short Course

More Information

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