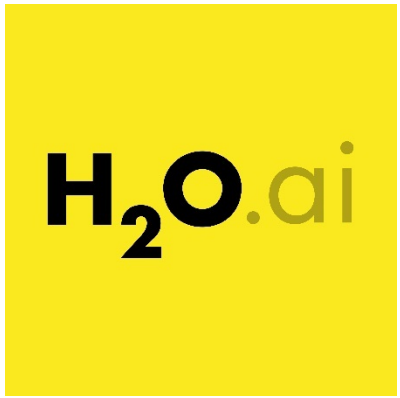
Workshop on Data Science and Industrial IoT



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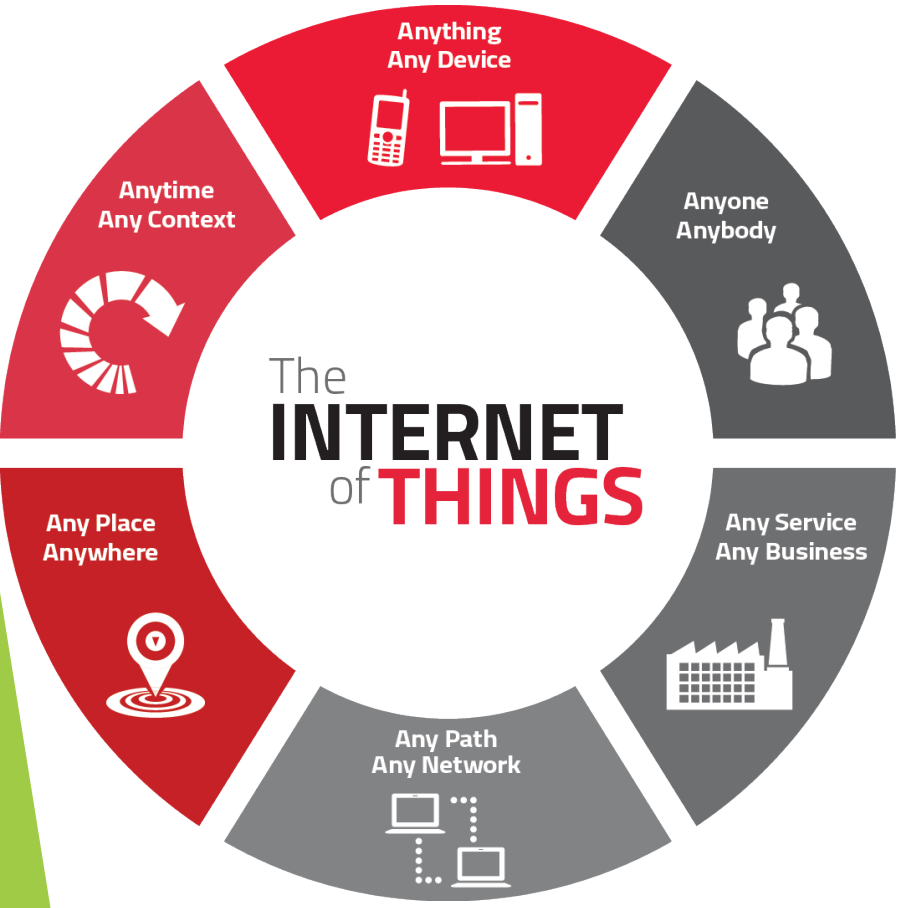
Internet of Things



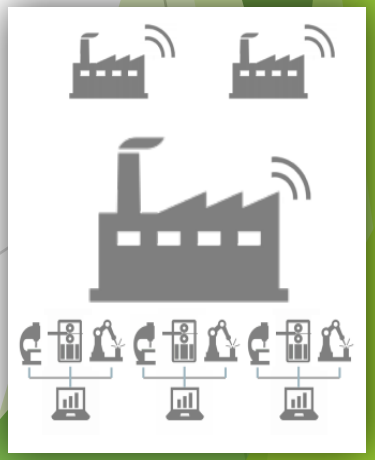
- The Internet of Things (IoT) is a futuristic technology trend
- It is the first step in becoming a truly digital business.
- By connecting people, assets, devices and systems, IoT delivers an Omni channel experience between the physical and digital world.

Future of Manufacturing and Industrial Internet of Things

- Sensor enabled devices
- Devices interconnected
- Multiple digital lines form the factory of the future
- Network of digital enabled devices forms the Internet of Things

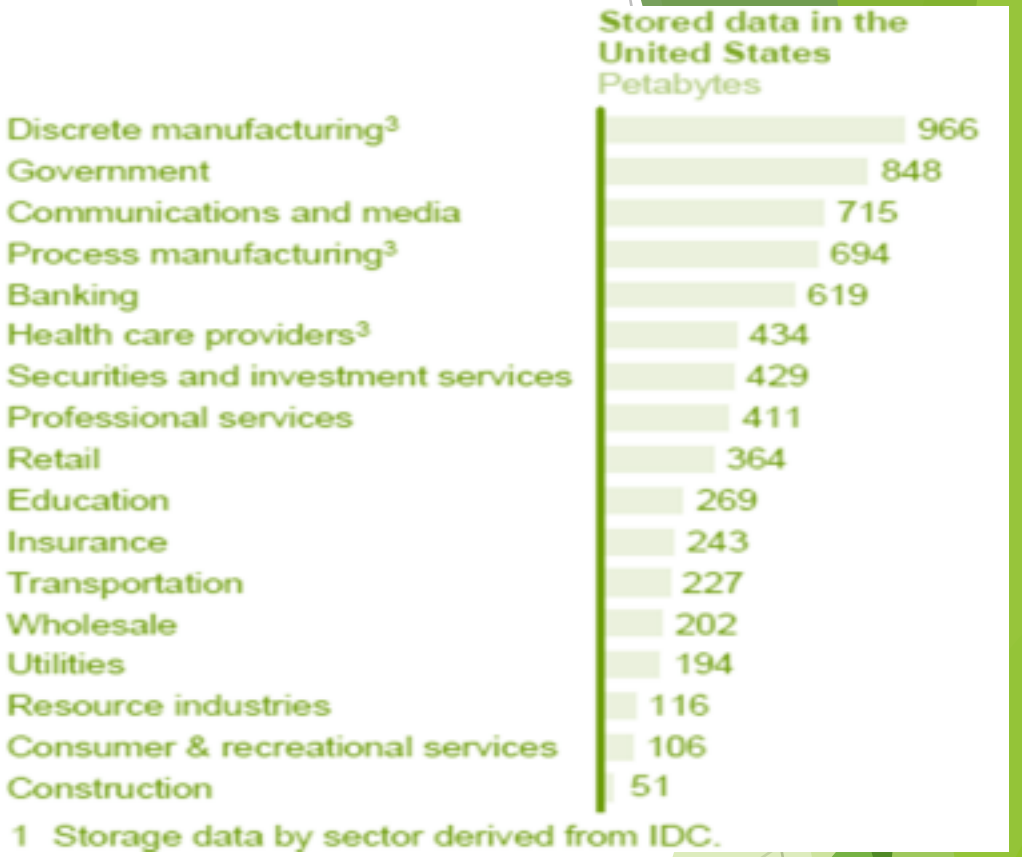
The Biggest Challenge…. Data Explosion!!!!!

Manufacturers are looking for ways to leverage value from this data



Manufacturing IoT: Big Data

Manufacturers are deploying instruments such as sensors and controllers or even smart, networked cameras or RFID readers to measure a wide range of operational processes



As the amount of data used by business grows, there are new opportunities for analyzing it, which stands to change how we make day-to-day business decisions.

Contribution of Data Scientists in IIoT

As Michael Rothschild discusses manufacturers seeking to extract maximum value from investing in big data projects should work backwards and ask a few fundamental questions:

- ✓ What business processes or decisions do you want to improve?
- ✓ How will these decisions improve the business?
  - Customer profitability?
  - Product rationalization?
  - Capacity planning?
- ✓ What are you trying to maximize?
  - Profits? Asset utilization? ROI? Revenues?
- ✓ What are the most meaningful metrics to measure progress toward those goals?
  - Unit margins? Profit-per-hour of machine time?
- ✓ What types of analysis do you need to perform to expose the data,
  - Explore 'what if' scenarios and iterate through alternatives to maximize profitability?
- ✓ And then, finally, what types of data do you need to collect in
  - Order to feed the above analysis and decision-making?

Contribution of Data Scientists in IIoT

- Predictive Maintenance Models
- Anomaly Detection
- Production Forecast
- Time Series Analysis
- 3D Printing

Predictive Maintenance

Reactive vs Proactive Maintenance

- Reactive Maintenance:
  - Reactive approach; dealing with breakdowns or problems when they occur
- Proactive(Predictive) Maintenance
  - Proactive approach
  - An attempt to determine when best to perform preventive maintenance activities. Example: Reducing breakdowns through a program of lubrication, adjustment, cleaning, inspection, and replacement of worn parts

Advantages of Predictive Maintenance

- Reduces fuel/energy costs
- Reduces parts and labor
- Increased machine availability
- Increased throughout
- Fewer catastrophic failures
- Improved safety
- Optimizes manpower deployment

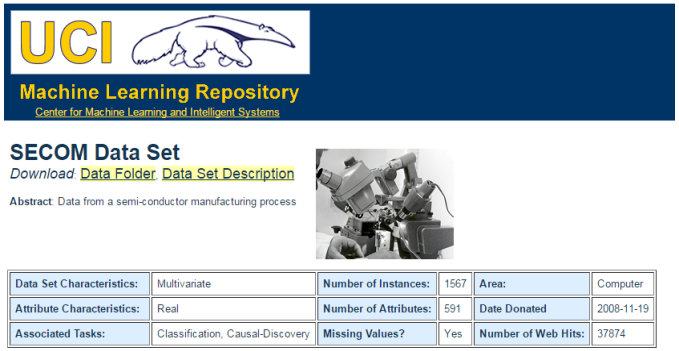
Workshop: Predictive Maintenance and Anomaly Detection using H2O.ai

A Data Scientist's H2O.ai Toolbox

Some of the Smart Applications using H2O.ai

Predictive Maintenance Use Case Data Set:

- SECOM dataset from UCI Machine Learning Repository


UCI
Machine Learning Repository
Center for Machine Learning and Intelligent Systems

SECOM Data Set

Download: Data Folder, Data Set Description

Abstract: Data from a semi-conductor manufacturing process

Data Set Characteristics:	Multivariate	**Number of Instances:**	1567	**Area:**	Computer
Attribute Characteristics:	Real	**Number of Attributes:**	591	**Date Donated**	2008-11-19
Associated Tasks:	Classification, Causal-Discovery	**Missing Values?**	Yes	**Number of Web Hits:**	37874

- It consists of 1567 records taken from a wafer fabrication production line. Each record is a vector of 590 sensor measurements plus a label of pass/fail test.
- Among the 1567 records, there are 104 fail cases which are labeled as 1 and the rest are labeled as negative 0.

Anomaly Detection

- MTCARS Dataset
- The data was extracted from the 1974 *Motor Trend* US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973–74 models).

Results – Anomalies in Automobile Design