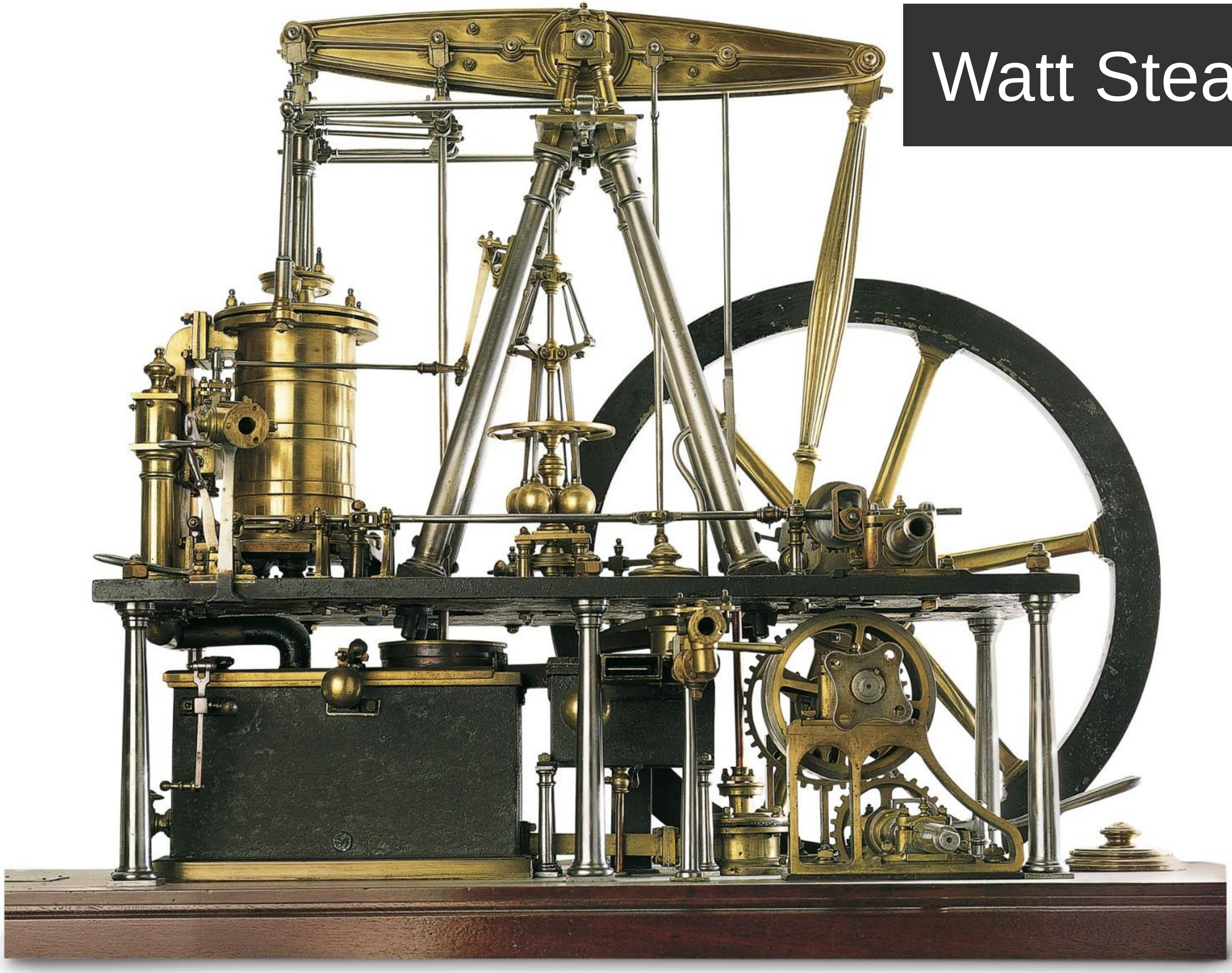
MATLAB EXPO 2019

Beyond the “I” in AI

Loren Shure

Watt Steam Engine



Artificial intelligence is a transformative technology

AI will create $13 trillion in value by 2030

based on McKinsey’s latest AI forecast – September 2018

AI has tremendous potential to increase productivity

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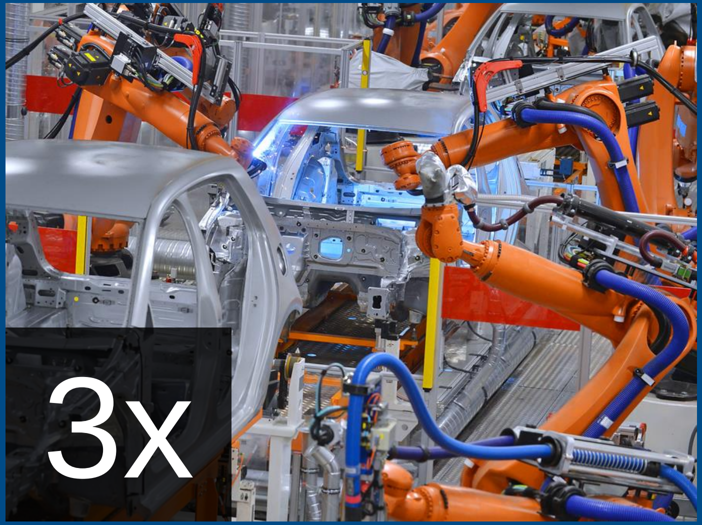


McKinsey Global Institute, September 2018

Yet AI is struggling

DigitalTonto
At the Crossroads of Media, Marketing and Technology...

Most AI Projects Fail. Here's How to Make Yours Successful.

July, 2018

DataRobot

Why Most AI Projects Fail

Oct, 2017

CMSWiRE

3 Common Reasons Artificial Intelligence Projects Fail

May, 2018

There are many ways Artificial Intelligence can **fail**

No data scientists

Too much data

Poor ROI

Not enough data

Beyond the skill of the team

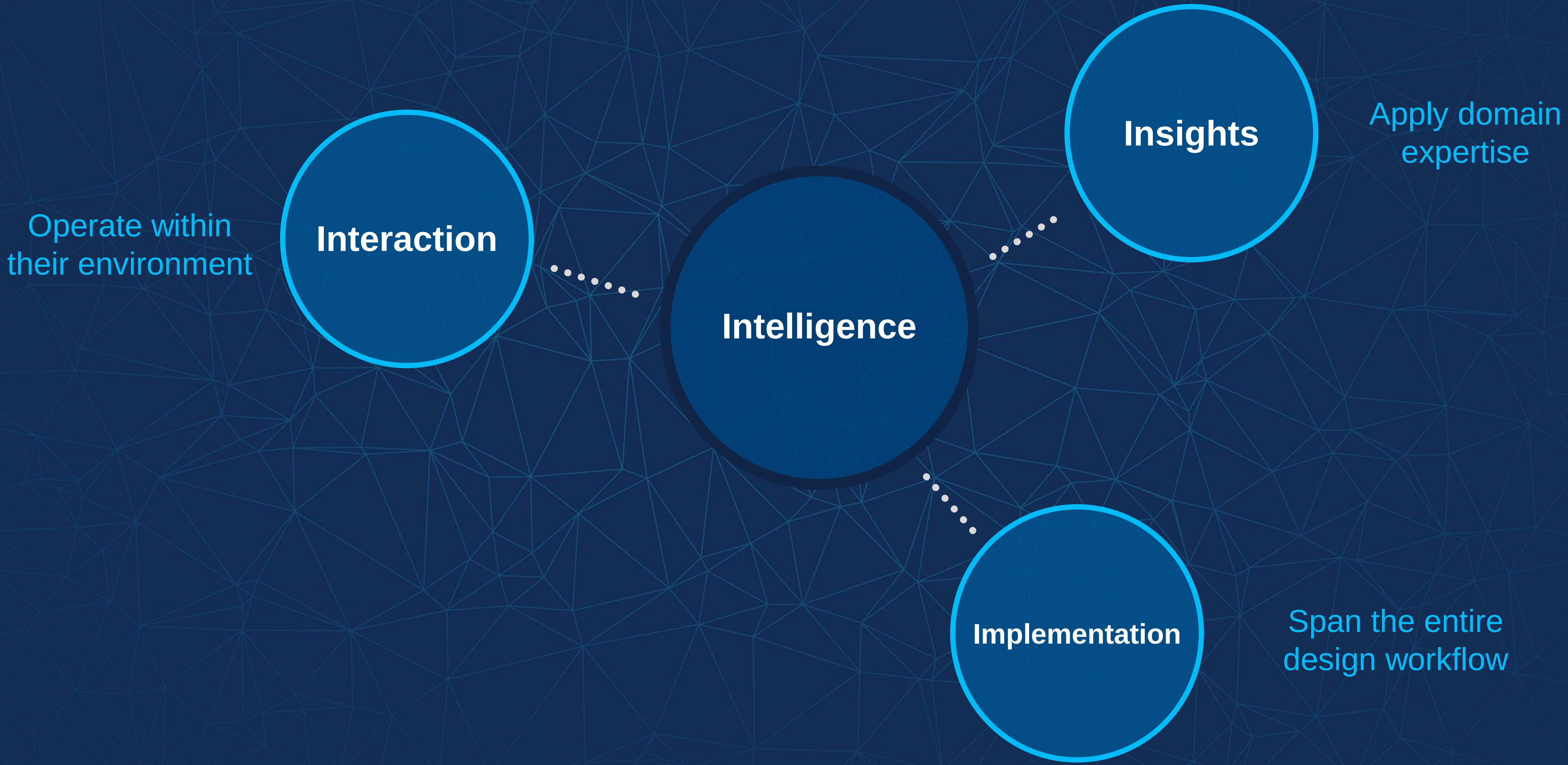
Incomplete tools

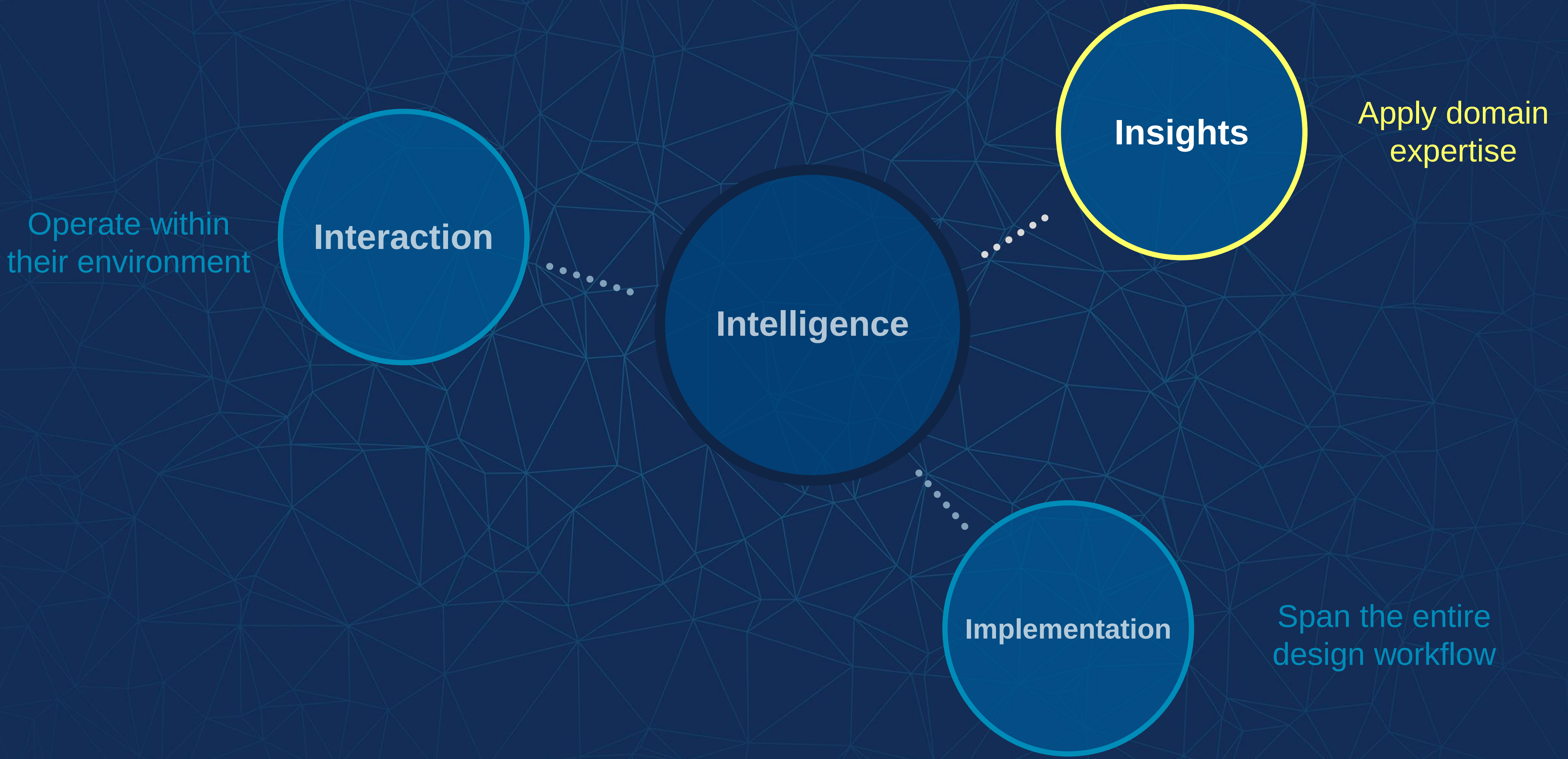
Problem is a poor fit for AI

Can’t interact with other systems

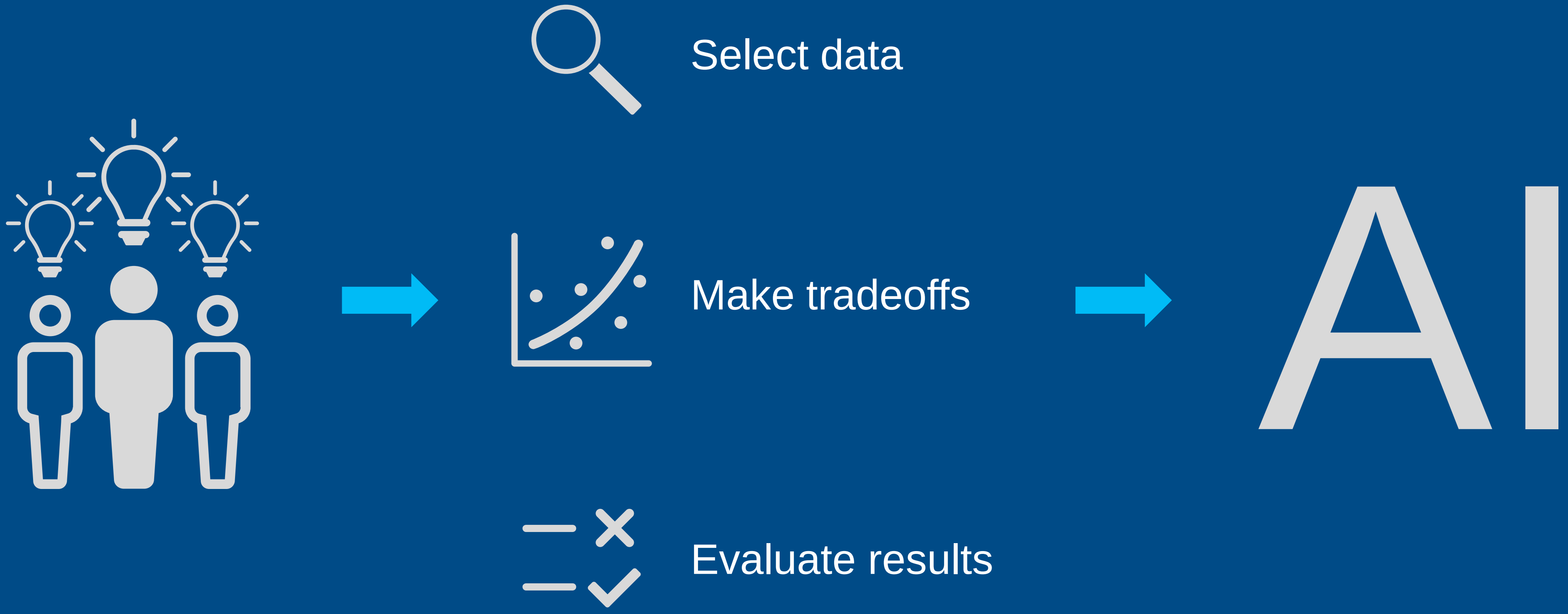
Problem is unsolvable

AI is more than just the intelligence of the algorithm

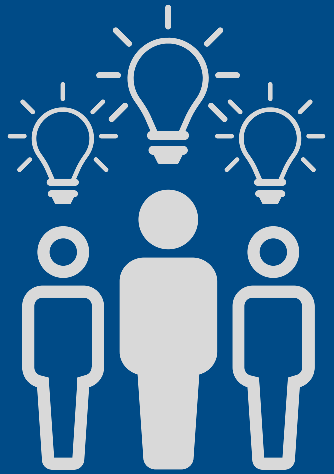



Operate within
their environment
Interaction
Intelligence
Insights
Apply domain
expertise
Implementation
Span the entire
design workflow

Bring human insights into AI



Bring human insights into AI

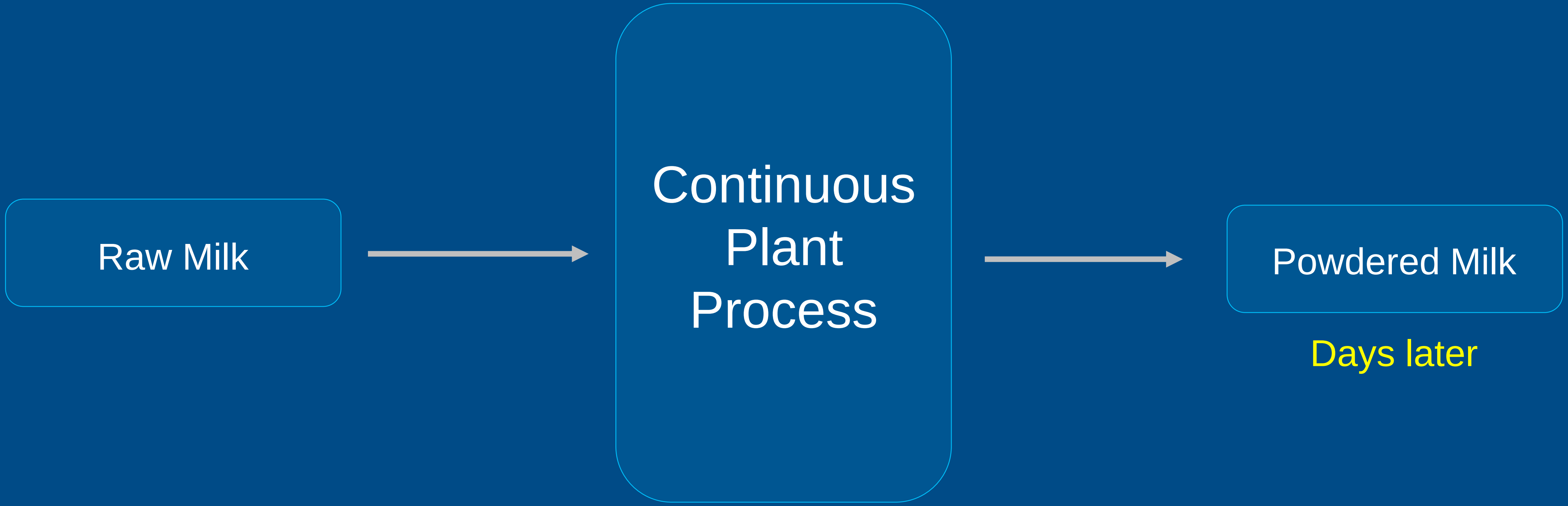


- We are the domain experts
- Shortage of data scientists
- We need the right tools

Improving New Zealand Dairy Processing

- University of Auckland
- Auckland University of Technology

Wanted to detect a bad product earlier



Wanted to detect a bad product earlier

Data

- Raw Milk
- Plant Process
- Powdered Milk

→ AI model → Predict Results

Near real-time

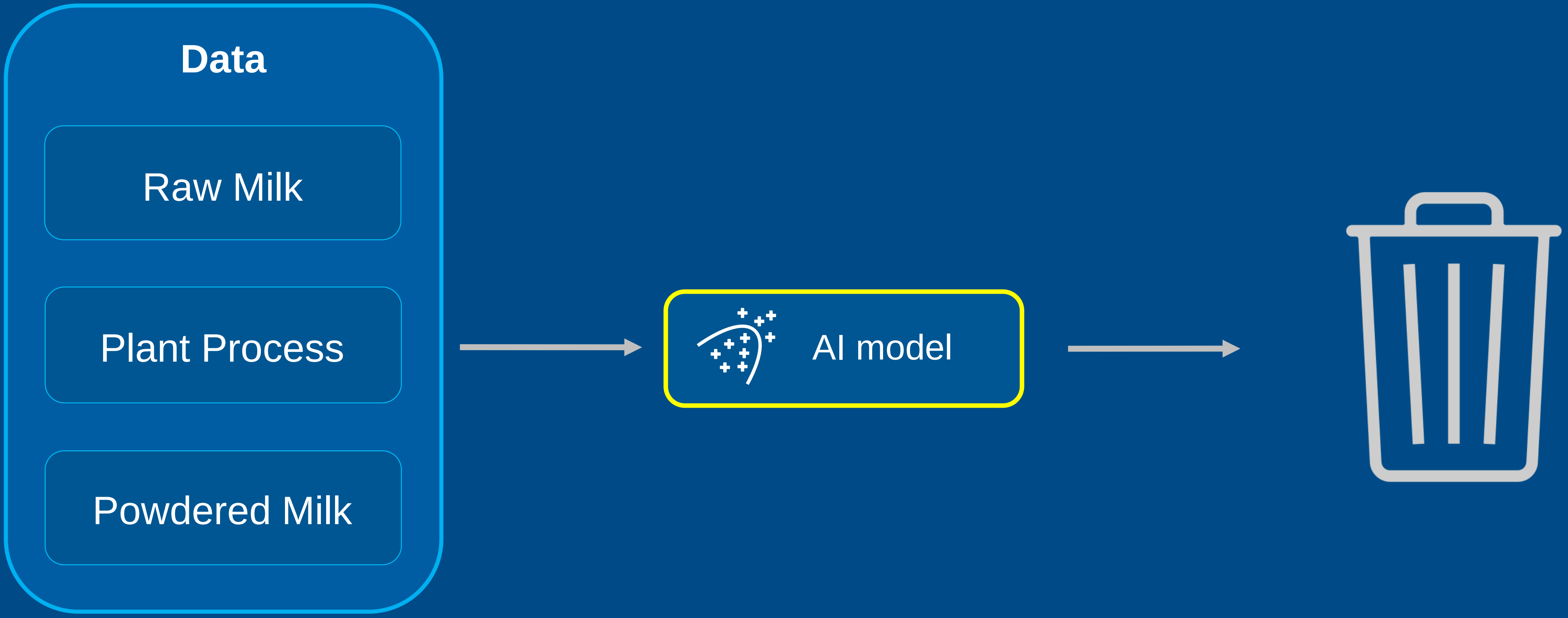
They had lots of data

Data

- Raw Milk
- Plant Process
- Powdered Milk

- Millions of data points
- 6 years
- 3 plants

But…



They made several key insights

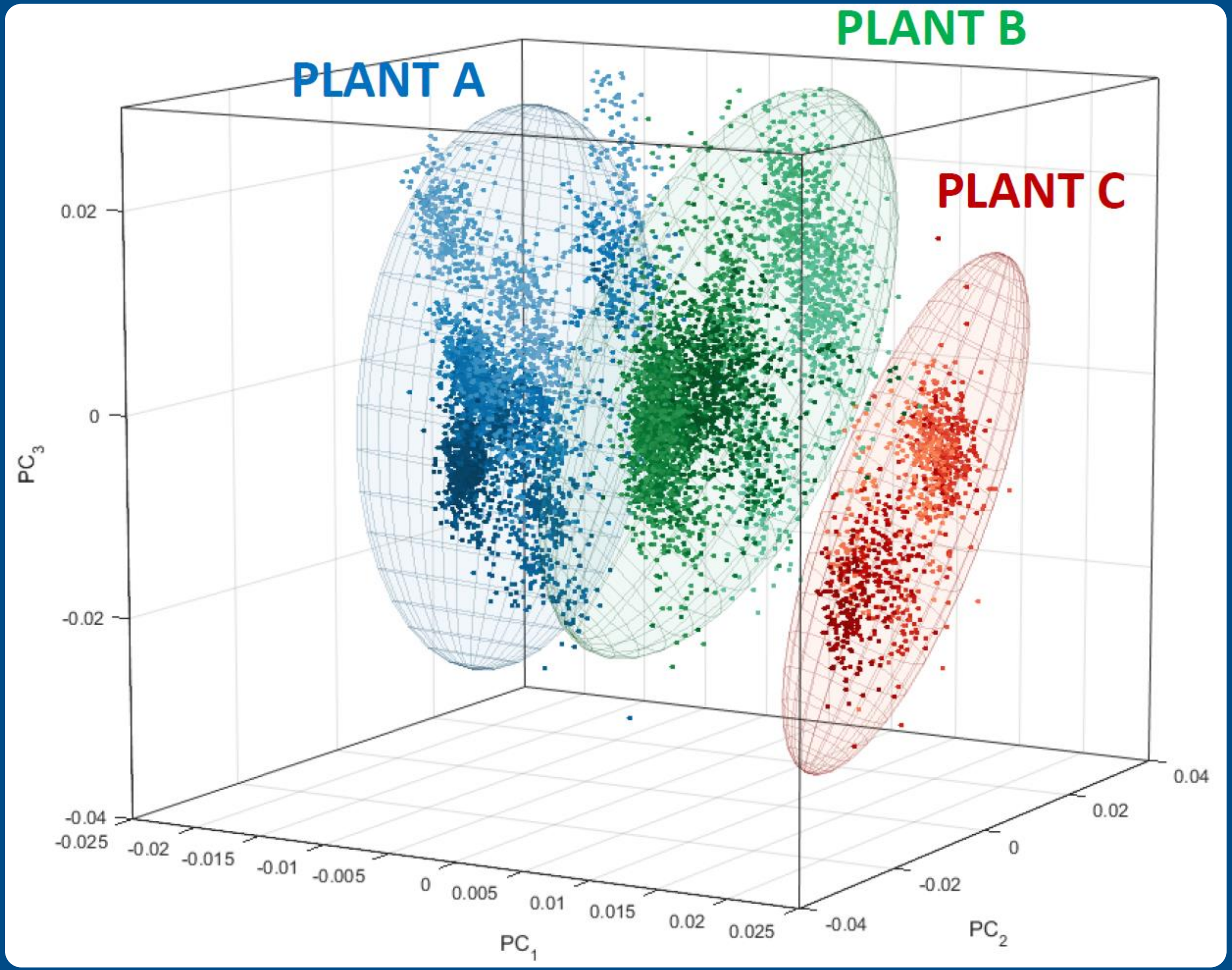
1. Results were wrong

They made several key insights

1. Results were wrong

2. Need to build a separate model for each plant

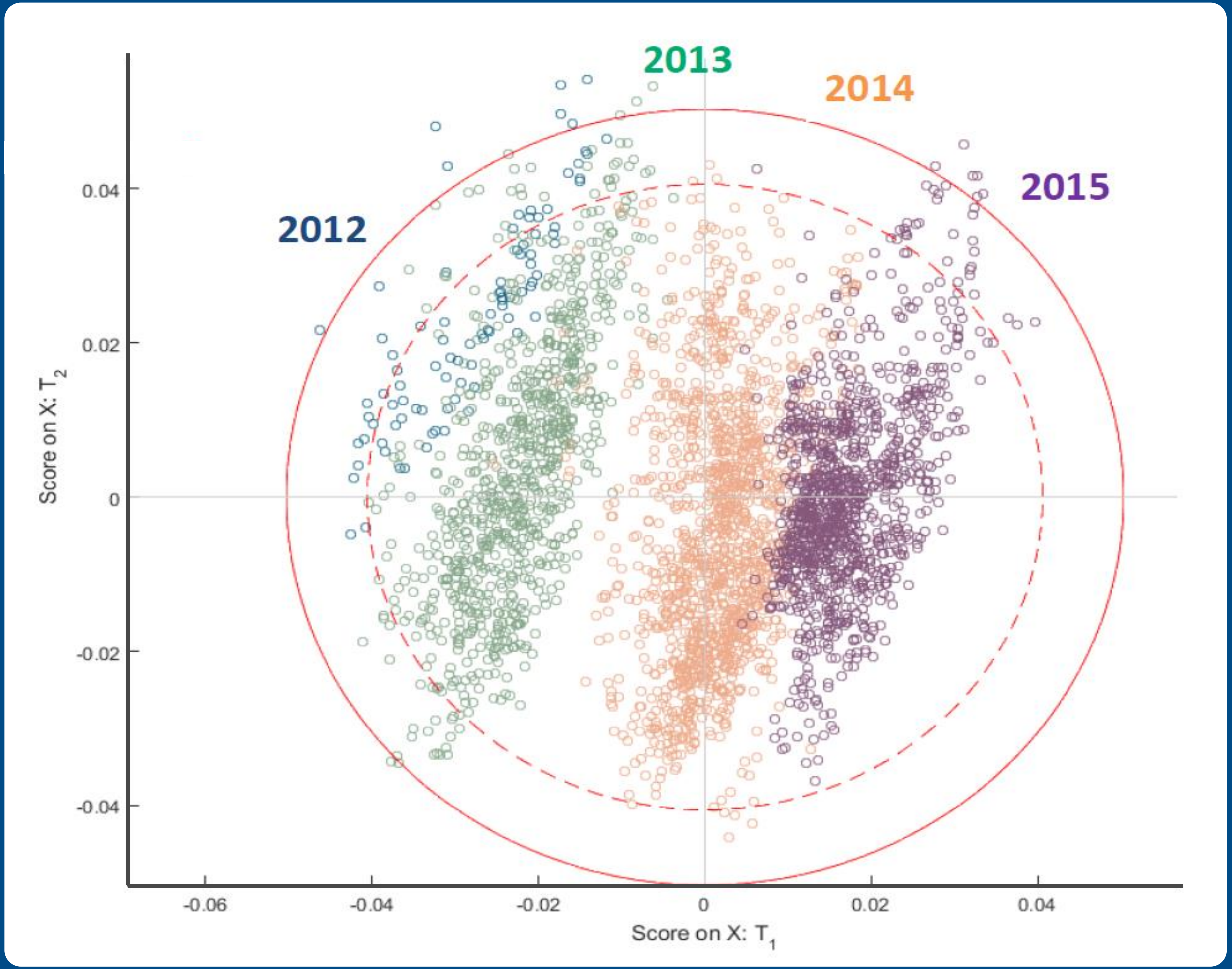
Plants behaved differently from each another



They made several key insights

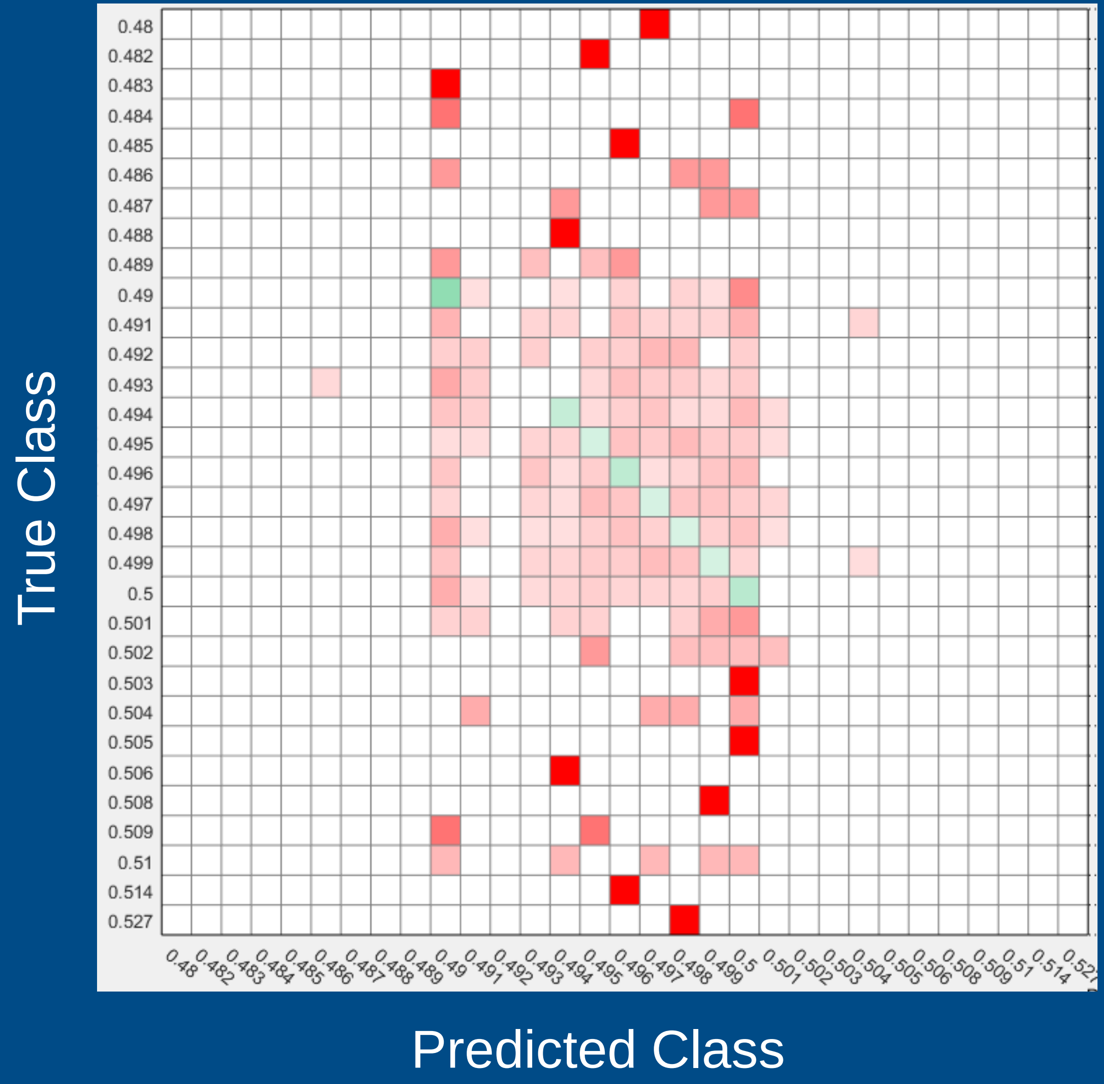
1. Results were wrong
2. Need to build a separate model for each plant
3. Plant’s operating state changes each year

Each year was like a completely different plant



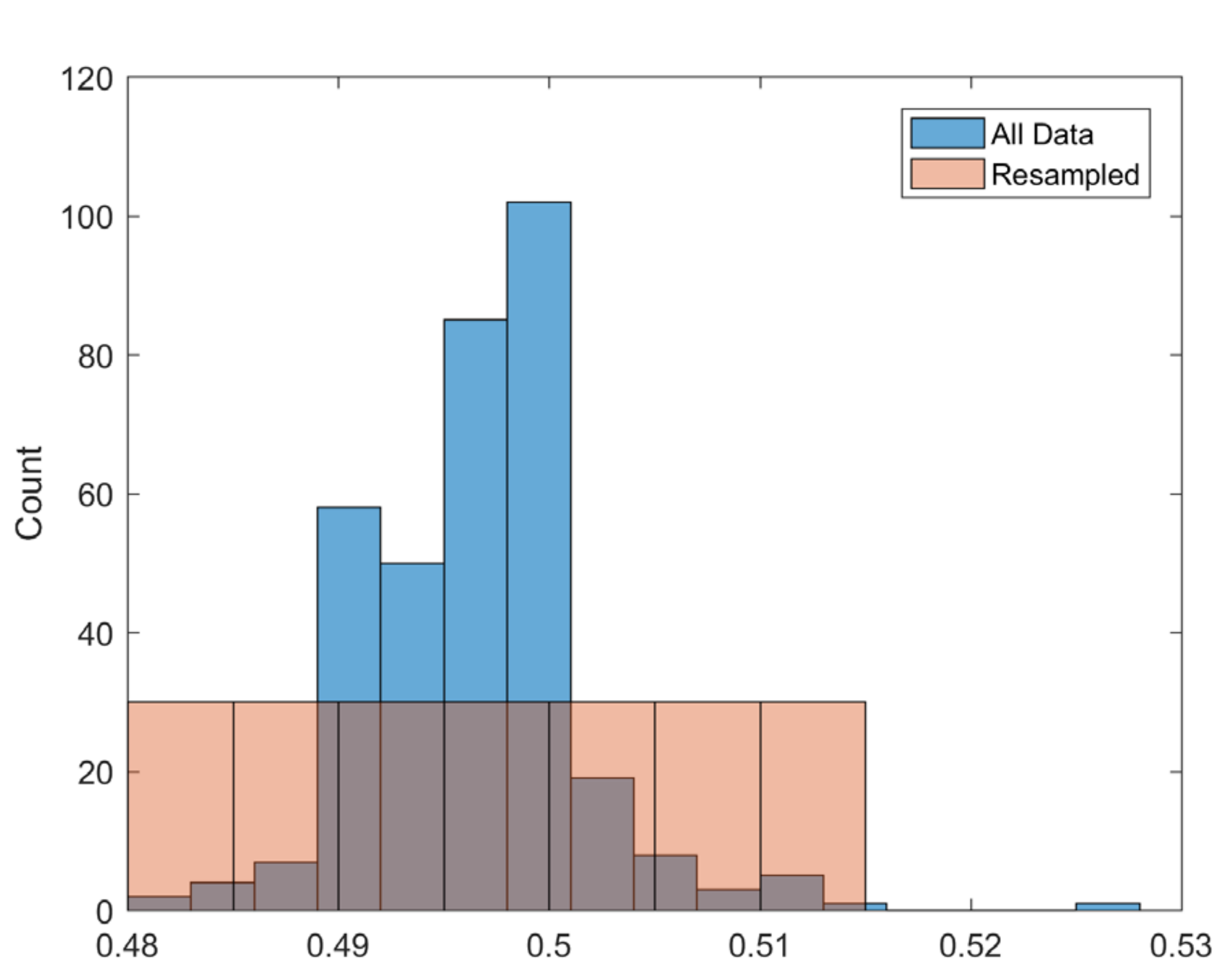
Bulk density prediction results were inaccurate

- Many false positives
- Unused classes



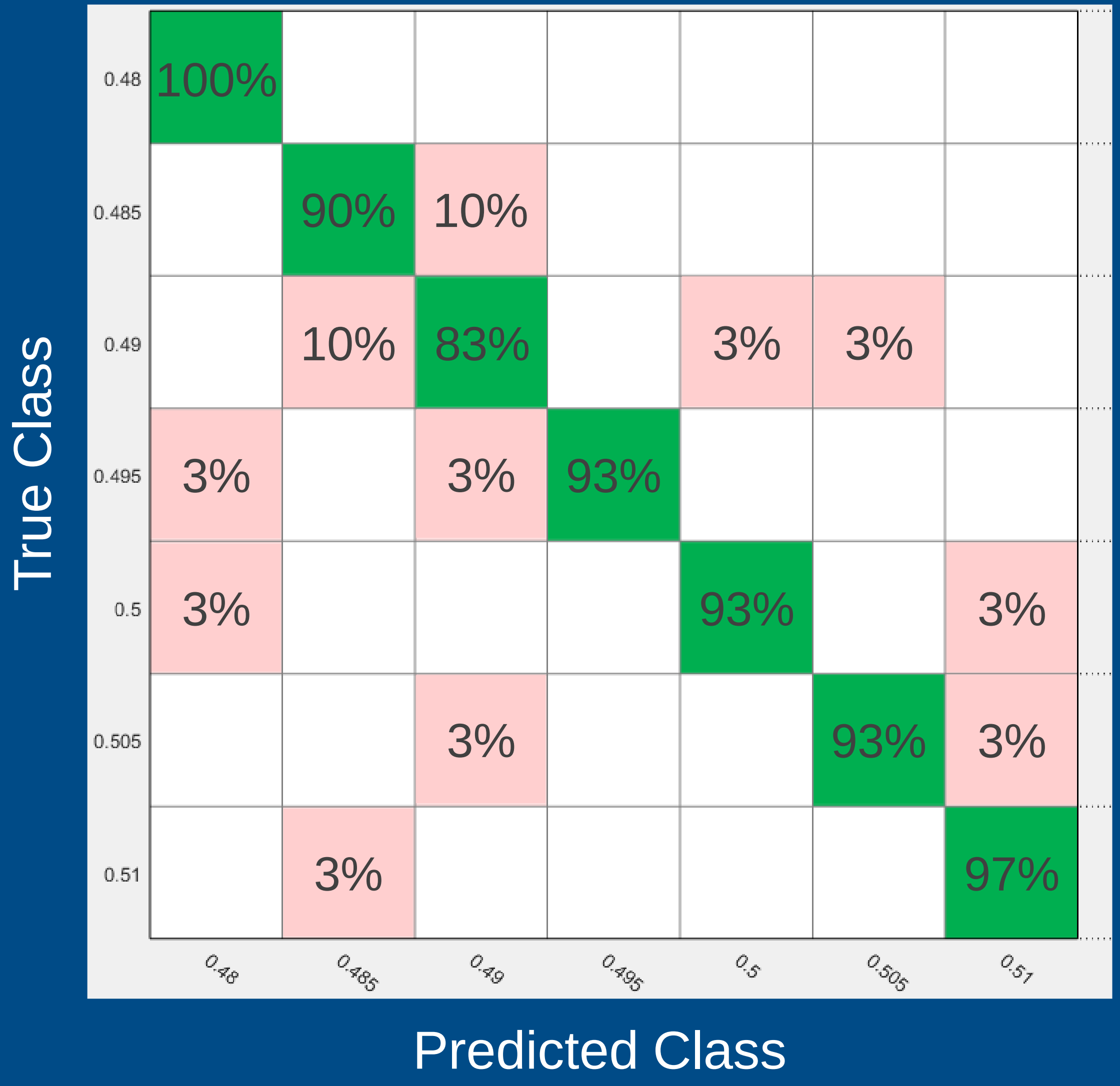
They made several key insights

1. Results were wrong
2. Need to build a separate model for each plant
3. Plant’s operating state changes each year
4. Training data was biased



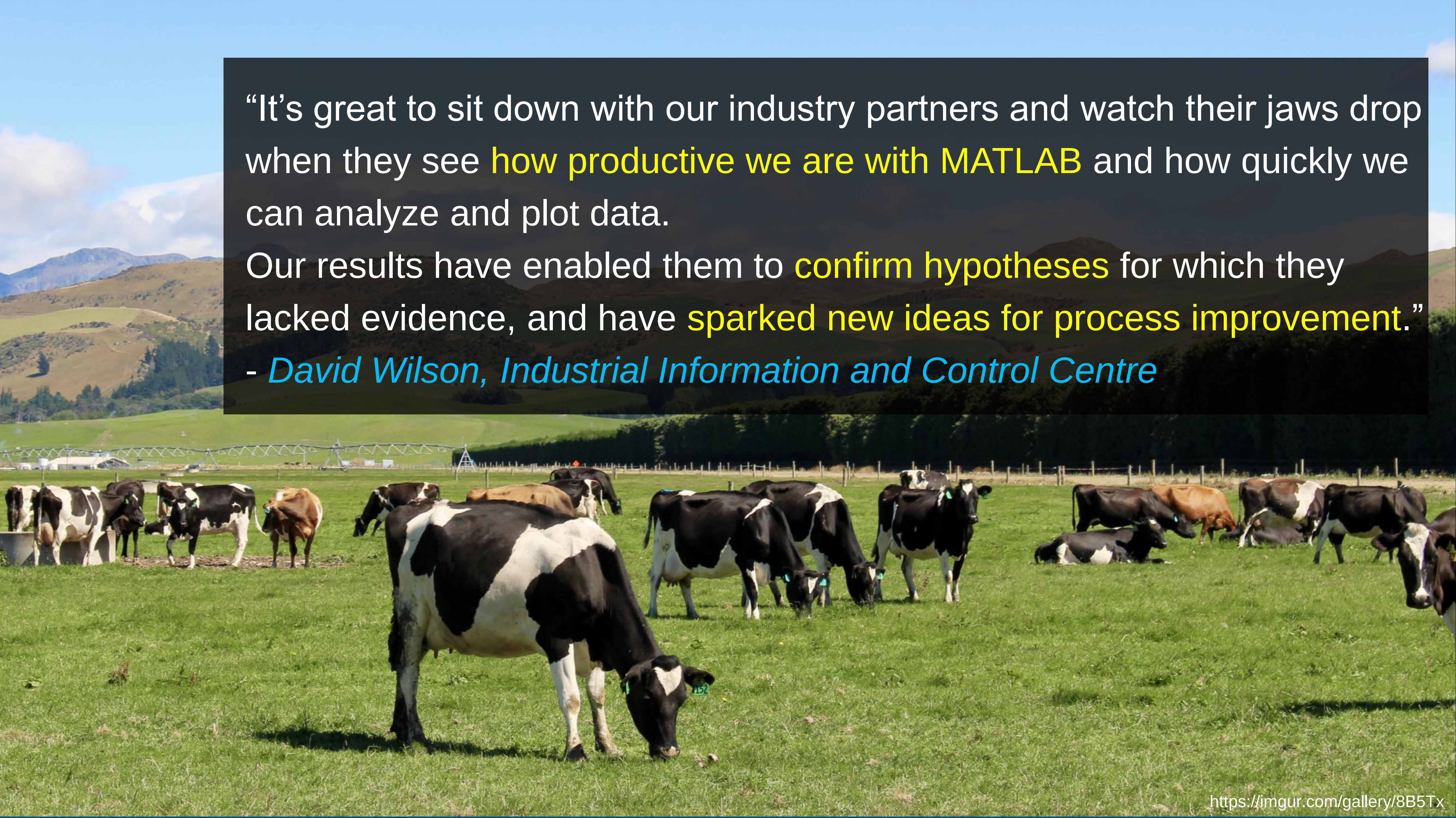
Resampling data resulted in higher predictive accuracy

- Resampled data
- Reduced the number of bins



"It's great to sit down with our industry partners and watch their jaws drop when they see how productive we are with MATLAB and how quickly we can analyze and plot data.
Our results have enabled them to confirm hypotheses for which they lacked evidence, and have sparked new ideas for process improvement."

- *David Wilson, Industrial Information and Control Centre*

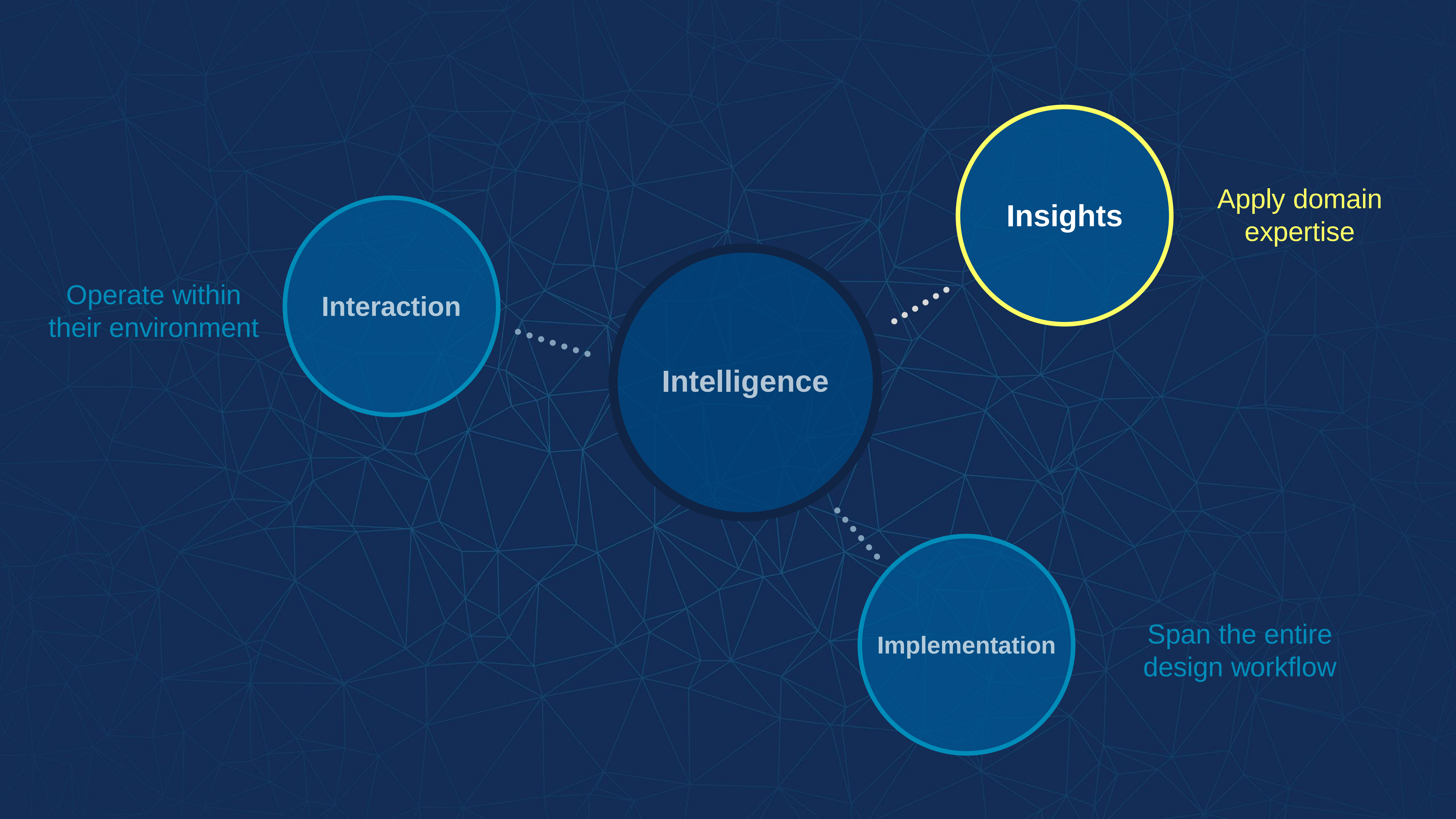


https://imgur.com/gallery/8B5Tx

To be successful with AI, we must …

Combine AI model building
with scientific and engineering insights

Along with tools that span
both the science and engineering and the data science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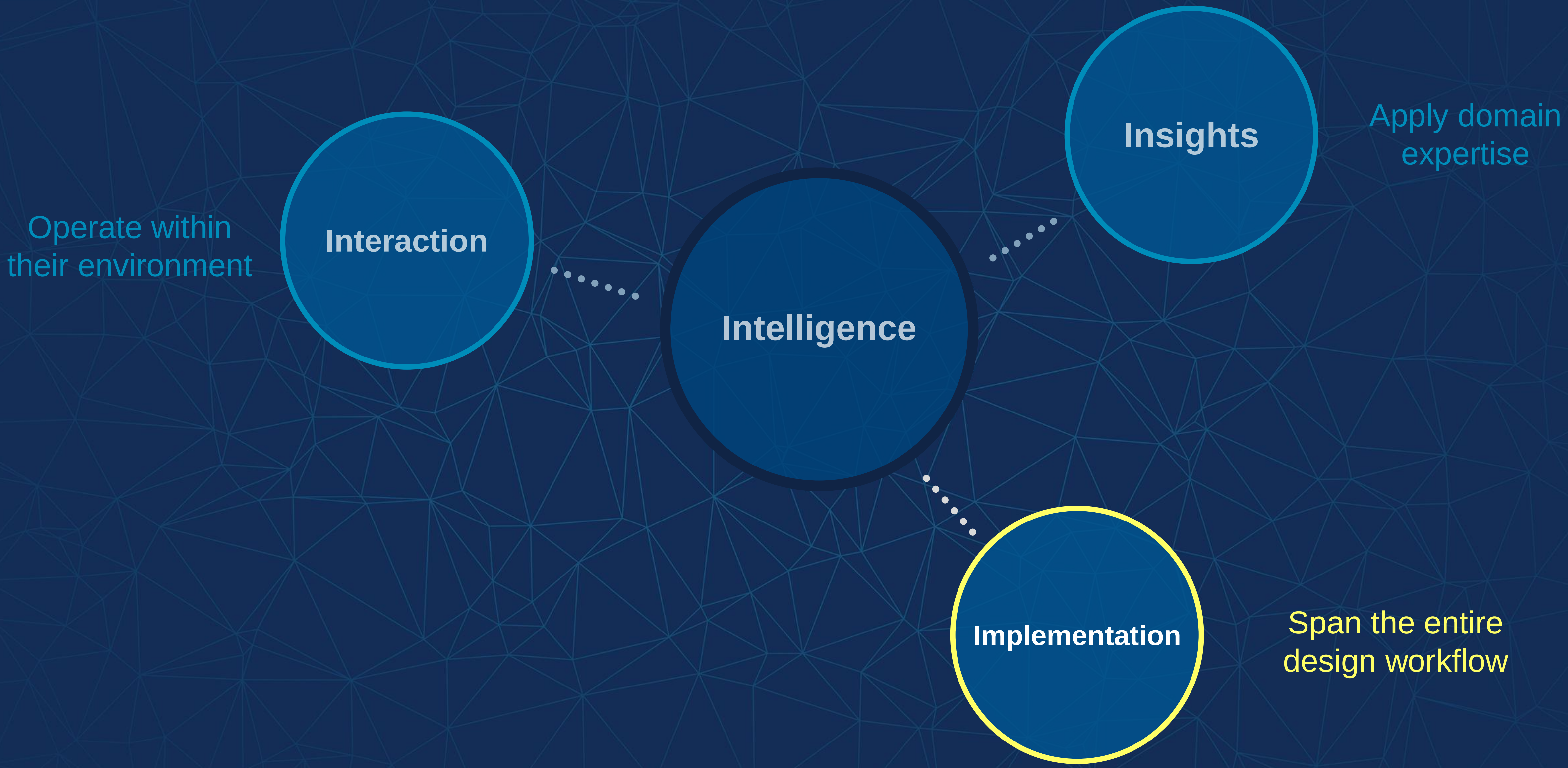
Operate within their environment
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Implementation is about designing the solution

Testing
Data analysis
Reporting

Developing concept
Prototyping
Deployment

Requirements building
Modeling and simulation
Verification and validation

“Deliver on the promise of self-driving cars today.”

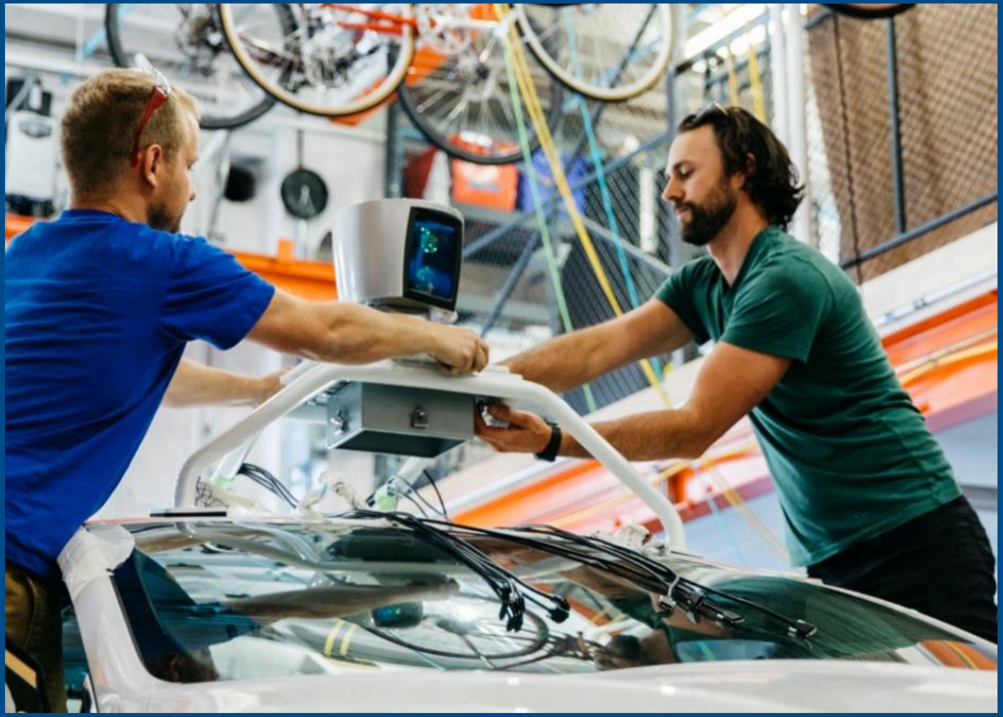
Voyage's goal was to quickly get to market

1. Target retirement communities

Voyage's goal was to quickly get to market

1. Target retirement communities

2. Use off-the-shelf components wherever possible



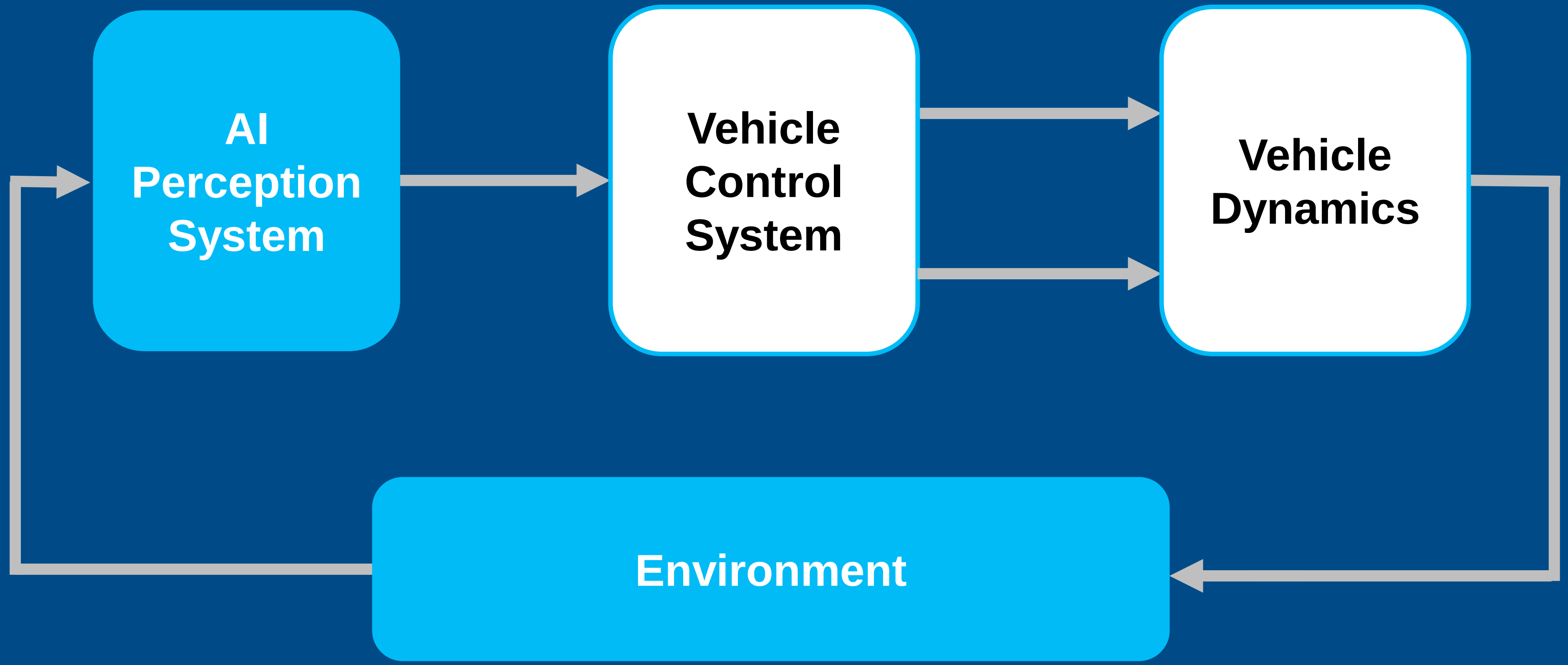
Voyage's goal was to quickly get to market

1. Target retirement communities
2. Use off-the-shelf components wherever possible
3. Bring in the right software tools across the entire workflow

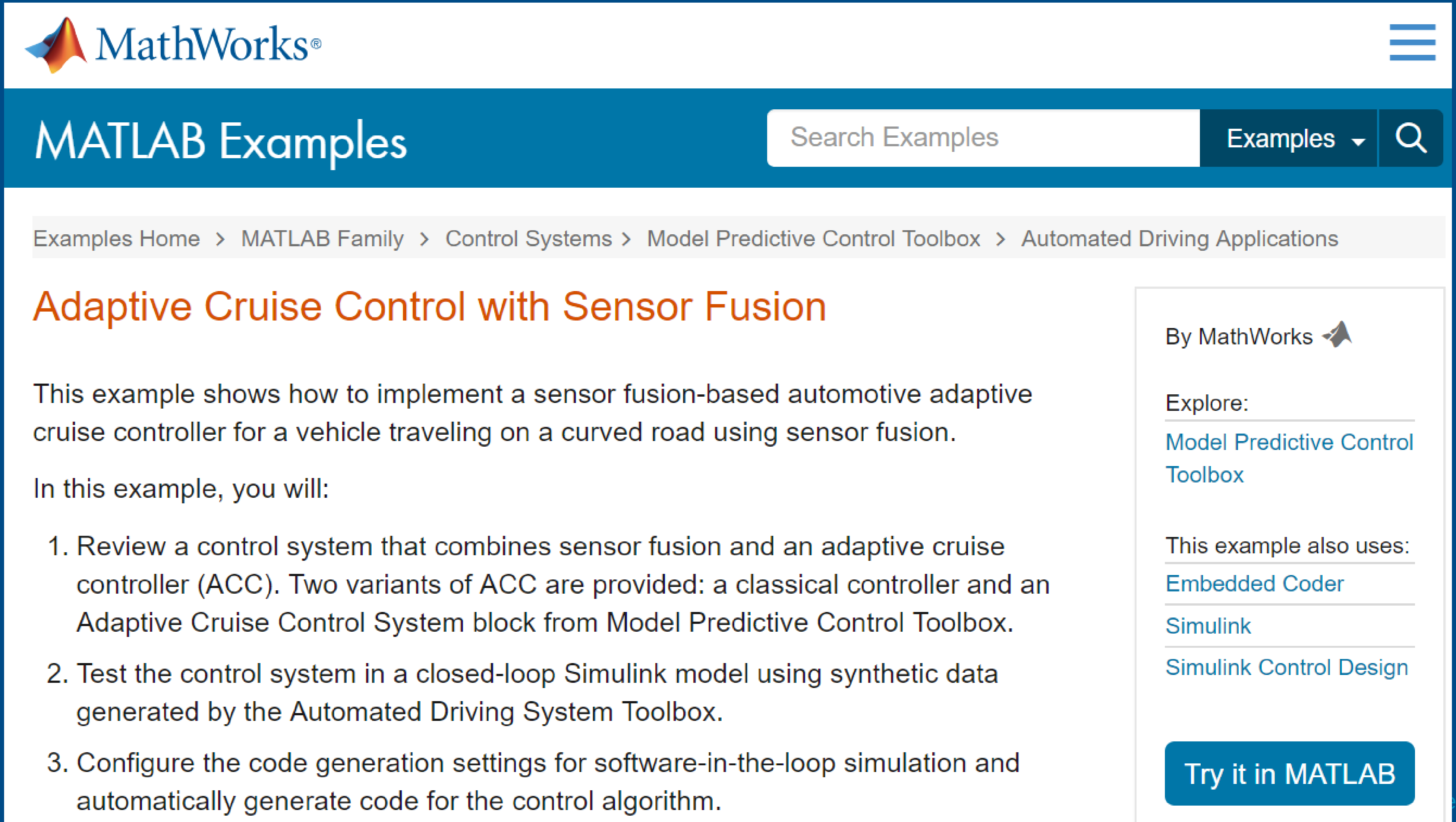
Voyage completed their AI system first

AI
Perception
System

But they needed to connect the AI to the rest of the system



Started with Simulink example that they could build upon



MATLAB Examples

Search Examples | Examples

Examples Home › MATLAB Family › Control Systems › Model Predictive Control Toolbox › Automated Driving Applications

Adaptive Cruise Control with Sensor Fusion

This example shows how to implement a sensor fusion-based automotive adaptive cruise controller for a vehicle traveling on a curved road using sensor fusion.

In this example, you will:

1. Review a control system that combines sensor fusion and an adaptive cruise controller (ACC). Two variants of ACC are provided: a classical controller and an Adaptive Cruise Control System block from Model Predictive Control Toolbox.
2. Test the control system in a closed-loop Simulink model using synthetic data generated by the Automated Driving System Toolbox.
3. Configure the code generation settings for software-in-the-loop simulation and automatically generate code for the control algorithm.

By MathWorks

Explore:

Model Predictive Control Toolbox

This example also uses:

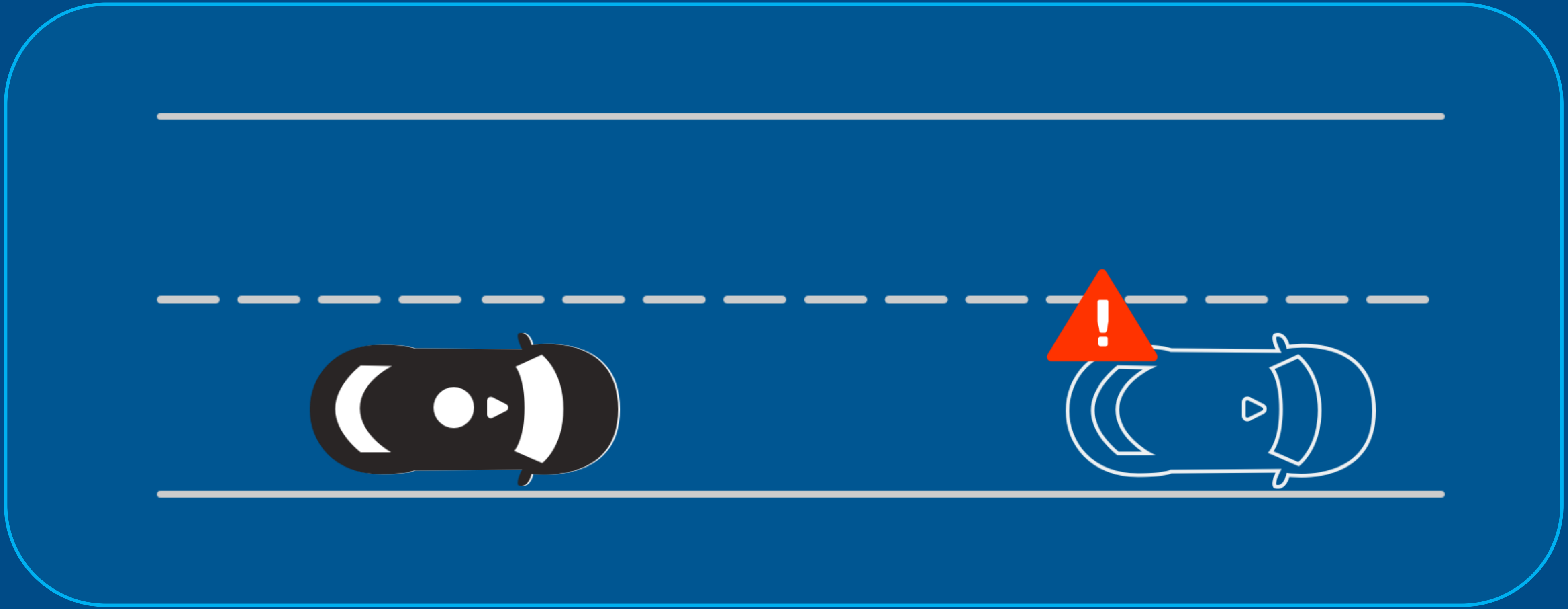
Embedded Coder

Simulink

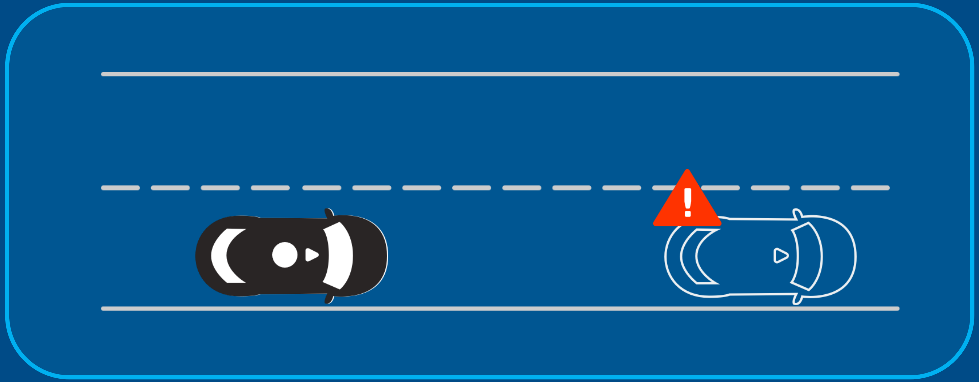
Simulink Control Design

Try it in MATLAB

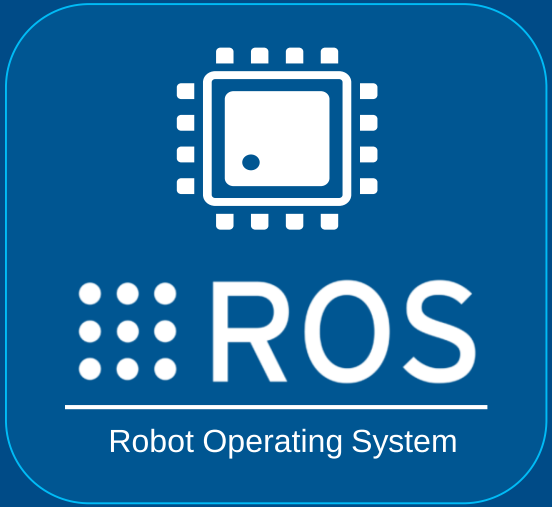
Injected simulated vehicles to interact with while driving



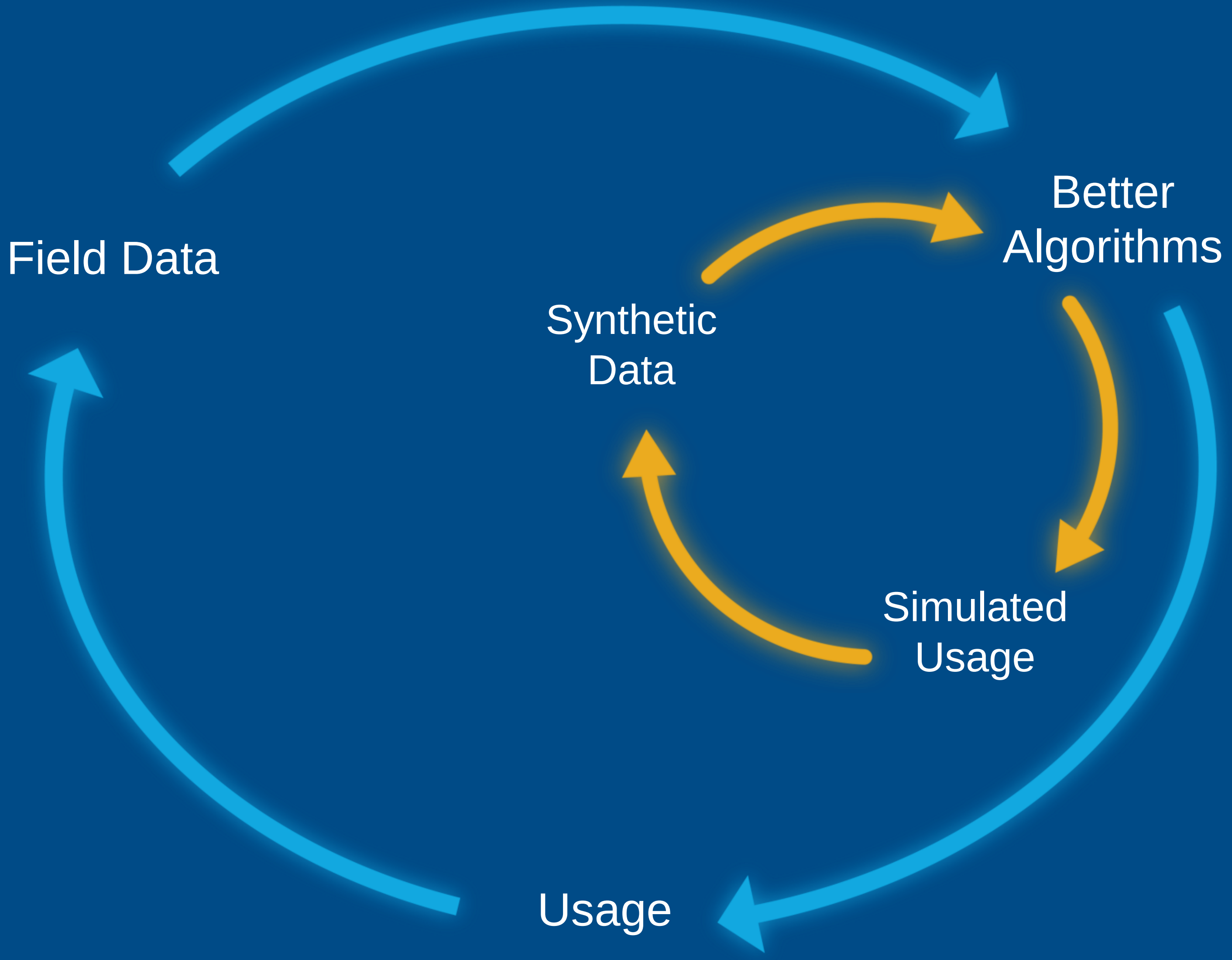
Deployed controller as ROS node and generated code



Robotics System Toolbox
Embedded Coder



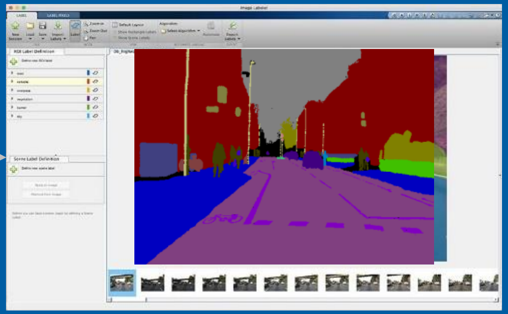
Train your AI faster with tight simulation loops



One example of leveraging simulation for data synthesis

Traditional deep learning workflow

Record



Label

AI model

Transfer Learning

Simulation-based workflow

Simulate

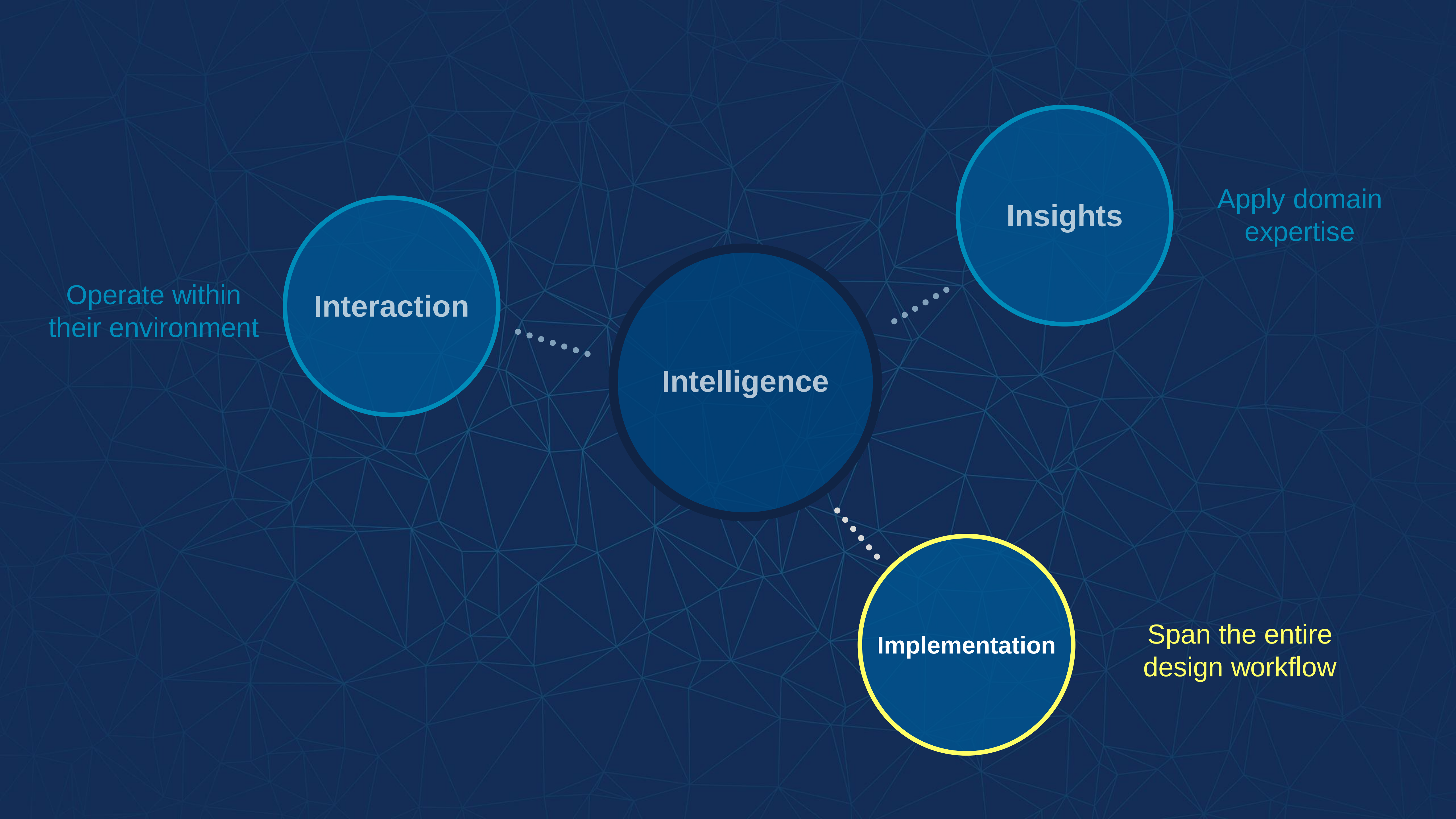
Auto-label

Preliminary AI model


“Simulink + ROS allowed us to deploy a Level 3 autonomous vehicle in less than 3 months.”
– Alan Mond, Voyage
VOYAGE

To be successful with AI, we must …

Use tool chains that span the entire design workflow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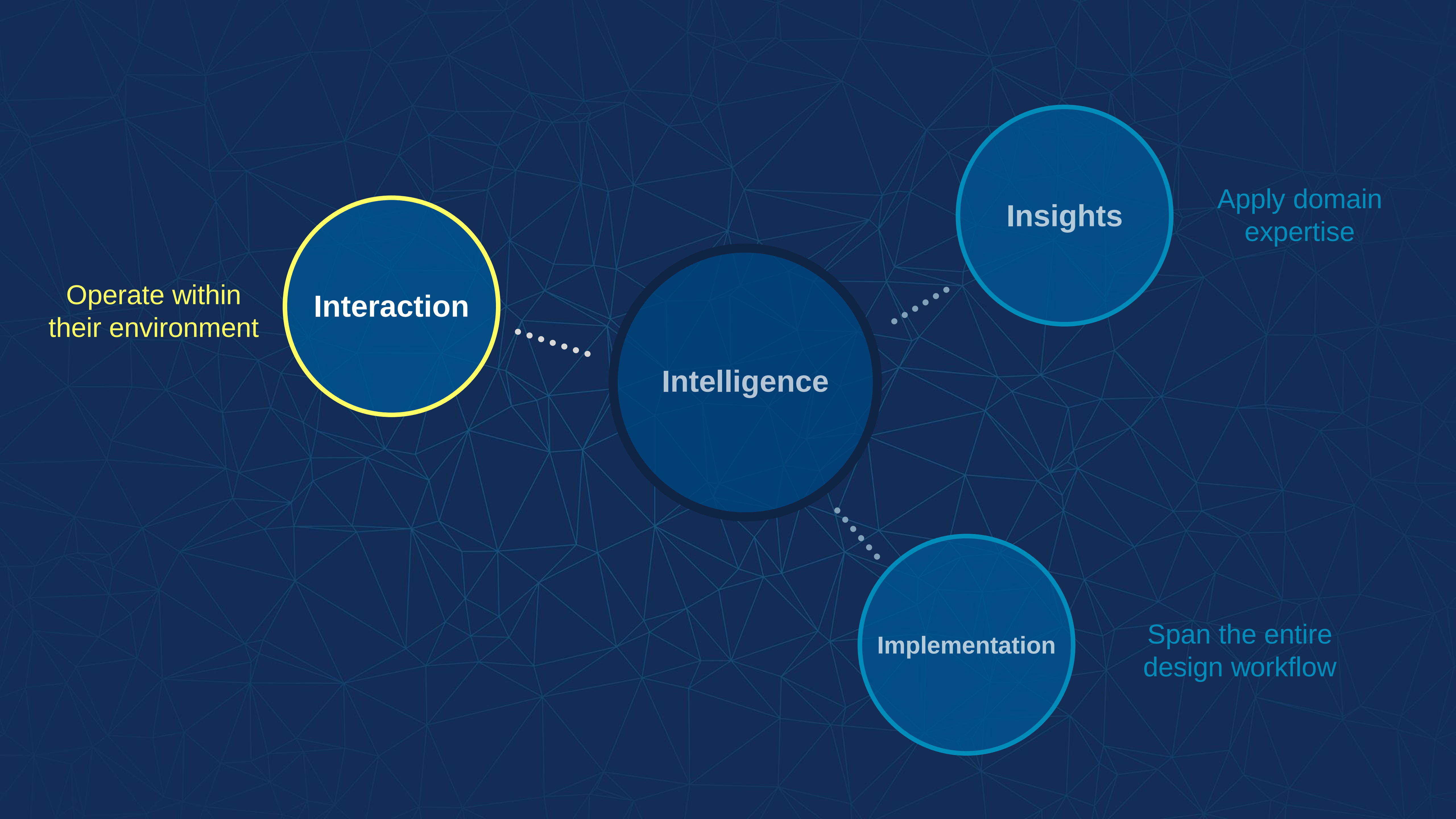
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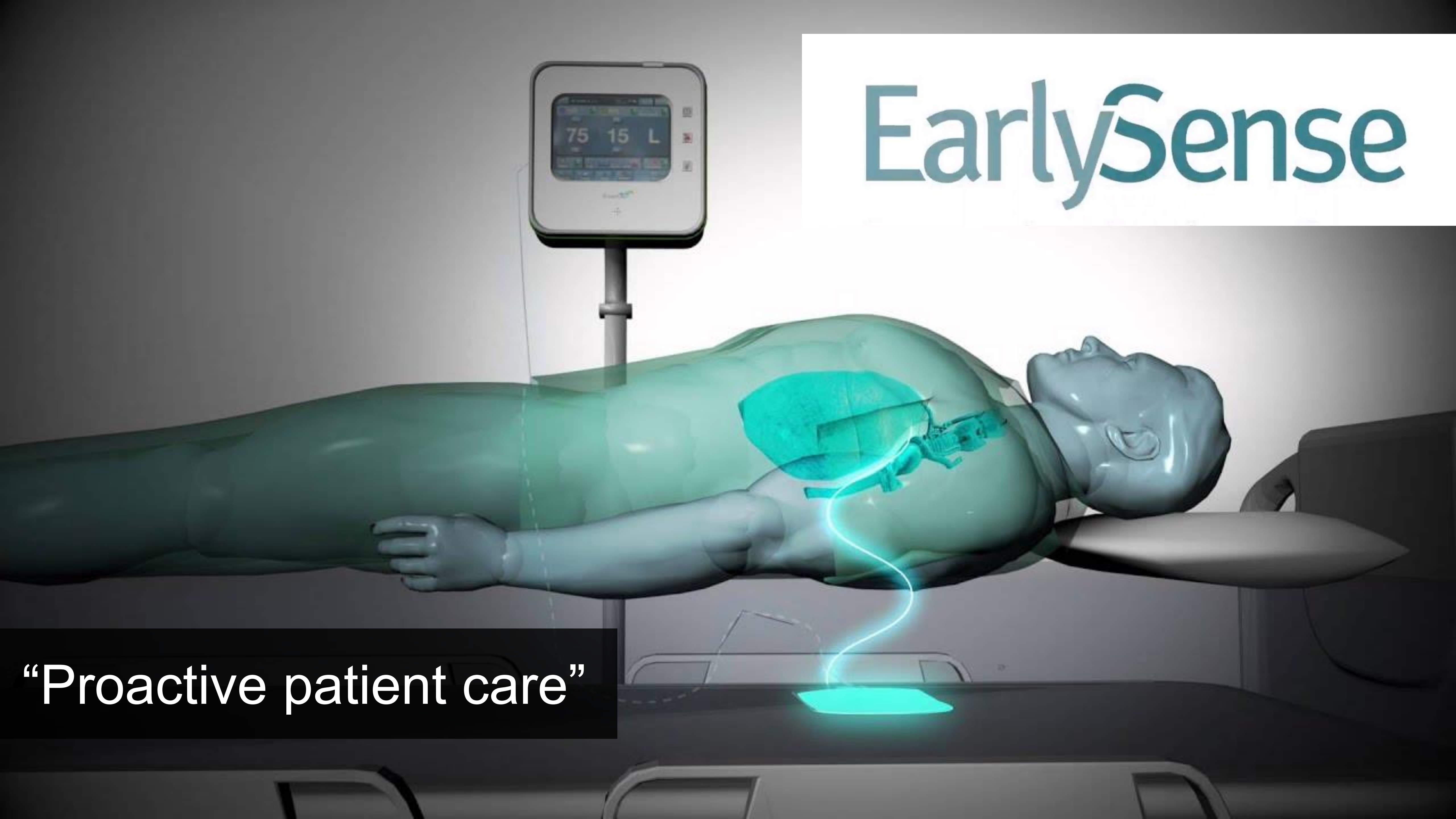
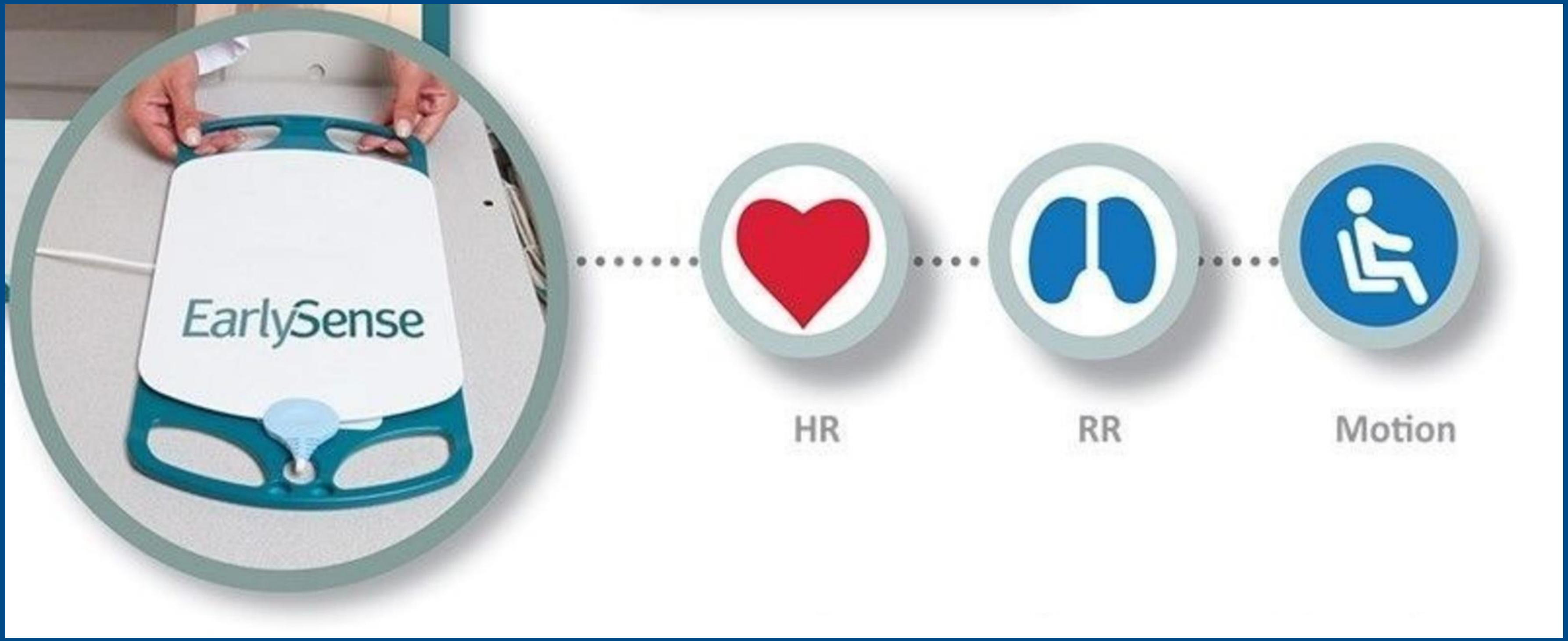
Interaction within complex environments

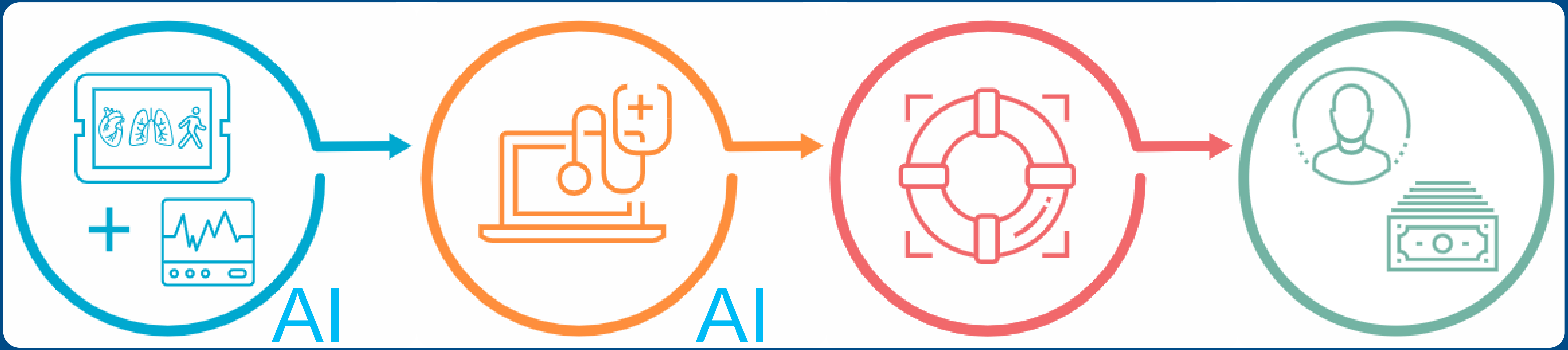
What was the larger system the vehicle had to operate in?


EarlySense
75 15 L
“Proactive patient care”

Statistics and Machine Learning Toolbox
Signal Processing Toolbox
MATLAB Coder
Embedded Coder



EarlySense's AI can predict critical events before they happen



Continuous Monitoring

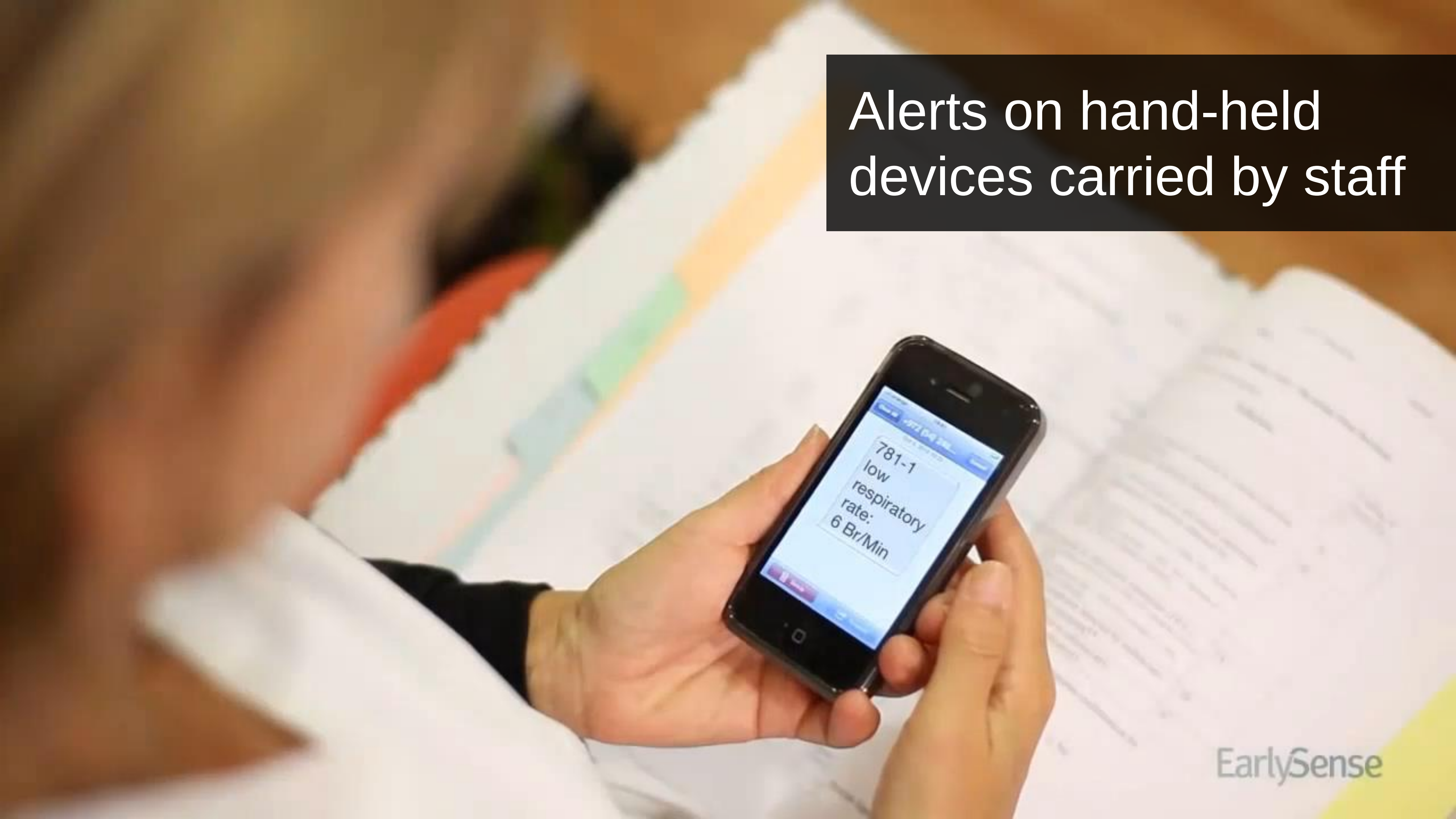
Early Detection

Early Intervention

Better Outcomes

Dashboards at nurses’ stations and on hallway monitors

Alerts on hand-held devices carried by staff



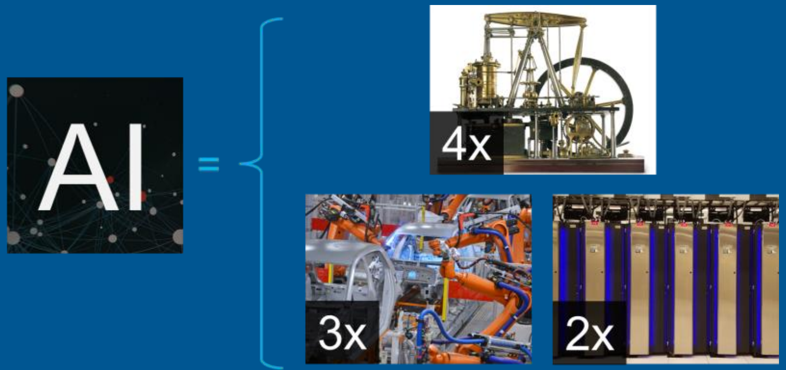

Address problems before they become emergencies

To be successful with AI, we must …

Design how our systems will integrate and interact within their environment

Success requires more than just intelligence

AI is a transformative technology



But AI projects can and do fail

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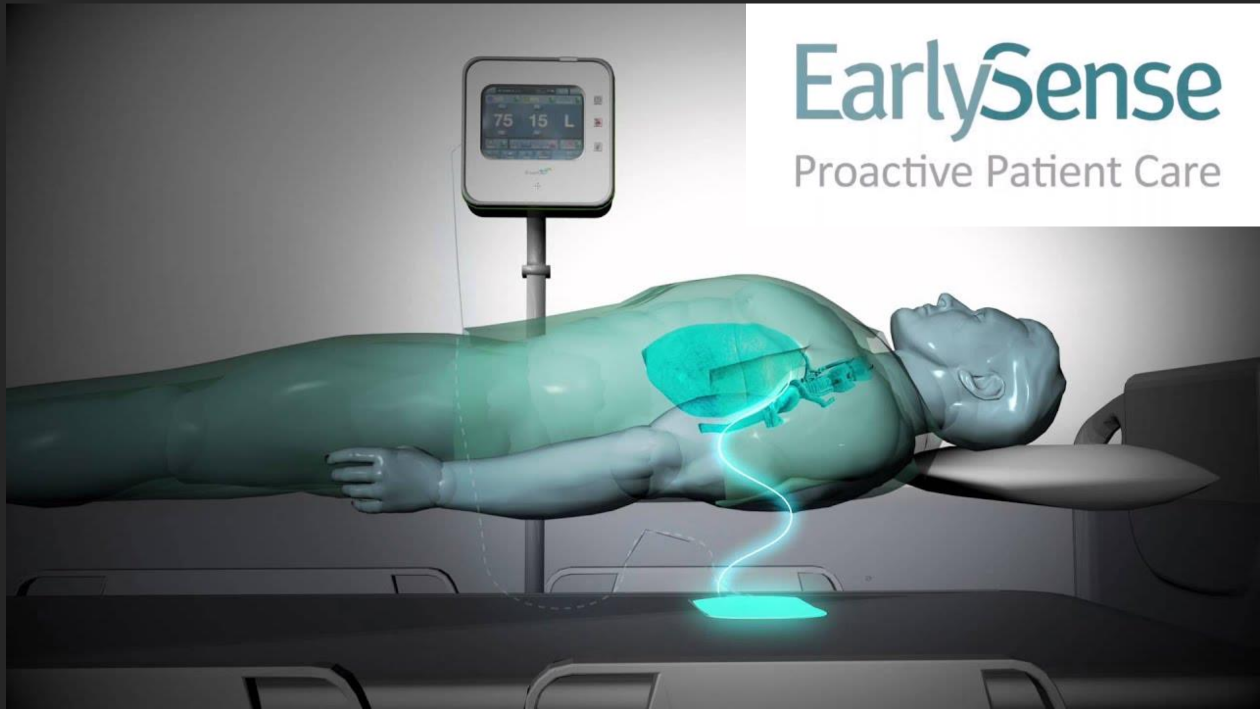
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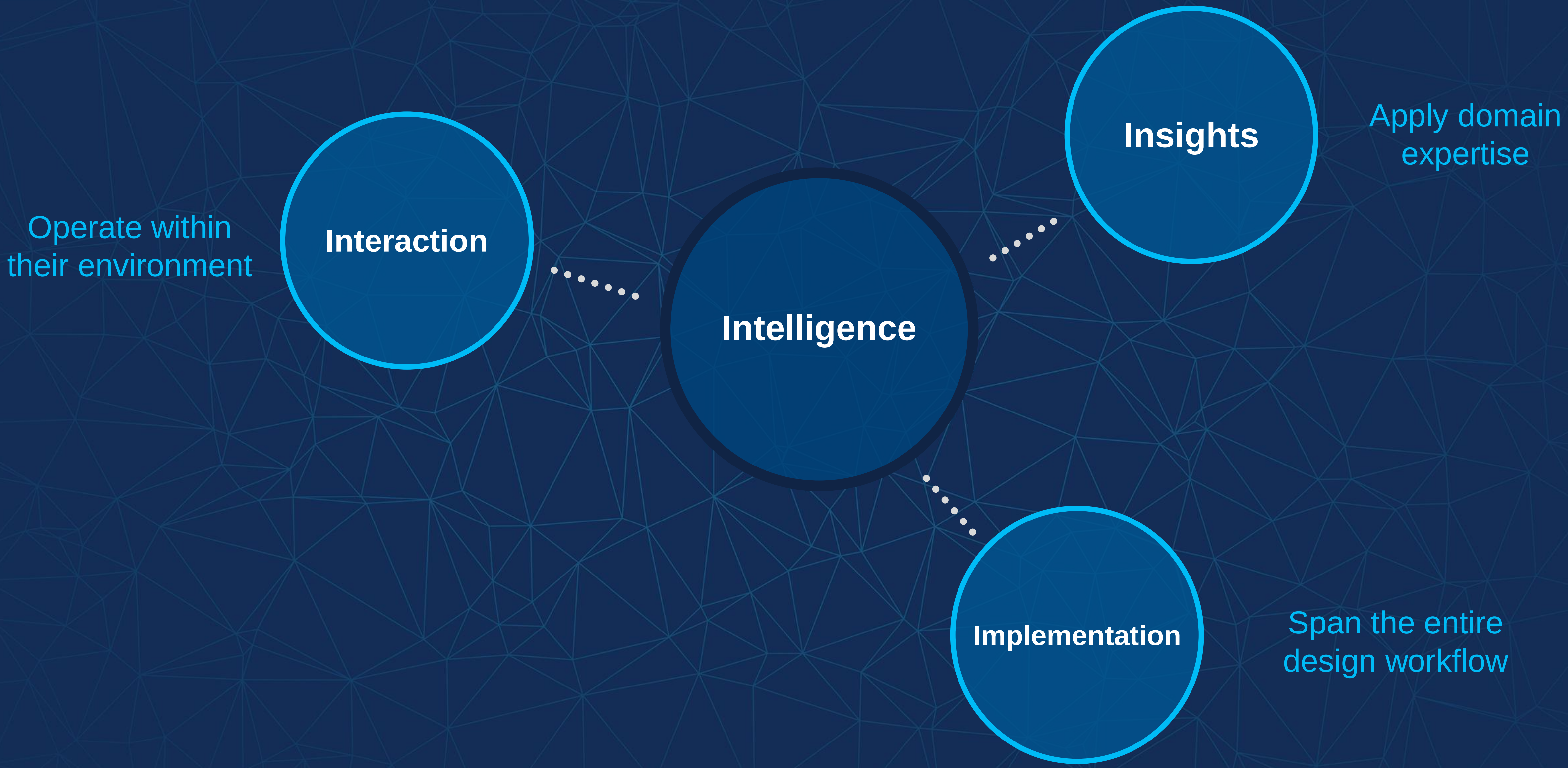
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How will you apply AI to your projects?

You have the right tools: MATLAB® & SIMULINK®

Apply your domain knowledge and insights

Implement the AI within the entire workflow

Design how your system will interact with the larger world