



Machine Learning Applications for Data Center Optimization

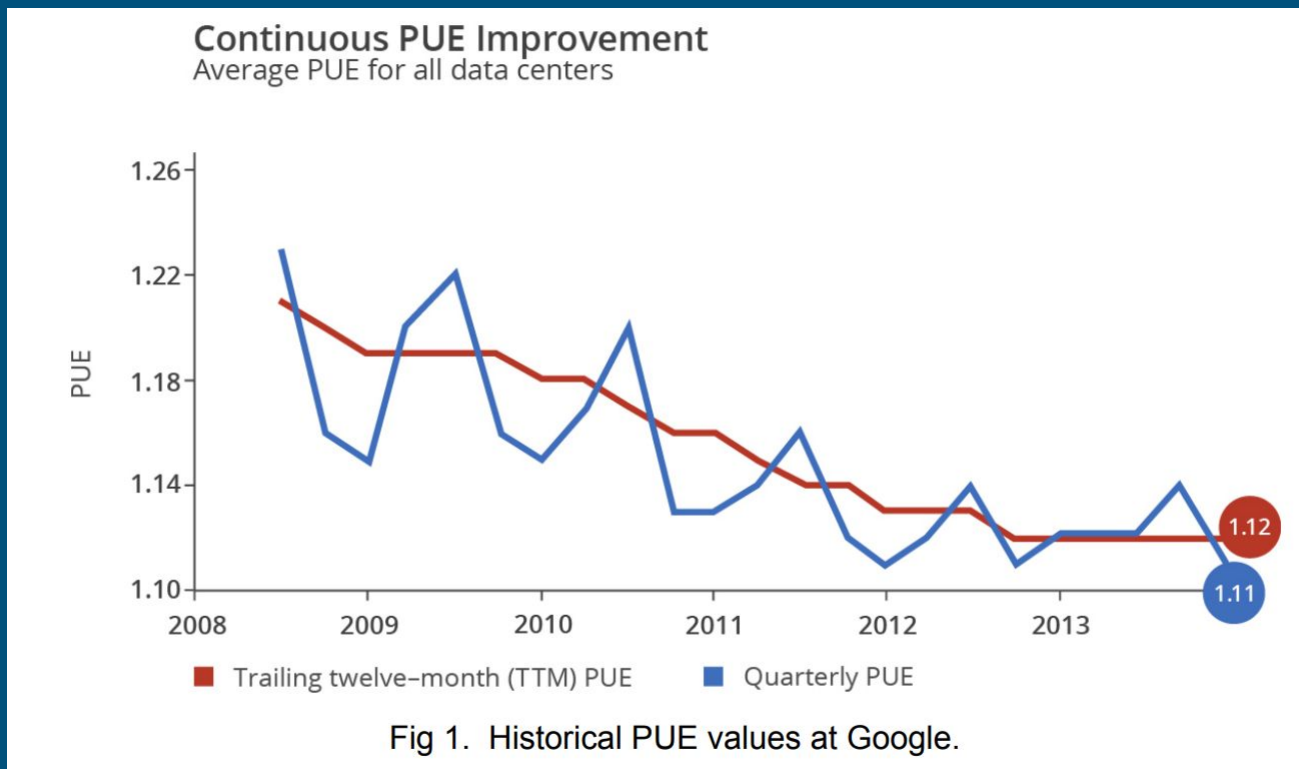
By Jim Gao, Google



Intro

- Rapid growth of large- scale data centers (DCs)
- Increasing pressure from energy costs and environmental responsibility (1.3% of the global energy usage in 2010)
- What have done? PUE of 1.21 in 2008 to 1.12 in 2013.
- PUE: Power usage effectiveness, less the better

Intro



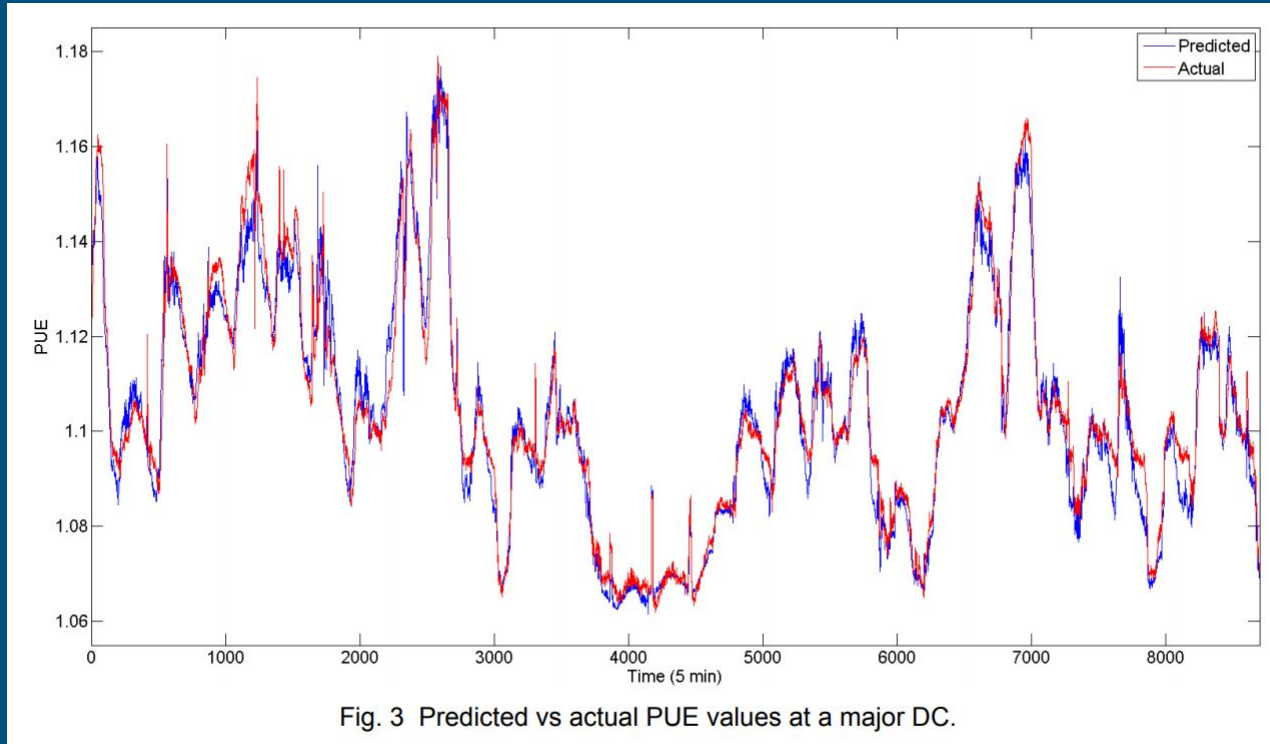
Methodology

- Why ML?
 - A wide variety of attributes, potential interactions
 - The sheer number of possible equipment combinations and their setpoint values
 - We are rich (in data)!

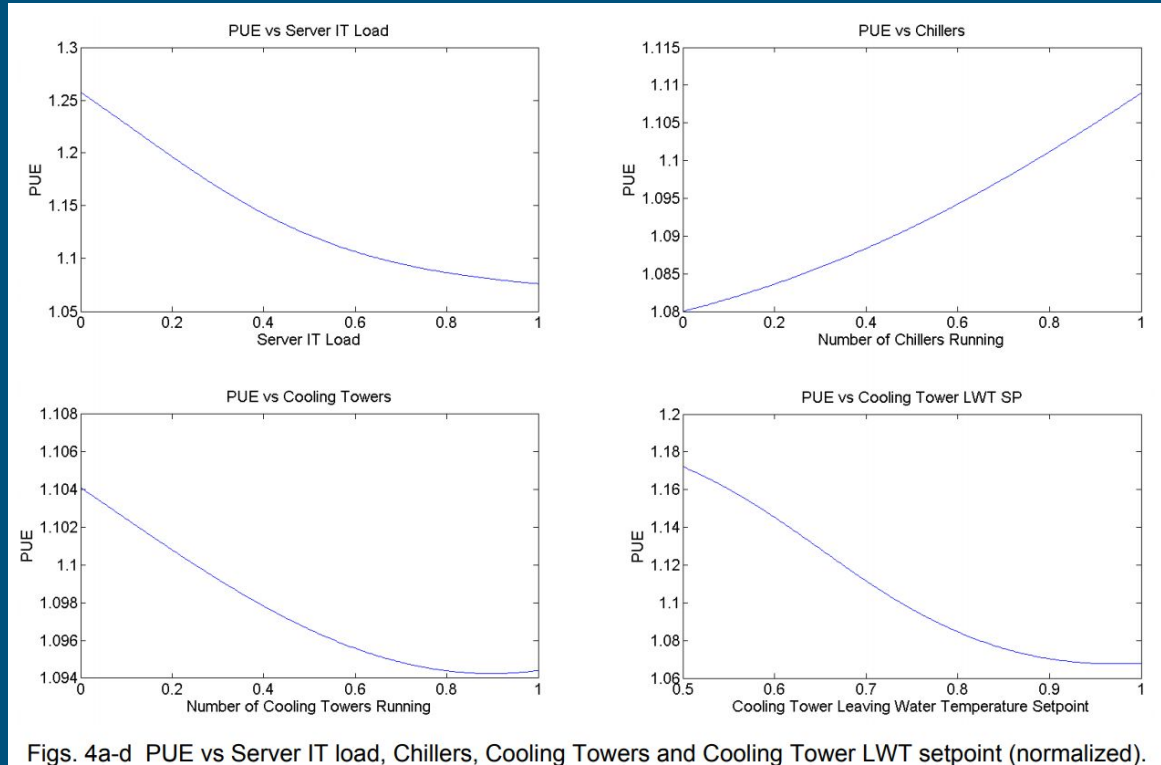
Methodology

- 5 hidden layer, 50 nodes for each layer
- values of a feature vector z are mapped to $[-1, 1]$

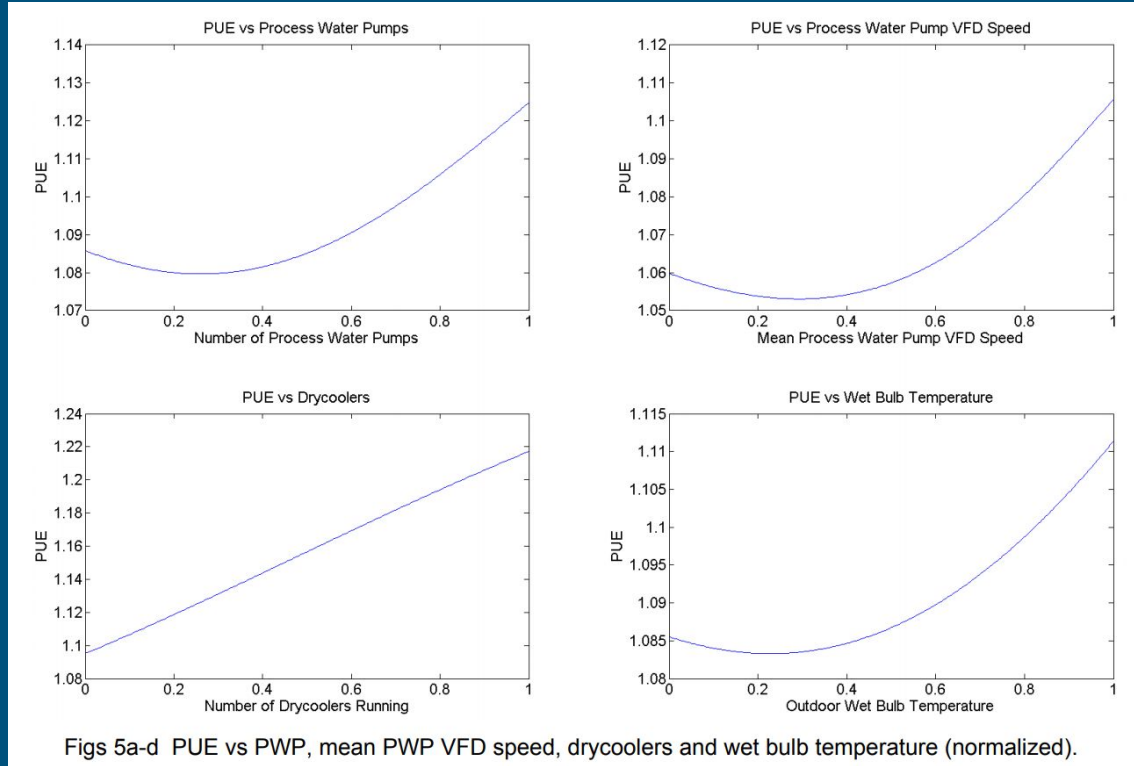
Result



Result



Result



Application

- Simulating Process Water Supply Temperature Increases
- Catching Erroneous Meter Readings
- DC Plant Configuration Optimization

Application

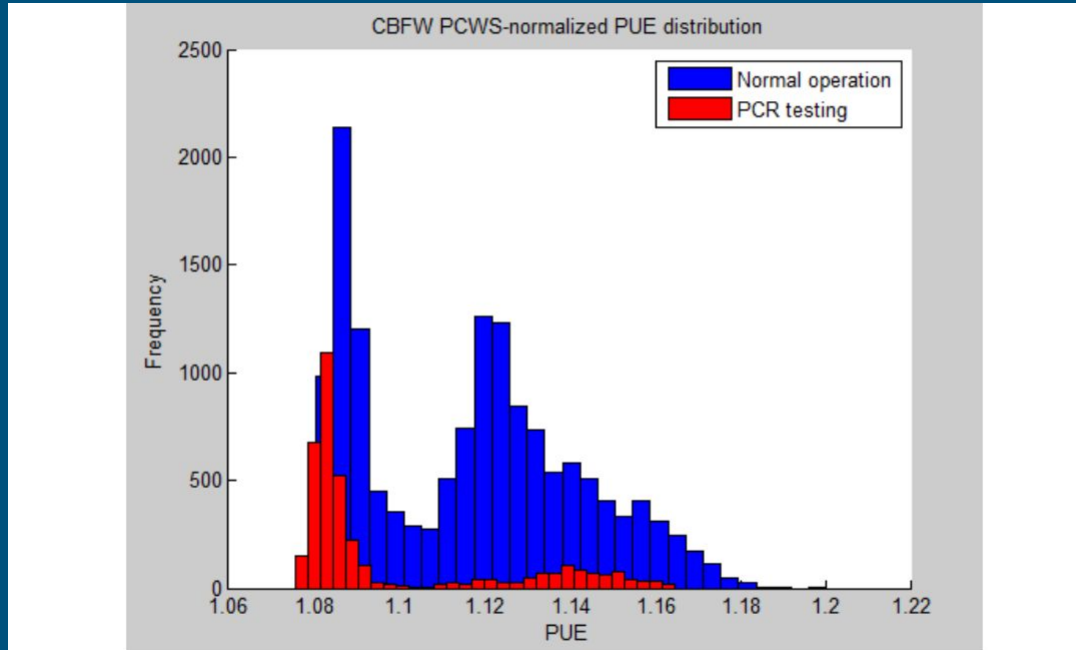


Fig. 7 PUE distributions corresponding to higher PWS temp (red) vs lower PWS temp (blue).