

Real Life Applications of Deep Reinforcement Learning (DRL) in Manufacturing

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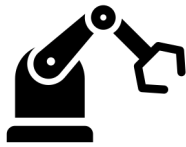


In this session...

AI infused quality management for manufacturing ... The low-code way...

- What are some of the main challenges in manufacturing?
- How do we combine Machine Teaching, simulation and DRL?
- Use Case 1: Autonomous control of yield on food extruders at Pepsi
- Use Case 2: CNC Machine Control at National Oilwell Varco (NOV)

(Some) Challenges for AI in Manufacturing



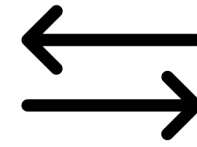
Long hardware/machinery refresh cycles mean that data is not available



Combined AI and Subject Matter Expertise (Engineers) is extremely rare



Long time to validate Improvements & Successes



High operating staff turnover

Machine Teaching Service Overview

A complete toolchain to build, train, and deploy BRAINs

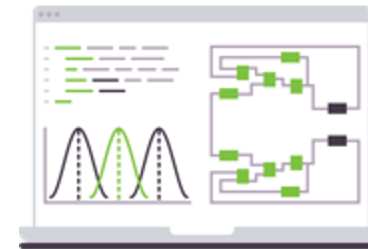


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1. Machine Teaching injects subject matter expertise into BRAIN training



2. Simulation tools for accelerated integration and scale of training



Long hardware/machinery refresh cycles mean that data is not available



Long time to validate Improvements & Successes



bonsai

3. AI Engine automates the generation and management of neural networks and DRL algorithms



4. Flexible runtime to deploy and scale models in the real world



Long hardware/machinery refresh cycles mean that data is not available



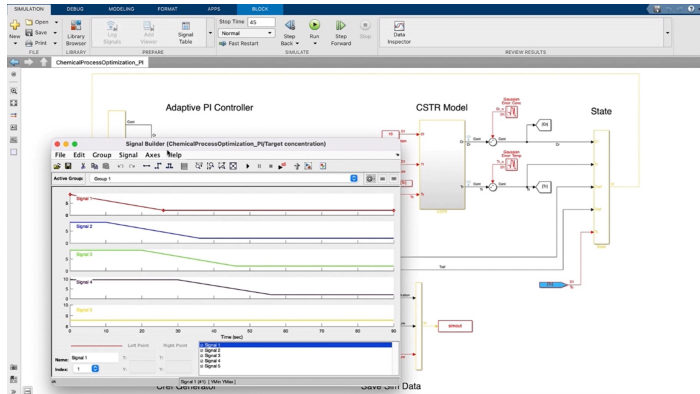
High operating staff turnover



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Simulations

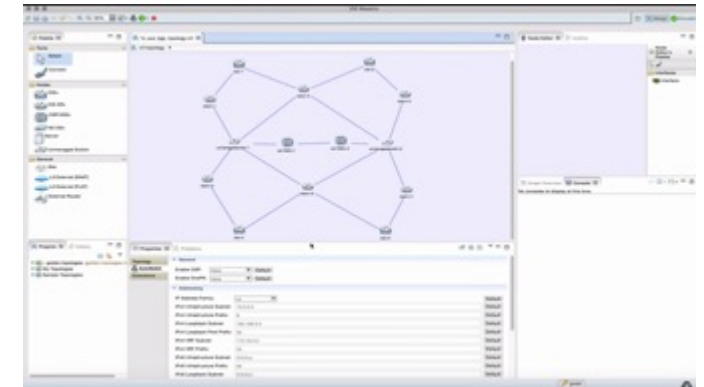
Available across a broad range of industries and systems



Mechanical & electrical engineering



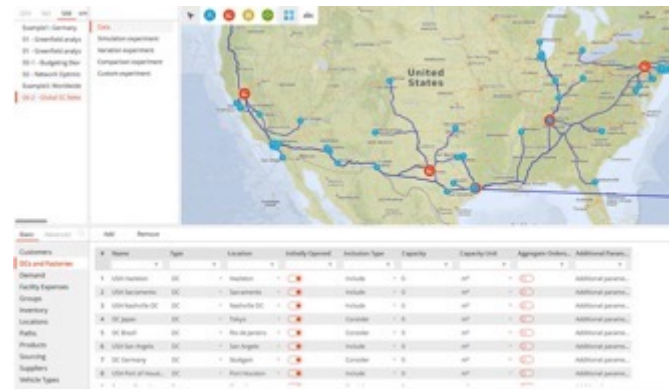
Autonomous vehicles



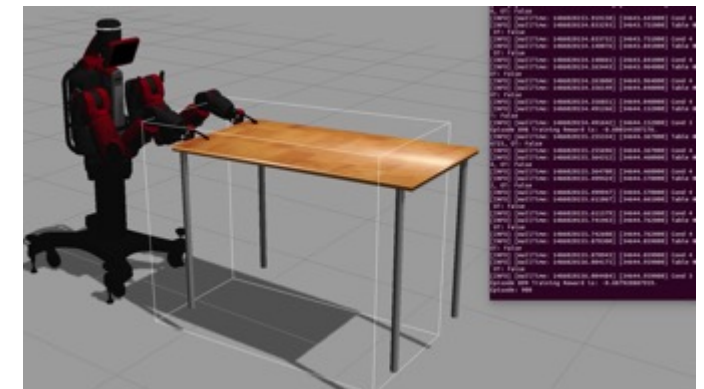
Security & networking



Discrete event simulations



Transportation & logistics

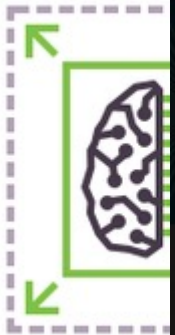


Robotics

Benefits of Machine Teaching

Combining human and machine intelligence to build more efficient & accurate models.

Develop
Scale



Allows SMEs
train and compare
models

Search by name

ChemicalProcessOptimization / v01

Teach Train

Visual editor (Beta)

Global SteadyState

SteadyState
Learned concept

TYPES

Output SimAction

```
{  
  # Delta to be applied to initial coolant temp  
  Te_adjust: number<-coolant_temp_deriv_limit .  
}
```

SELECTS

Click "+" to add a select concept

GOAL

minimize Concentration Reference
avoid Thermal Runaway

LESSONS

Lesson 1 Lesson 1

```
{  
  Cref_signal: number<5>,  
  noise_percentage: number<0 .. 5>,  
}
```

PARAMETERS >

NOTES >

TRAINING PARAMETERS

able
ies



dularize
ed and
ncepts.

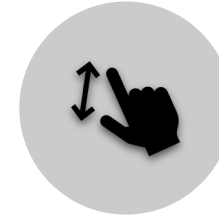
Autonomous
control of yield
on food
extruders at
Pepsi



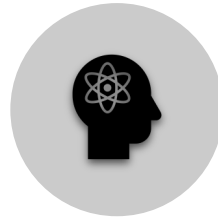
Problem Statement



Extruders self contained production lines



Manually operated

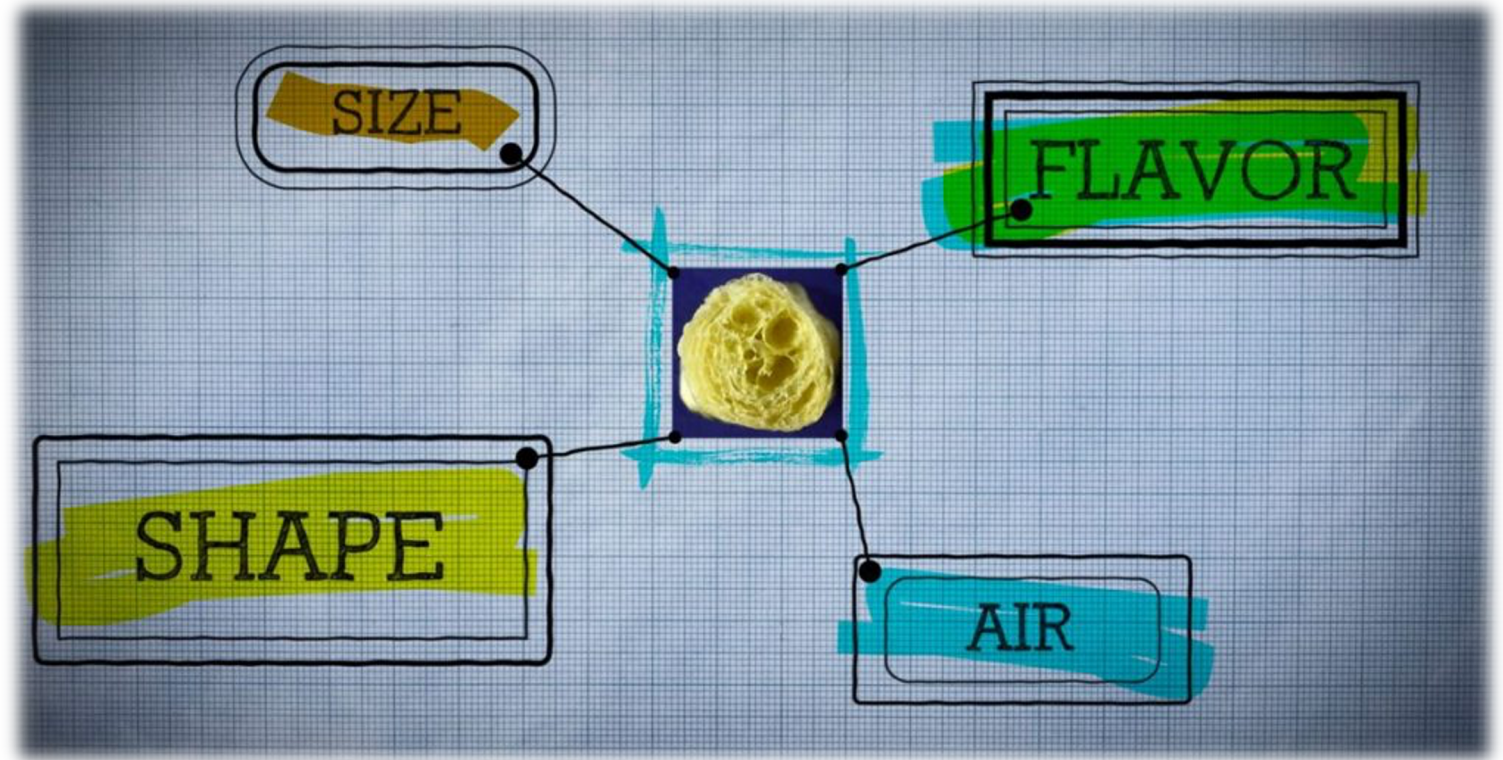


Knowledge heavy control process

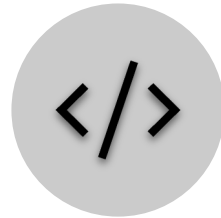


Infrequent sampling

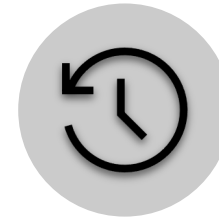
The perfect
Cheetos



The solution



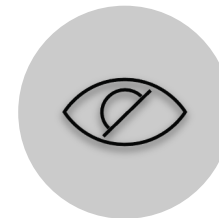
Simulation Codesigned
with SME



Can simulate a day's
run in 30 seconds



Recommendation and
closed loop mode



Computer vision
instead of machine
sensors

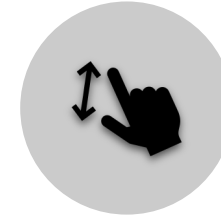
CNC Machine
Control at
National Oilwell
Varco (NOV)



Problem Statement



Crowd sourcing from general knowledge



Rapidly pivoting between product lines



High Turnover



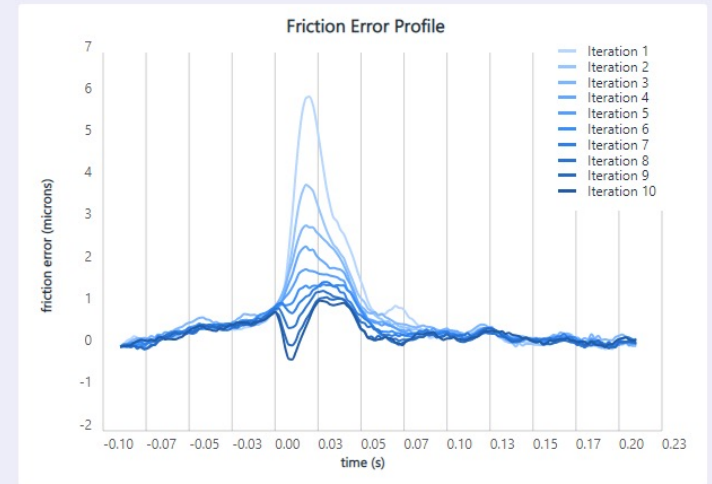
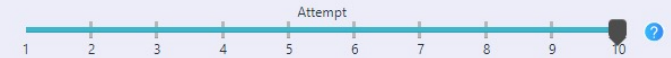
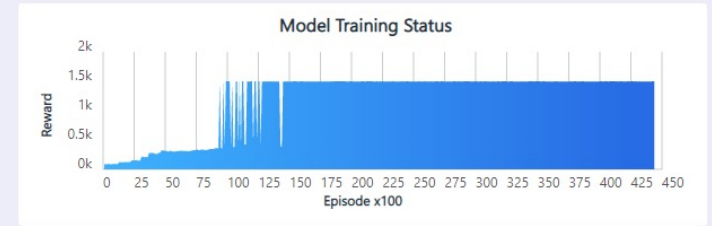
Limited trained Applicants

AI-supported decision making

Motor Alignment Drill Bit Alignment Slider Alignment

Sensors

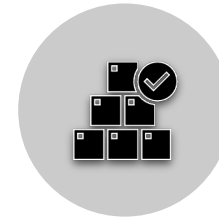
Iteration	Mean Peak
10	0.941



The solution



AI making suggestions to the agent



Quality prediction



Continuous assisted learning by new operators



Right balance between speed and Quality

What we have seen....

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Questions?
