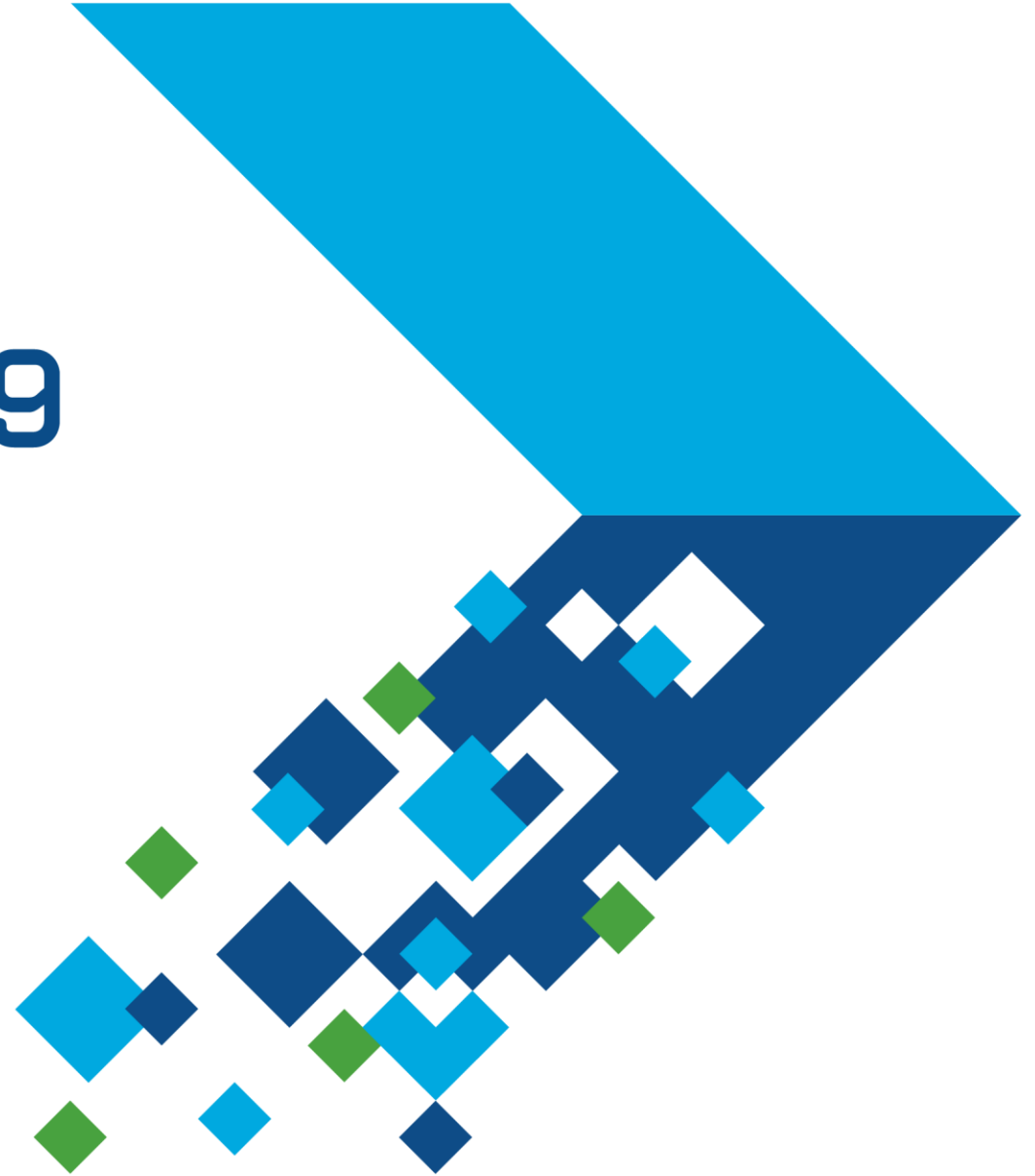


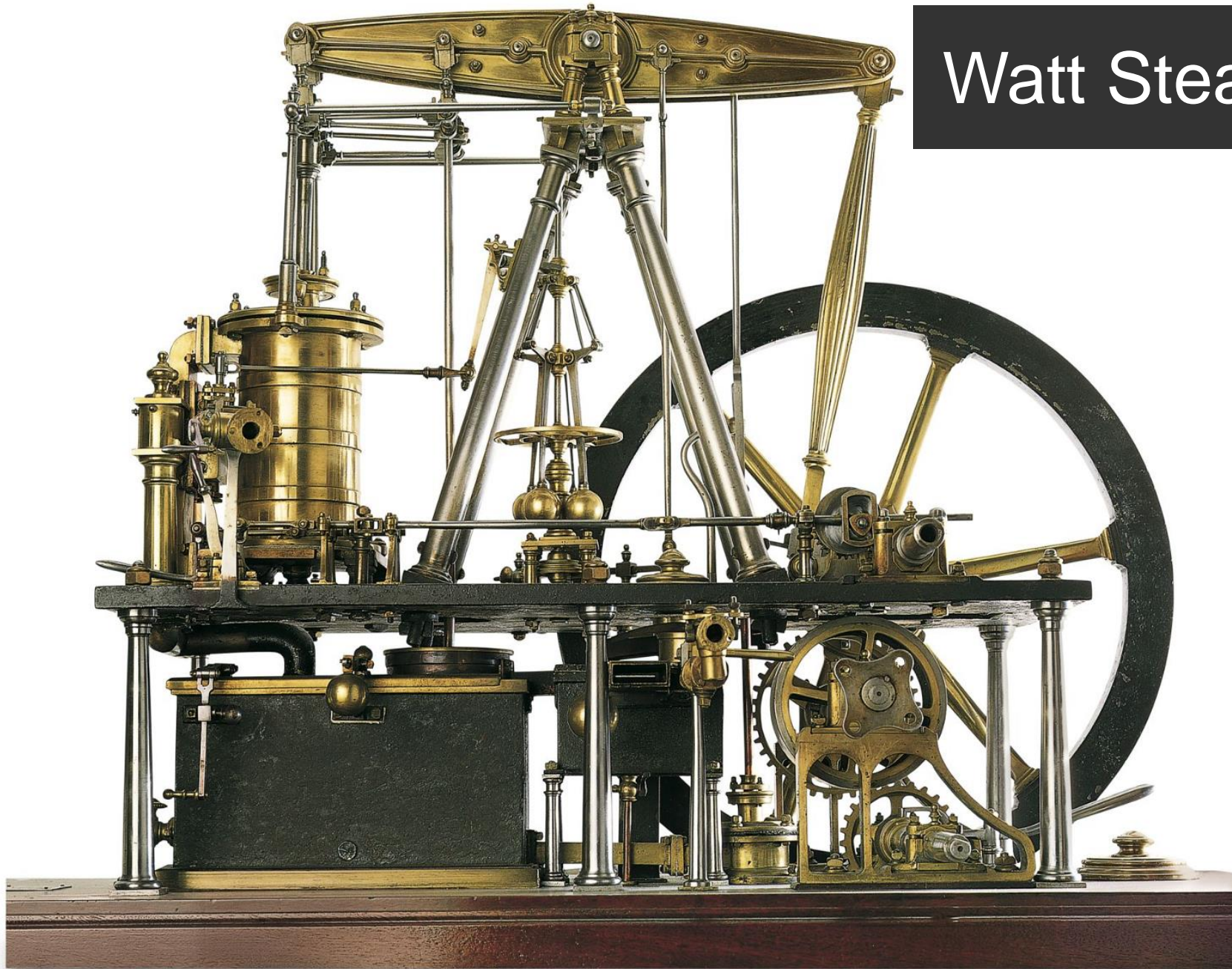
MATLAB EXPO 2019

Beyond the “I” in AI

Mike Agostini



Watt Steam Engine



Artificial intelligence is a transformative technology

McKinsey Global Institute

Notes from the AI frontier: Modeling the impact of AI on the world economy

September 2018 | Discussion Paper

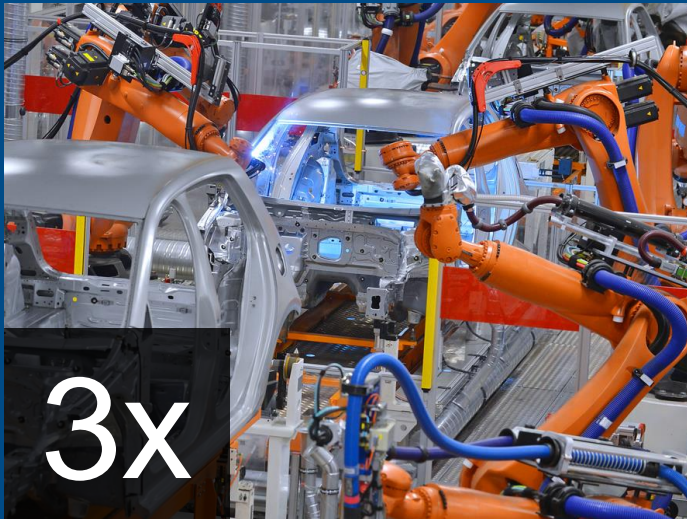
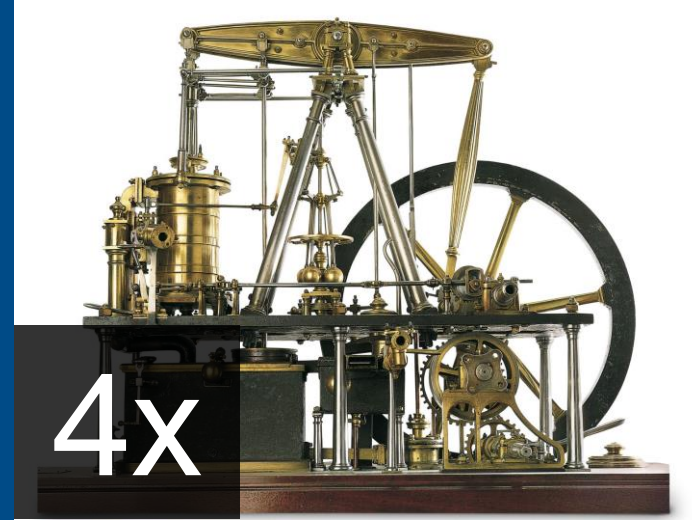
AI will create \$13 trillion in value by 2030

based on McKinsey's latest AI forecast – September 2018

AI has tremendous potential to increase productivity



=



Yet AI is struggling



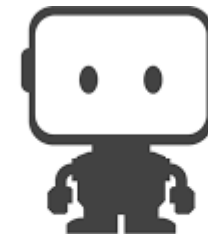
Most AI Projects Fail. Here's
How to Make Yours Successful.

July, 2018



3 Common Reasons Artificial
Intelligence Projects Fail

May, 2018



DataRobot

Why Most AI Projects Fail

Oct, 2017

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

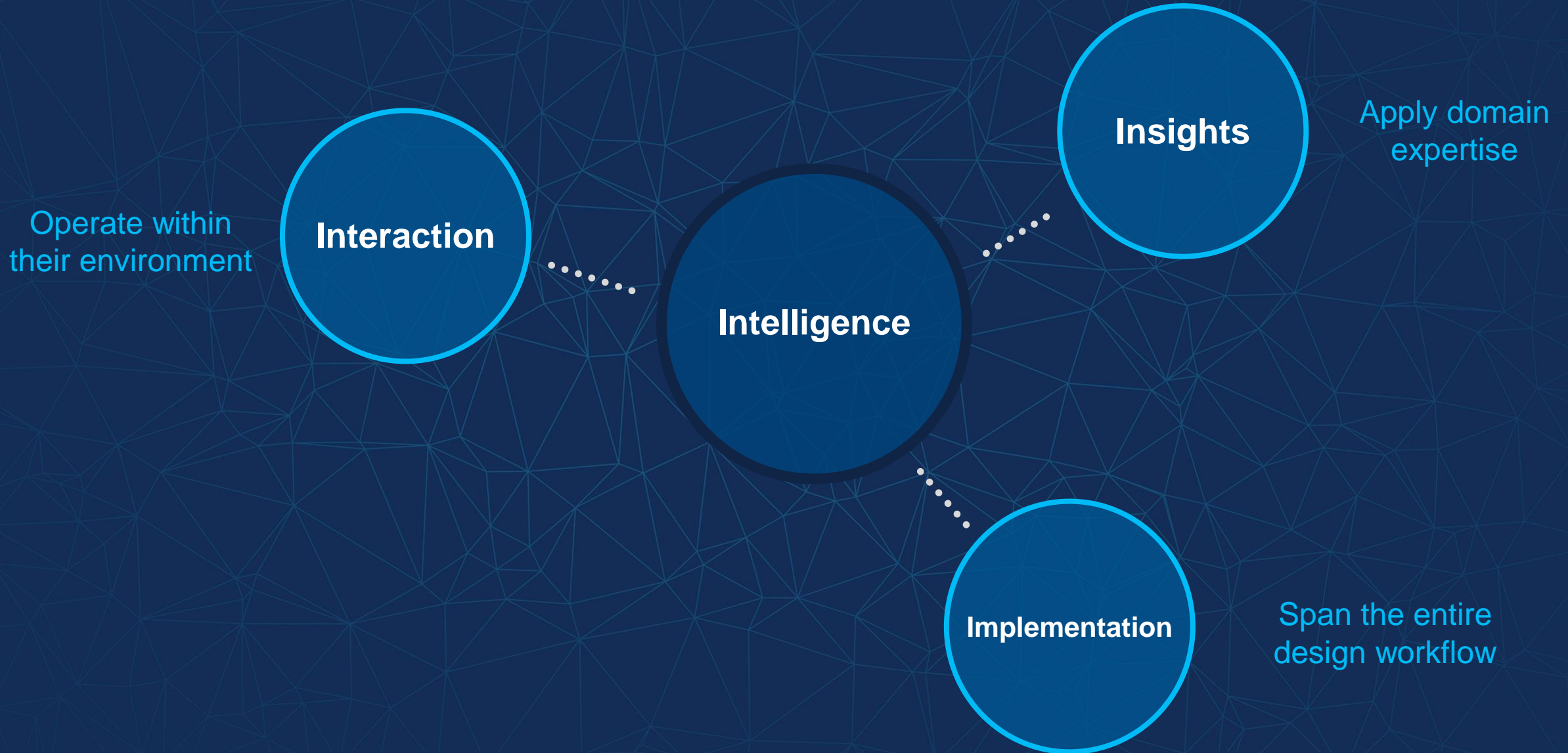
Incomplete
tools

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

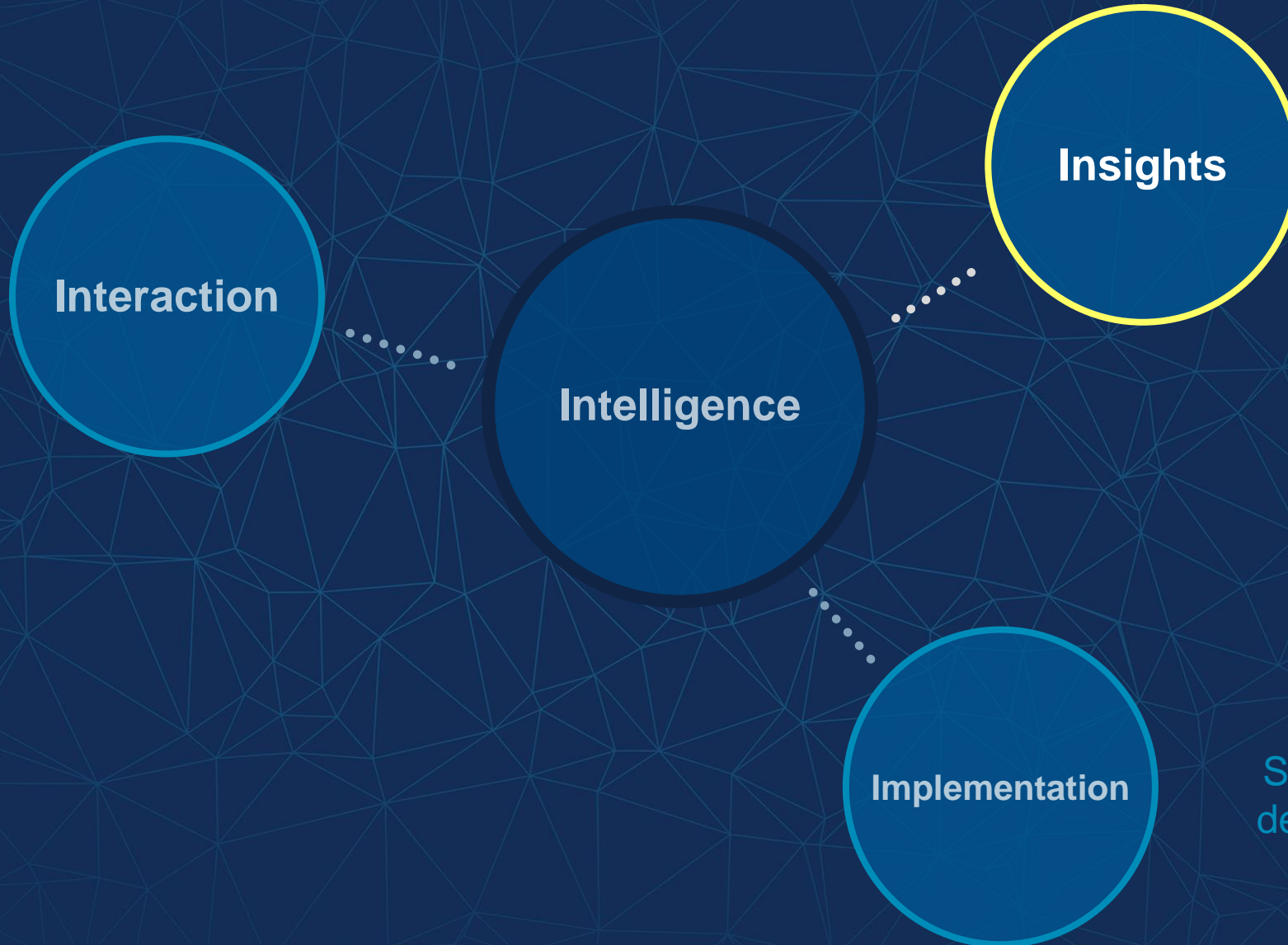
Intelligence

Insights

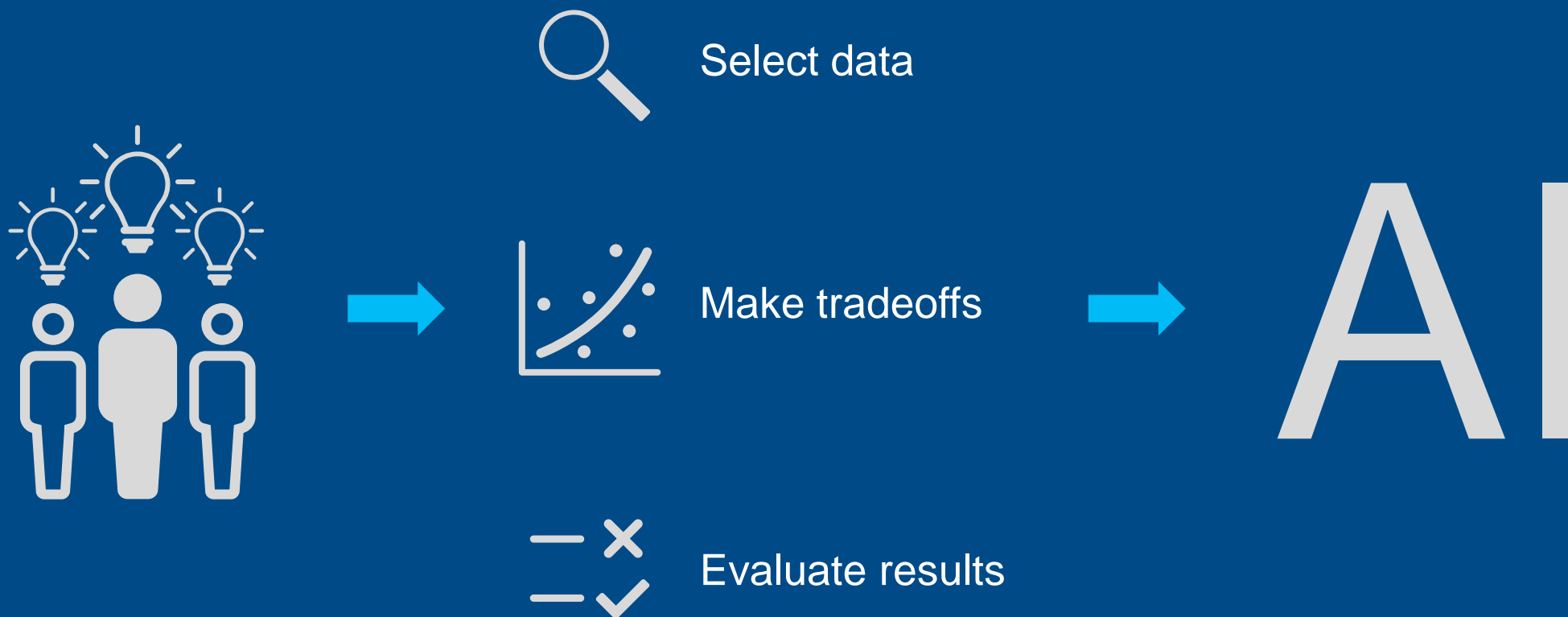
Apply domain
expertise

Implementation

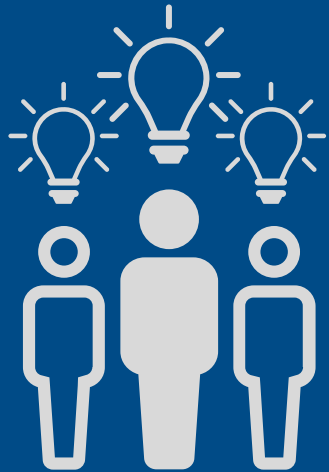
Span the entire
design workflow



Bring human insights into AI



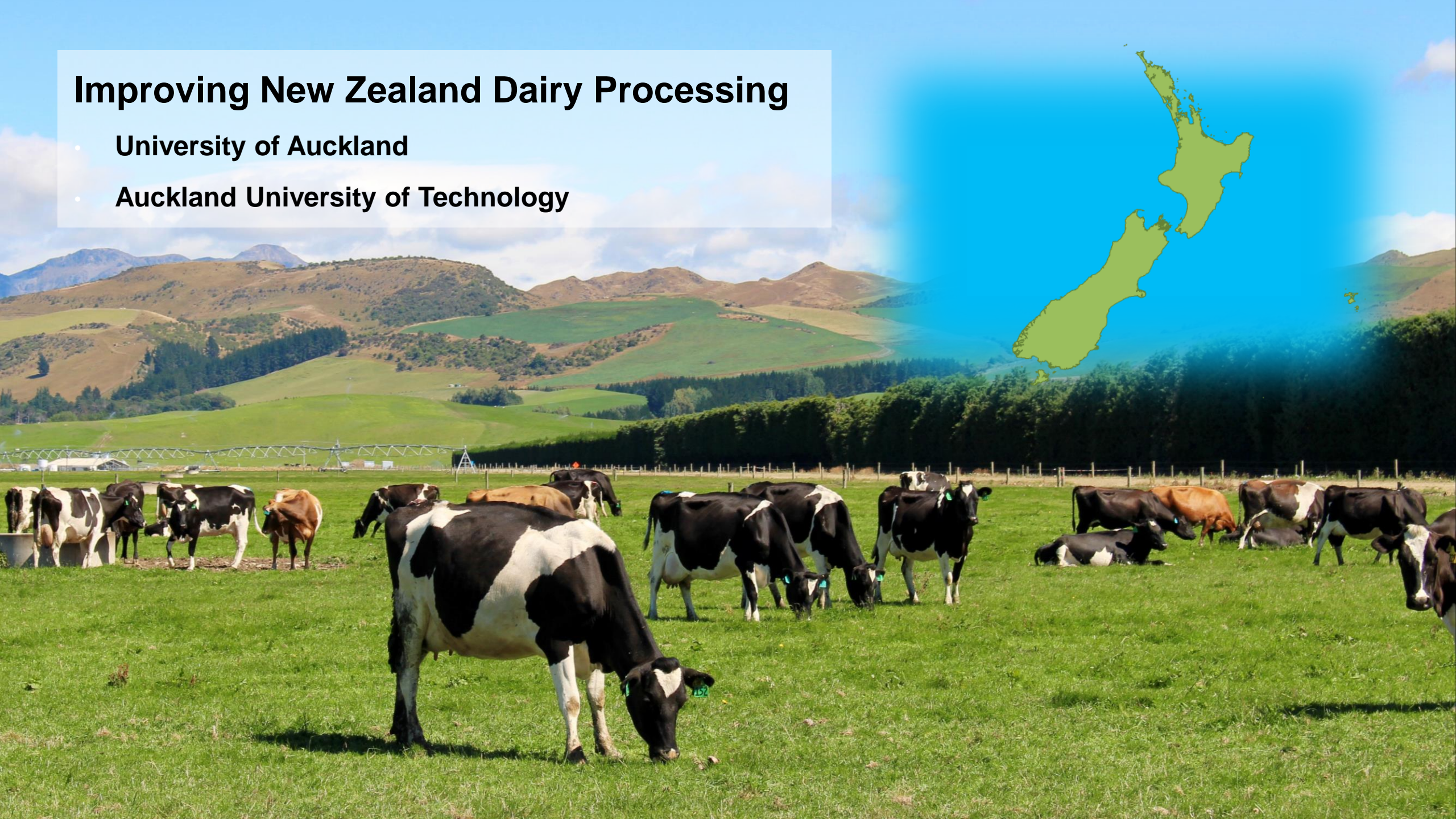
Bring human insights into AI



- 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

Continuous Plant Process

Raw Milk

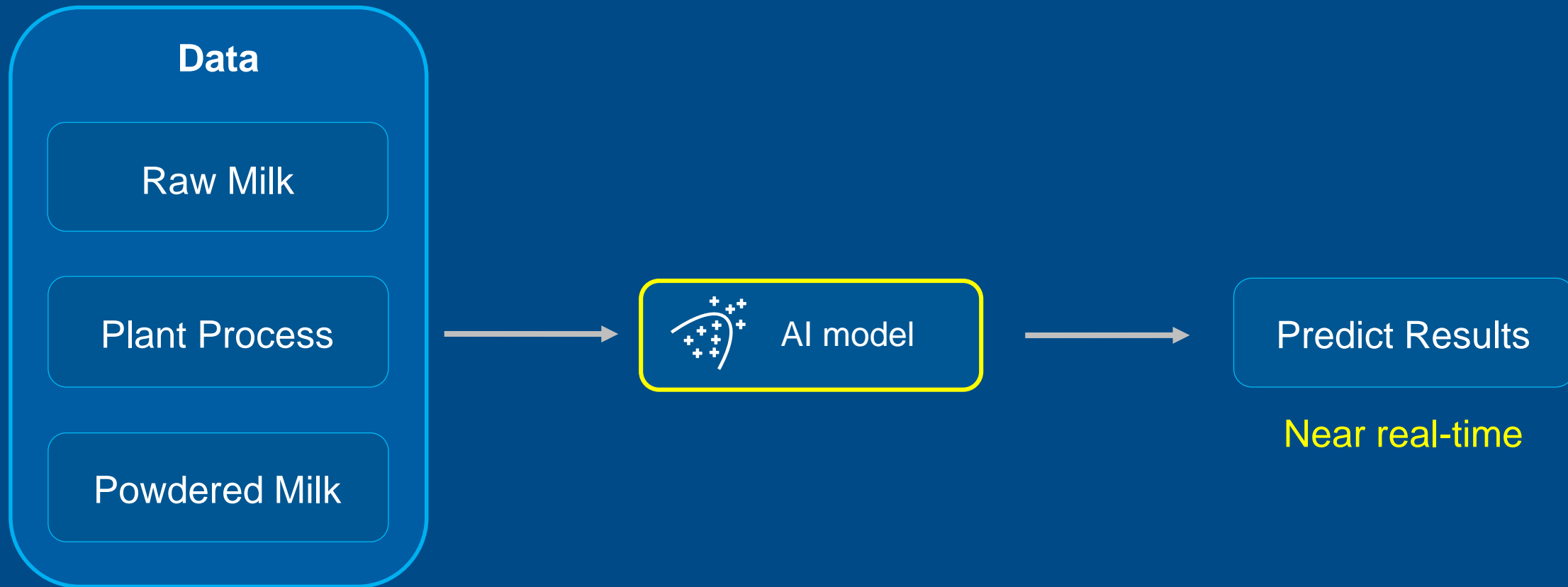


Powdered Milk



Days later

Wanted to detect a bad product earlier

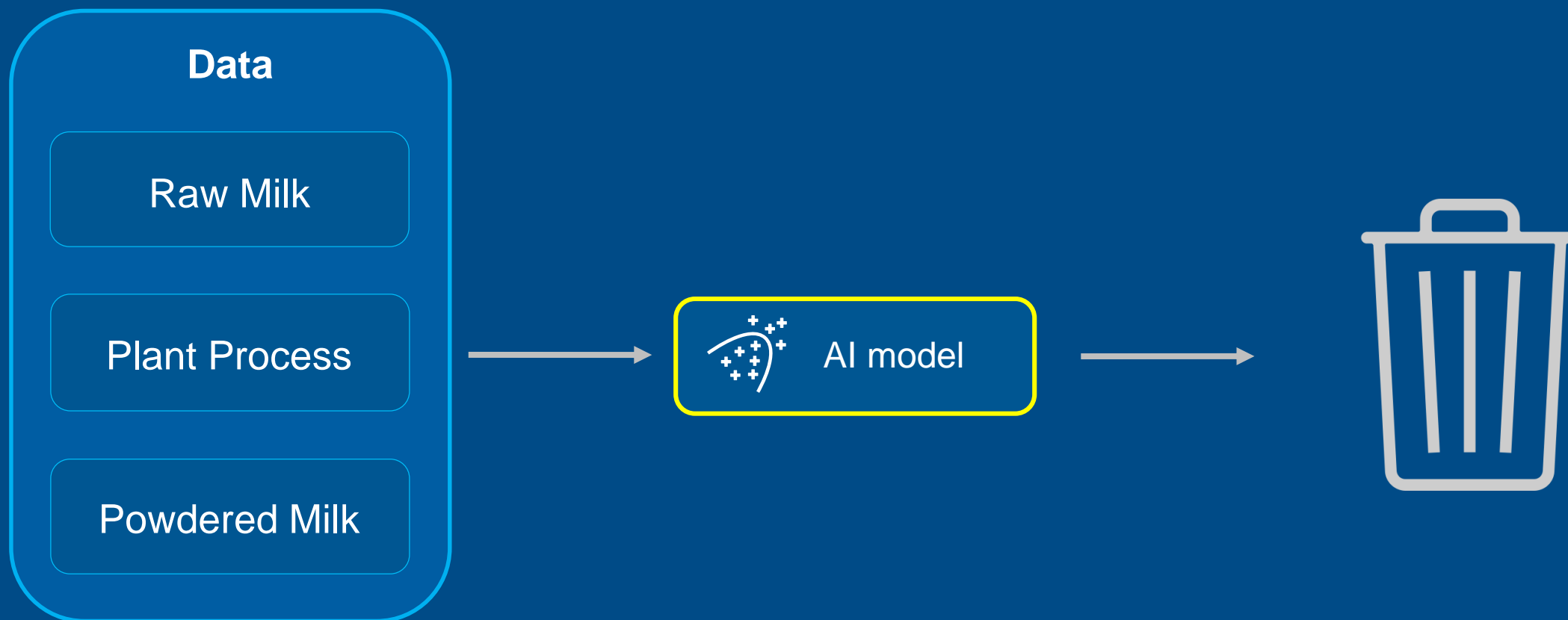


They had **lots** of data



- Millions of data points
- 6 years
- 3 plants

But...



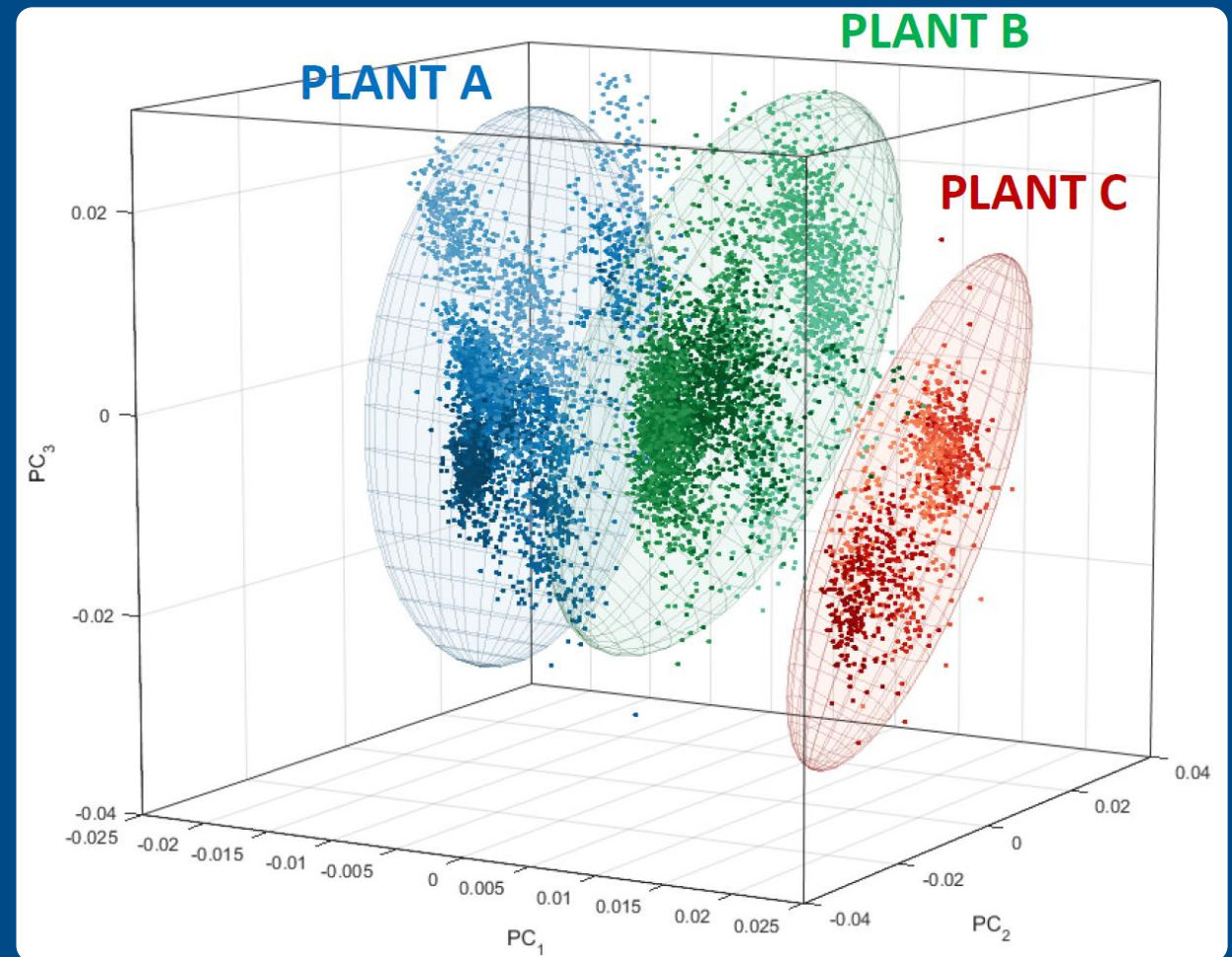
They made several key insights

1. Results were wrong

They made several key insights

1. Results were wrong
2. Need to build a separate model for each plant

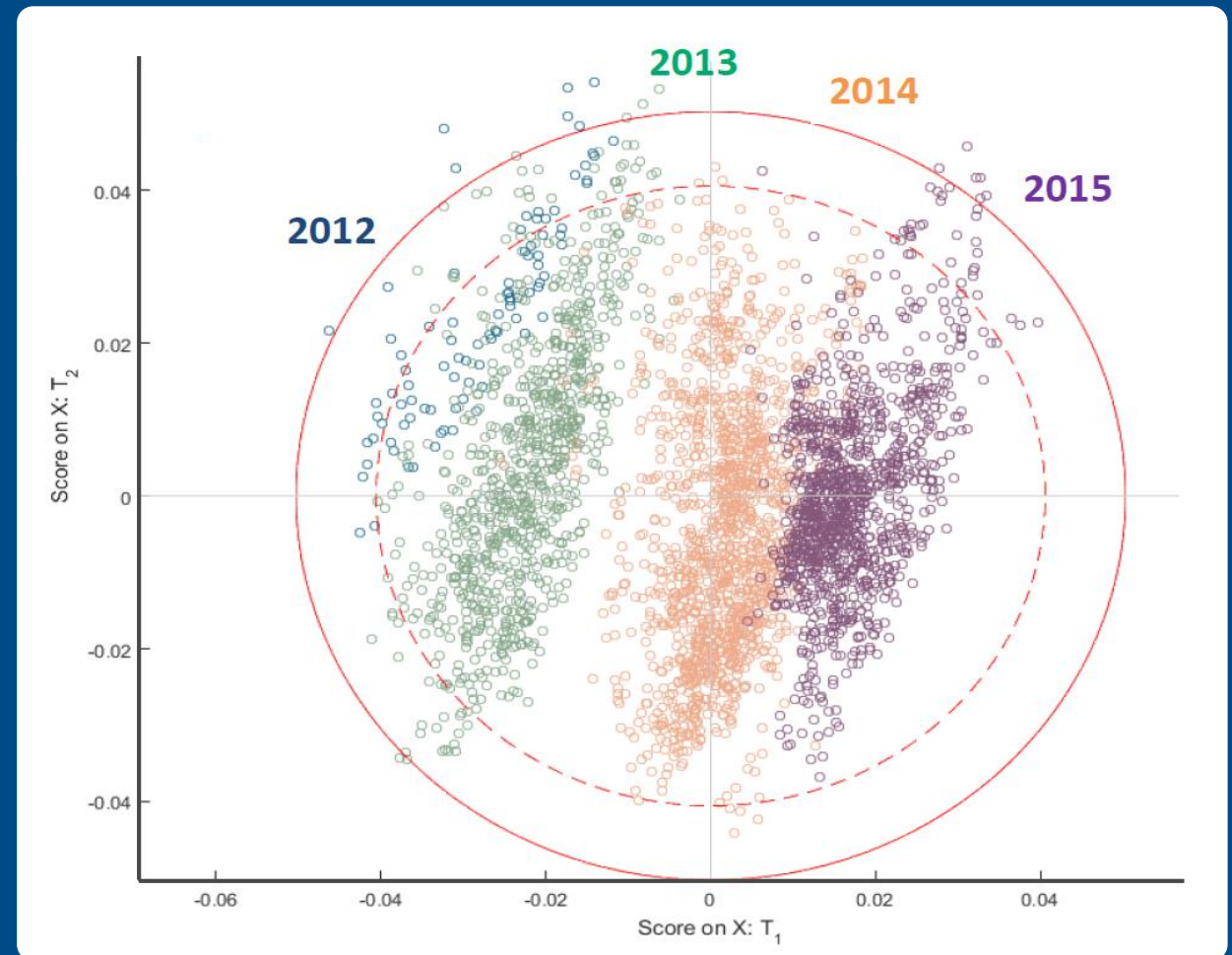
Plants **behaved differently**
from each another



They made several key insights

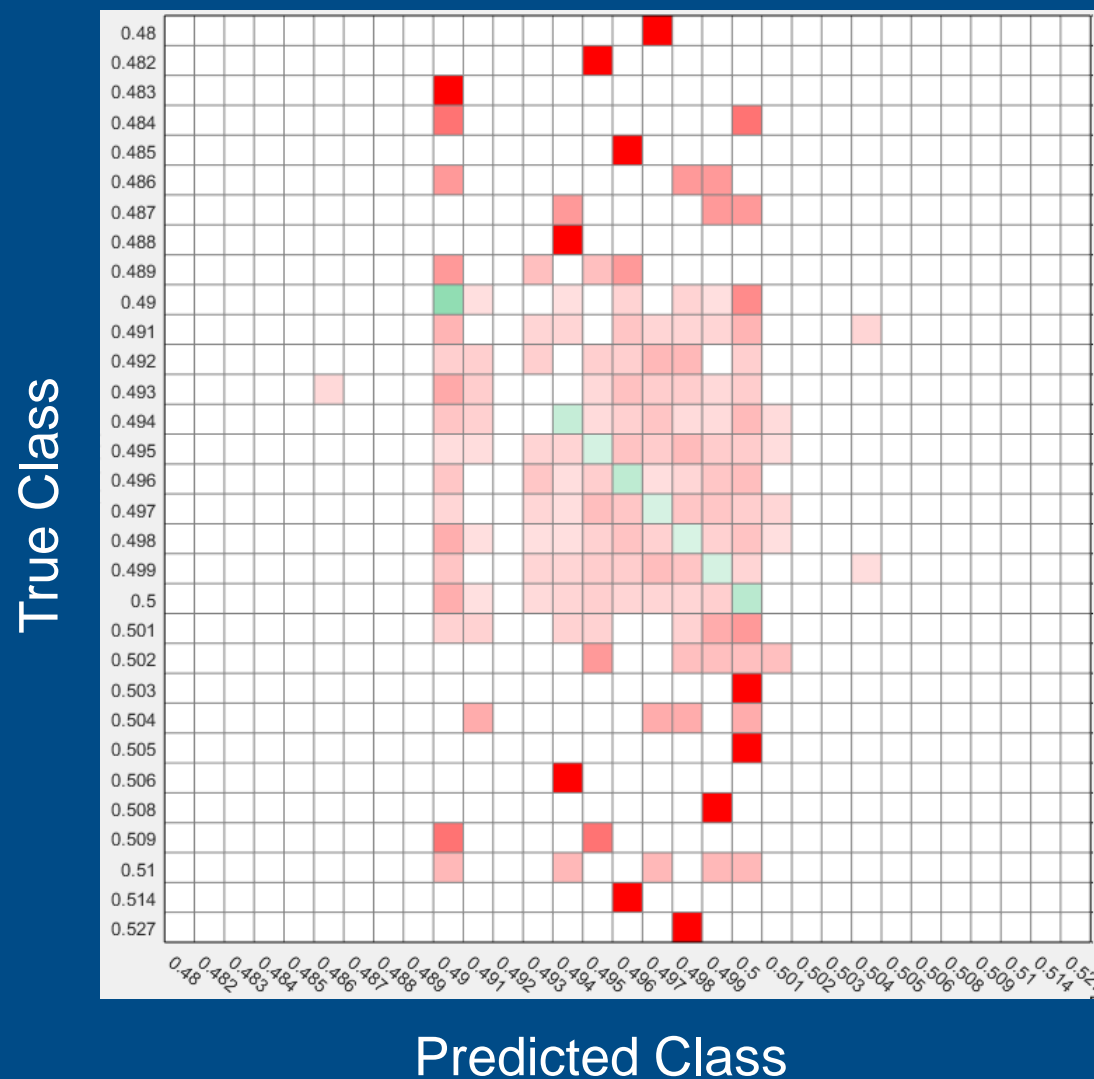
1. Results were wrong
2. Need to build a separate model for each plant
3. Plant's operating state changes each year

Each year was like a
completely different plant



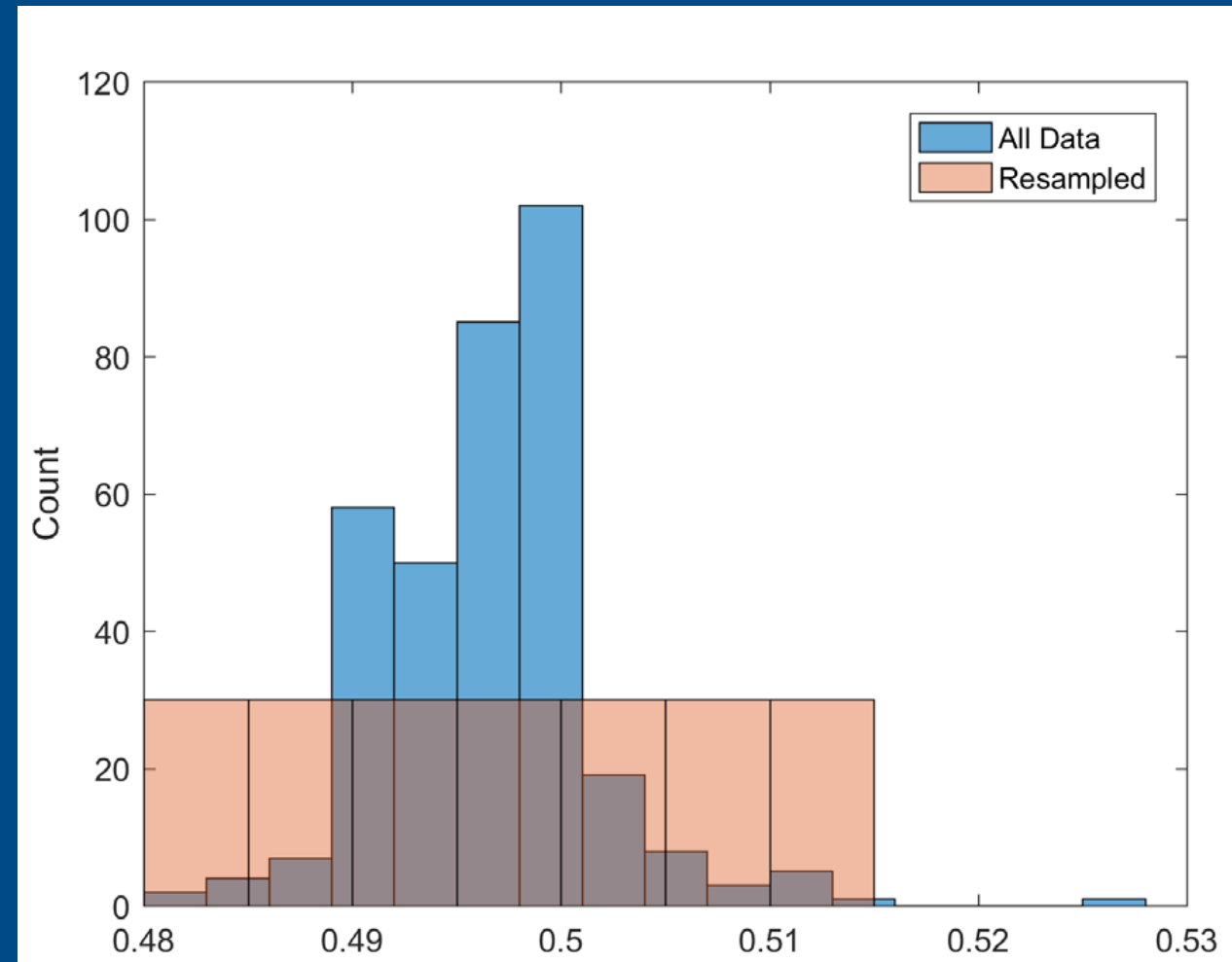
Bulk density prediction results were inaccurate

- Many false positives
- Unused classes



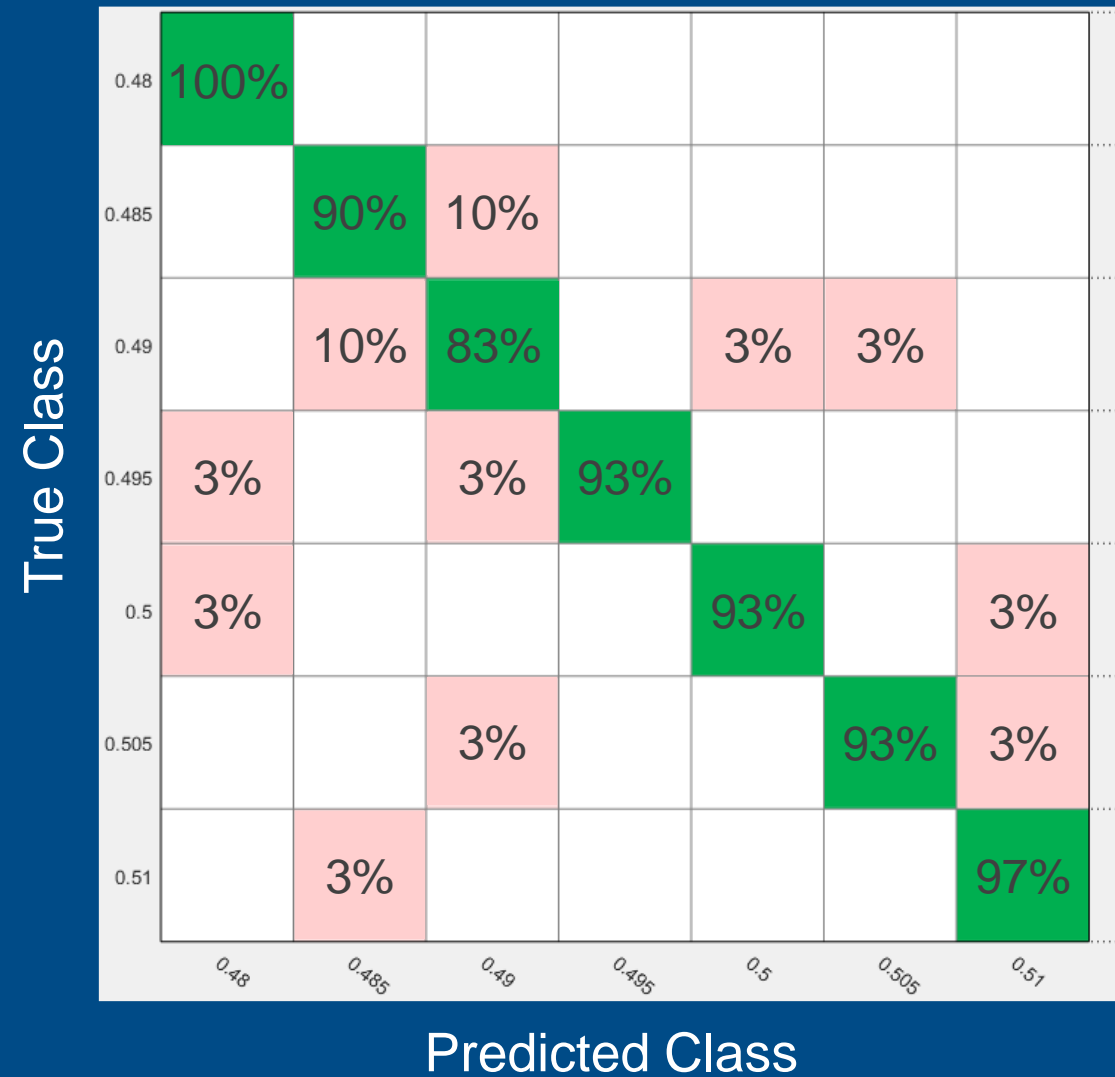
They made several key insights

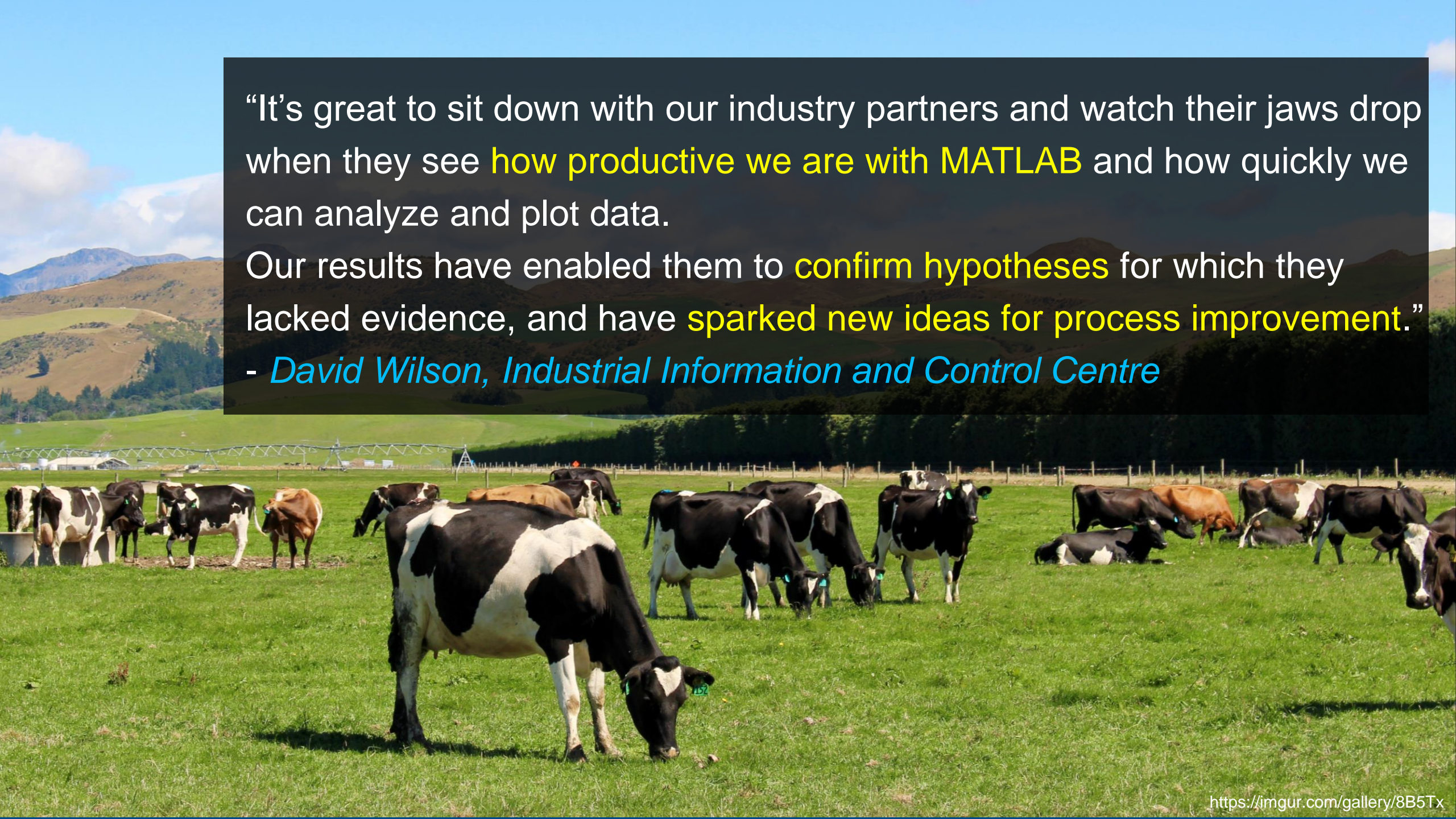
1. Results were wrong
2. Need to build a separate model for each plant
3. Plant's operating state changes each year
4. Training data was biased



Resampling data resulted in higher predictive accuracy

- Resampled data
- Reduced the number of bins



A photograph of a herd of black and white cows grazing in a lush green field. In the background, there are rolling green hills and mountains under a blue sky with some clouds. A semi-transparent dark box is overlaid on the top half of the image, containing white and yellow text.

“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*

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

Operate within
their environment

Interaction

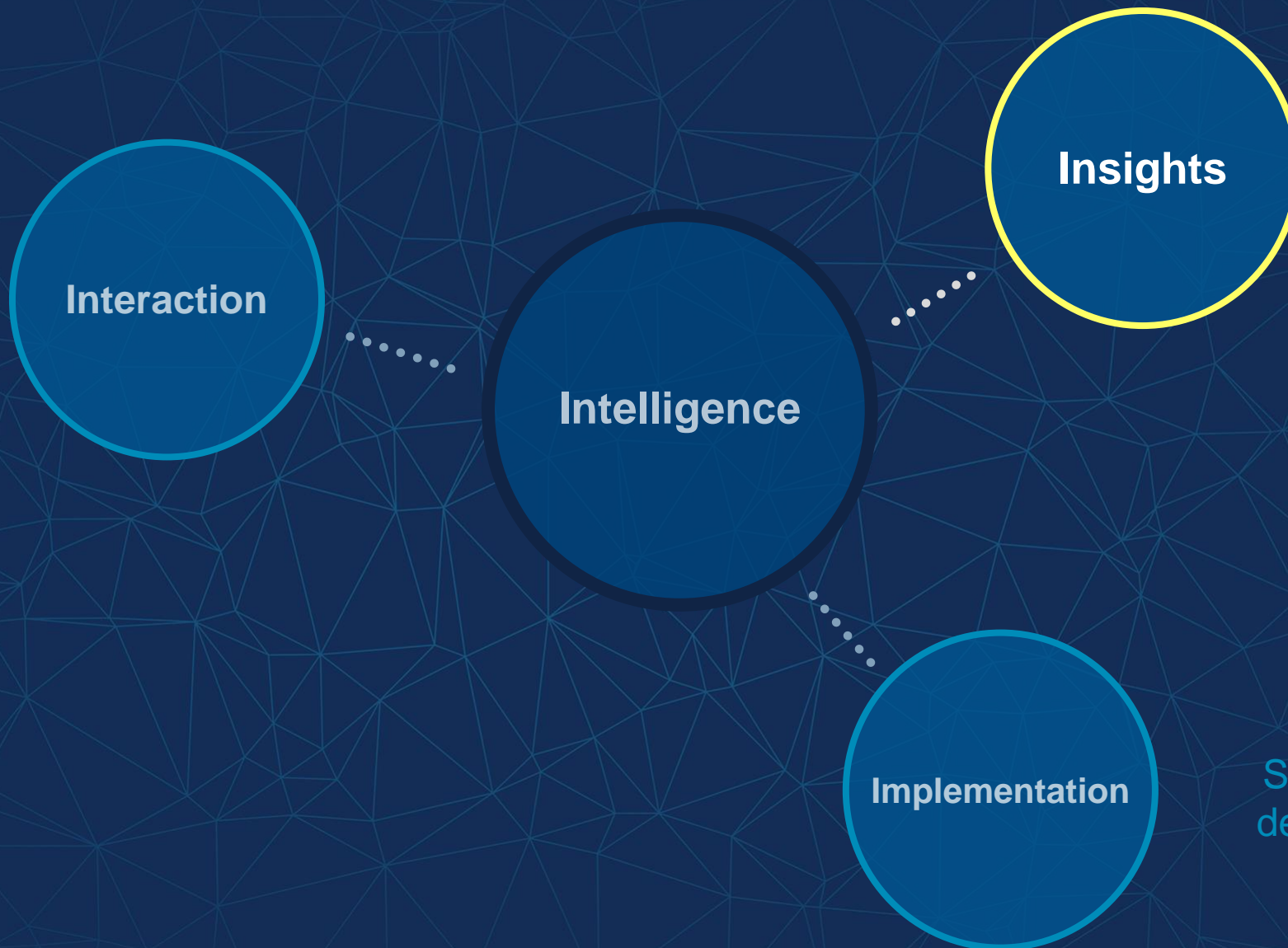
Intelligence

Insights

Apply domain
expertise

Implementation

Span the entire
design workflow



Operate within
their environment

Interaction

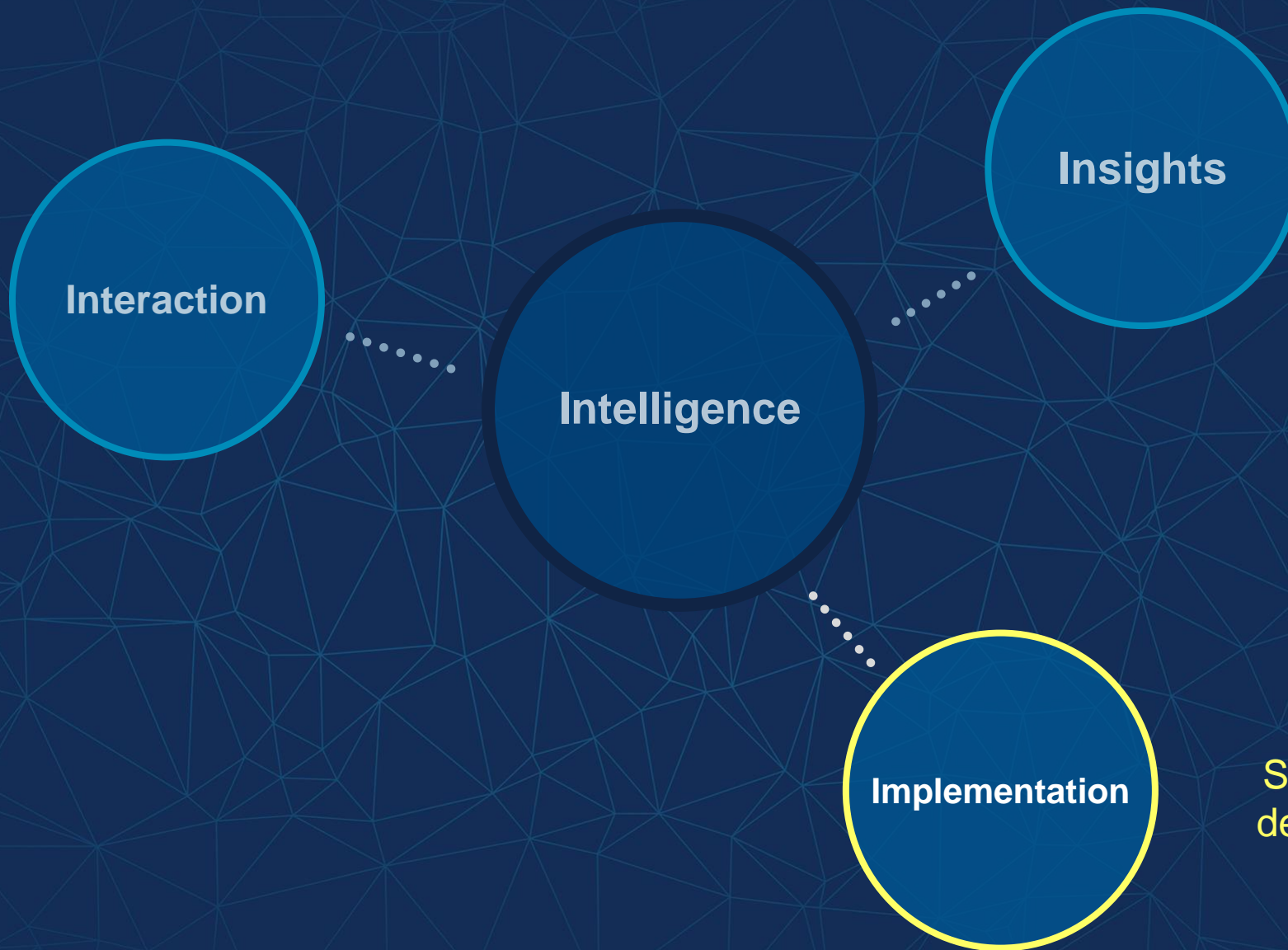
Intelligence

Insights

Apply domain
expertise

Implementation

Span the entire
design workflow



Implementation is about designing the solution

Research



Testing
Data analysis
Reporting

Manufacturing



Developing concept
Prototyping
Deployment

Autonomous System



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

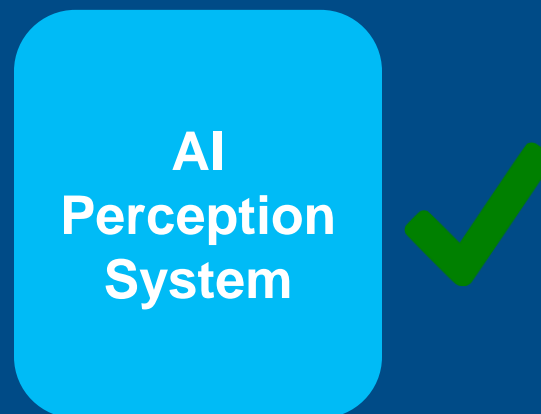


Voyage's goal was to quickly get to market

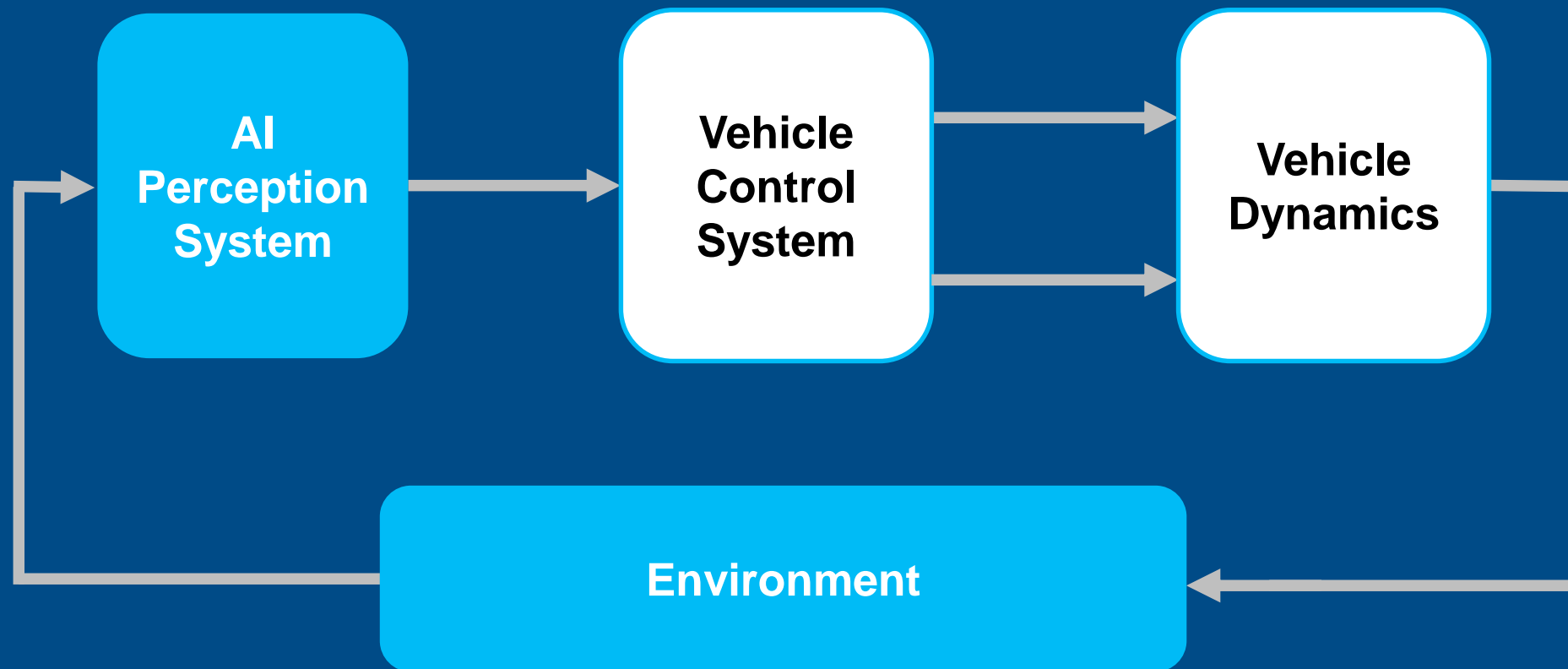
1. Target retirement communities
2. Use off-the-shelf components wherever possible
3. Bring in the right software tools across the entire workflow

The LUMINAR logo, with the word 'LUMINAR' in a black sans-serif font. The letters 'I' and 'N' are colored red and blue respectively.The CARMERA logo, featuring a stylized orange and purple infinity symbol above the word 'CARMERA' in a black sans-serif font.The ROS logo, featuring a 3x3 grid of dots above the word 'ROS' in a large black sans-serif font, with 'Robot Operating System' in a smaller black sans-serif font below it.

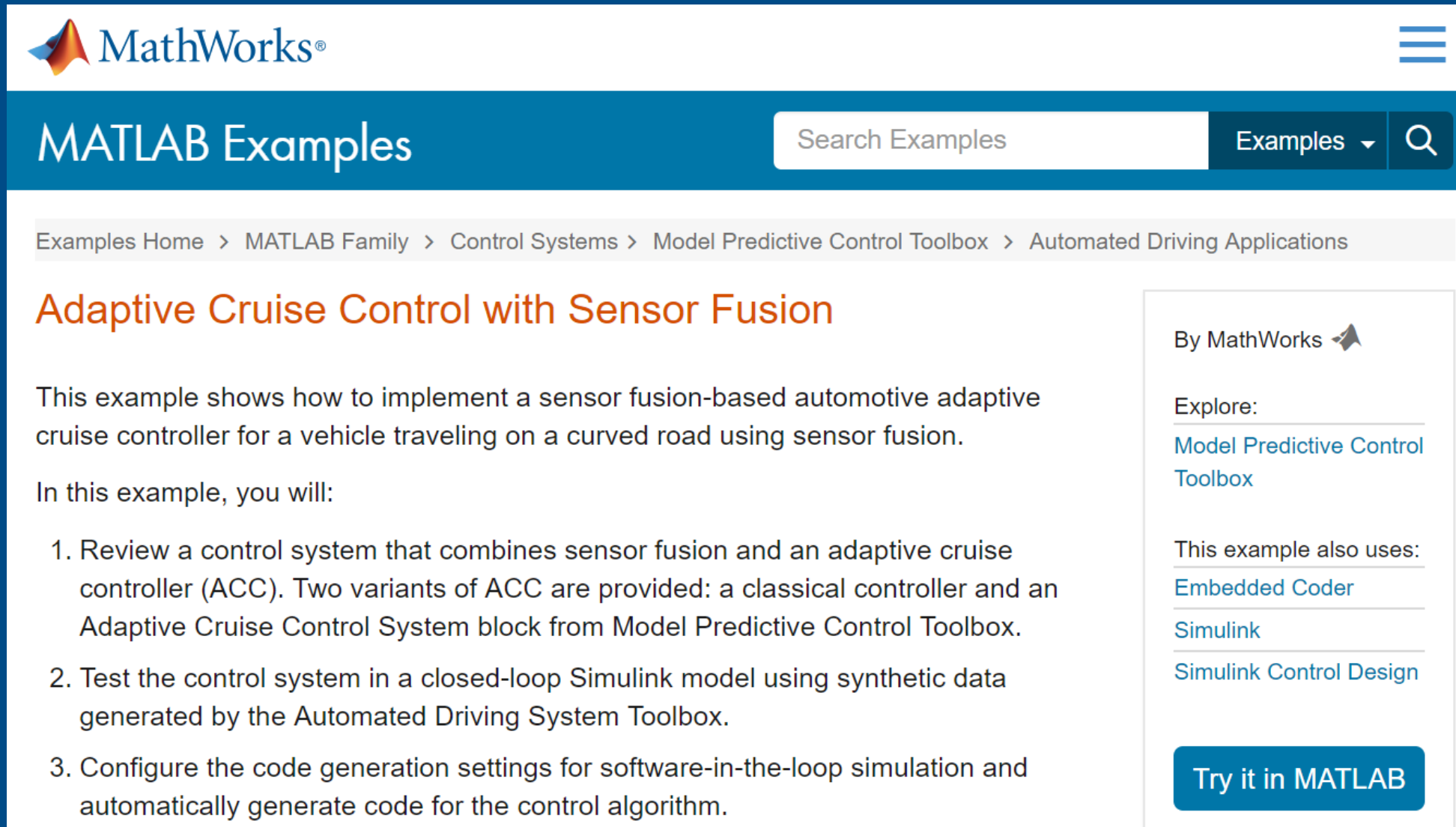
Voyage completed their AI system first



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



Started with Simulink example that they could build upon



The screenshot shows the MathWorks MATLAB Examples website. The header includes the MathWorks logo and a search bar. The main navigation bar is blue with the text 'MATLAB Examples'. Below this is a breadcrumb trail: 'Examples Home > MATLAB Family > Control Systems > Model Predictive Control Toolbox > Automated Driving Applications'. The main content area is titled 'Adaptive Cruise Control with Sensor Fusion' in orange. It describes an example of implementing a sensor fusion-based automotive adaptive cruise controller. A list of three steps is provided. On the right, there is a sidebar with the text 'By MathWorks' and a list of related topics: 'Model Predictive Control Toolbox', 'Embedded Coder', 'Simulink', and 'Simulink Control Design'. A blue button labeled 'Try it in MATLAB' is at the bottom right of the sidebar.

MathWorks®

MATLAB Examples

Search Examples Examples Q

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.

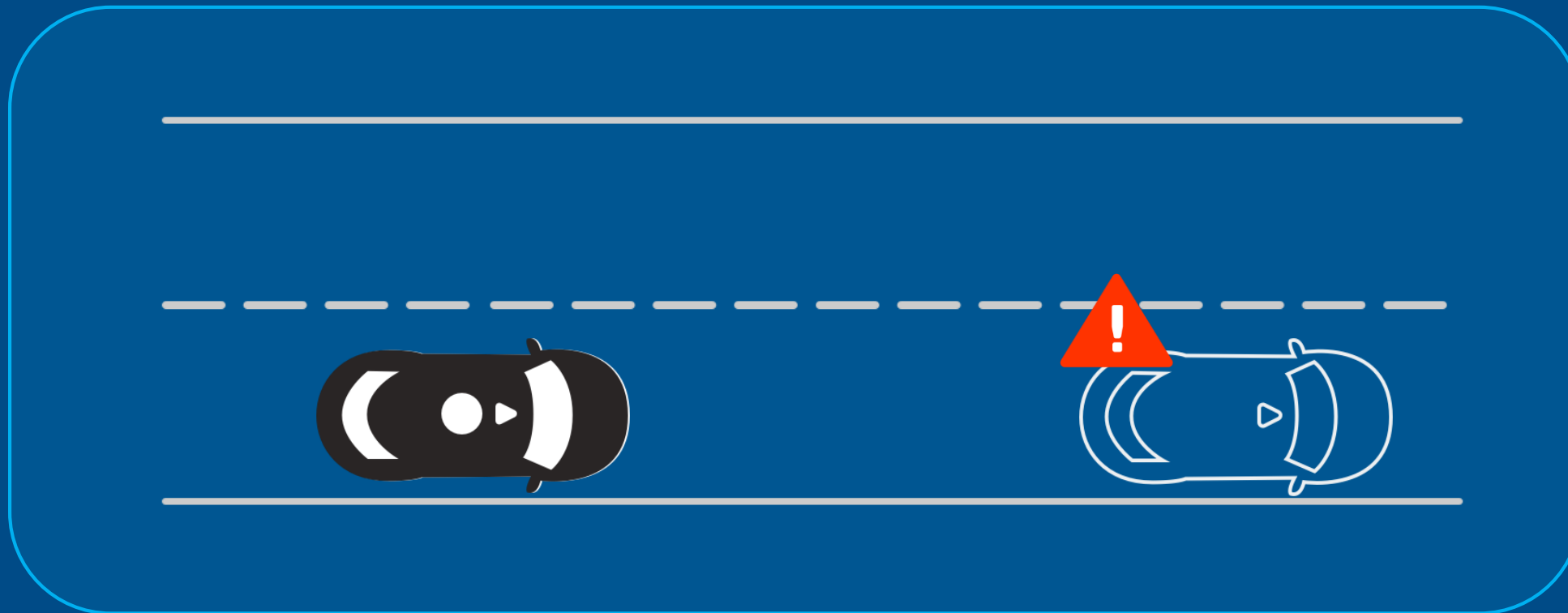
By MathWorks

Explore:

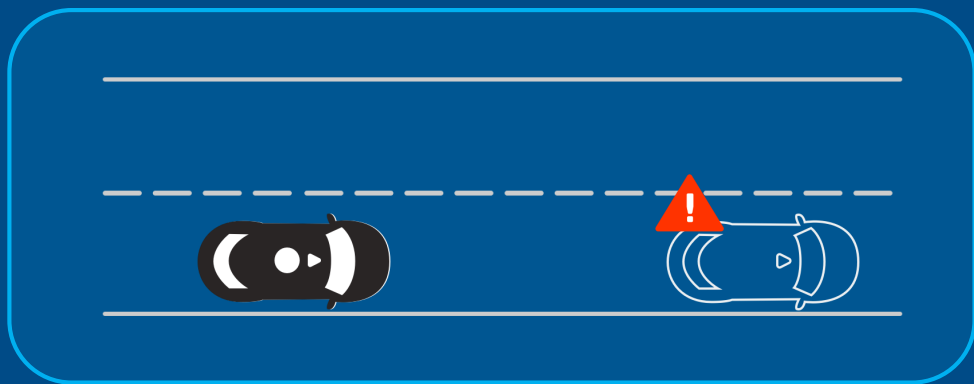
- [Model Predictive Control Toolbox](#)
- [Embedded Coder](#)
- [Simulink](#)
- [Simulink Control Design](#)

Try it in MATLAB

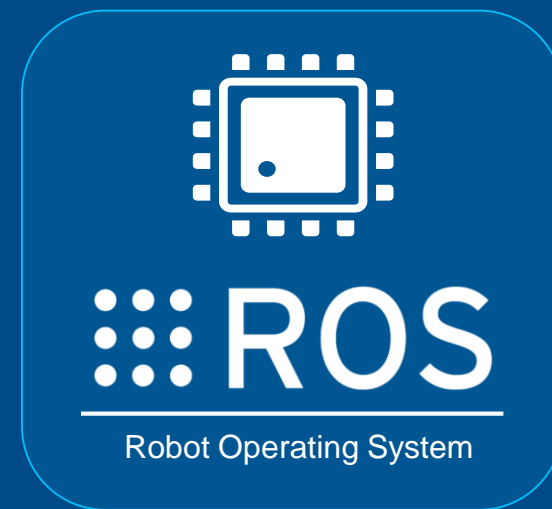
Injected simulated vehicles to interact with while driving



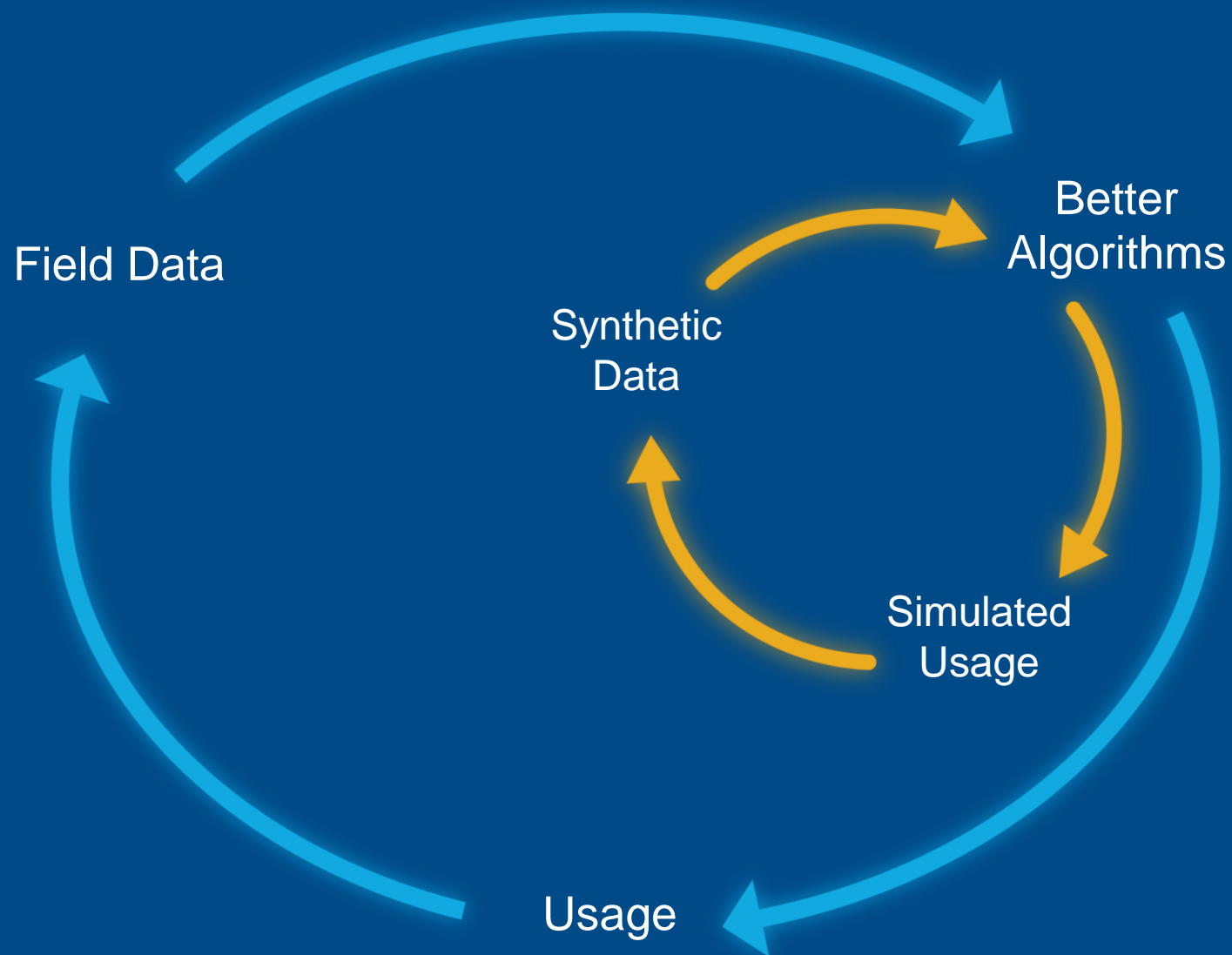
Deployed controller as ROS node and generated code



Robotics System Toolbox
Embedded Coder



Train your AI faster with tight simulation loops

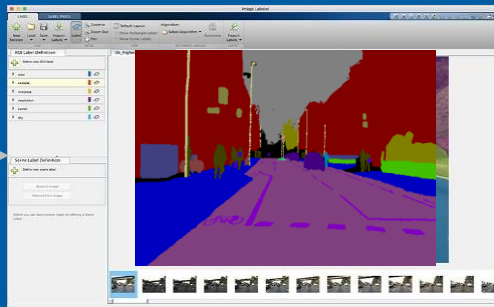


One example of leveraging simulation for data synthesis

Traditional deep learning workflow



Record



Label



AI model

Simulation-based workflow



Simulate



Auto-label



***“Simulink + ROS allowed us to
deploy a Level 3 autonomous
vehicle in less than 3 months.”***

– Alan Mond, Voyage



To be successful with AI, we must ...

Use tool chains that **span
the entire design workflow**

Operate within
their environment

Interaction

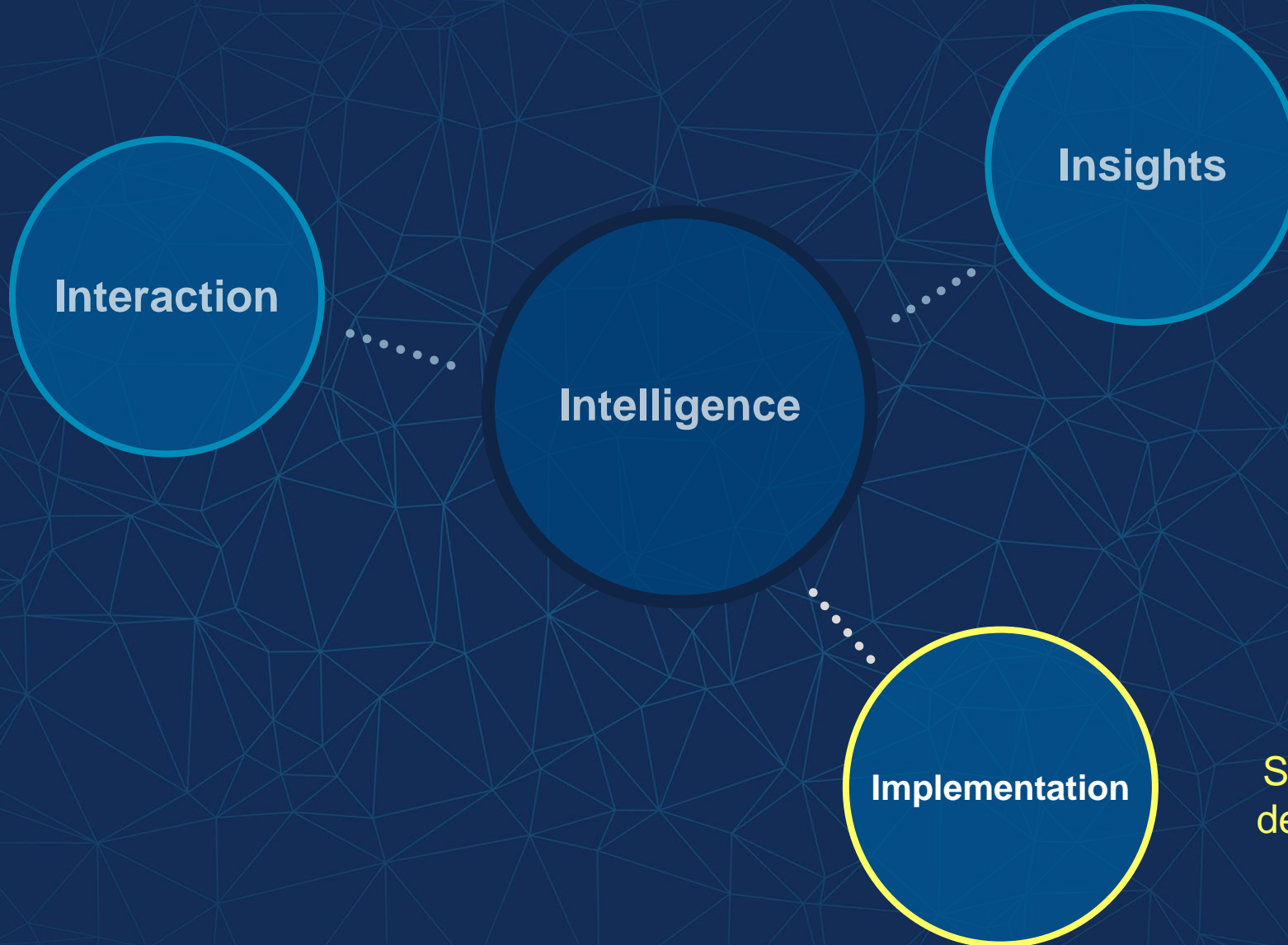
Intelligence

Insights

Apply domain
expertise

Implementation

Span the entire
design workflow



Operate within
their environment

Interaction

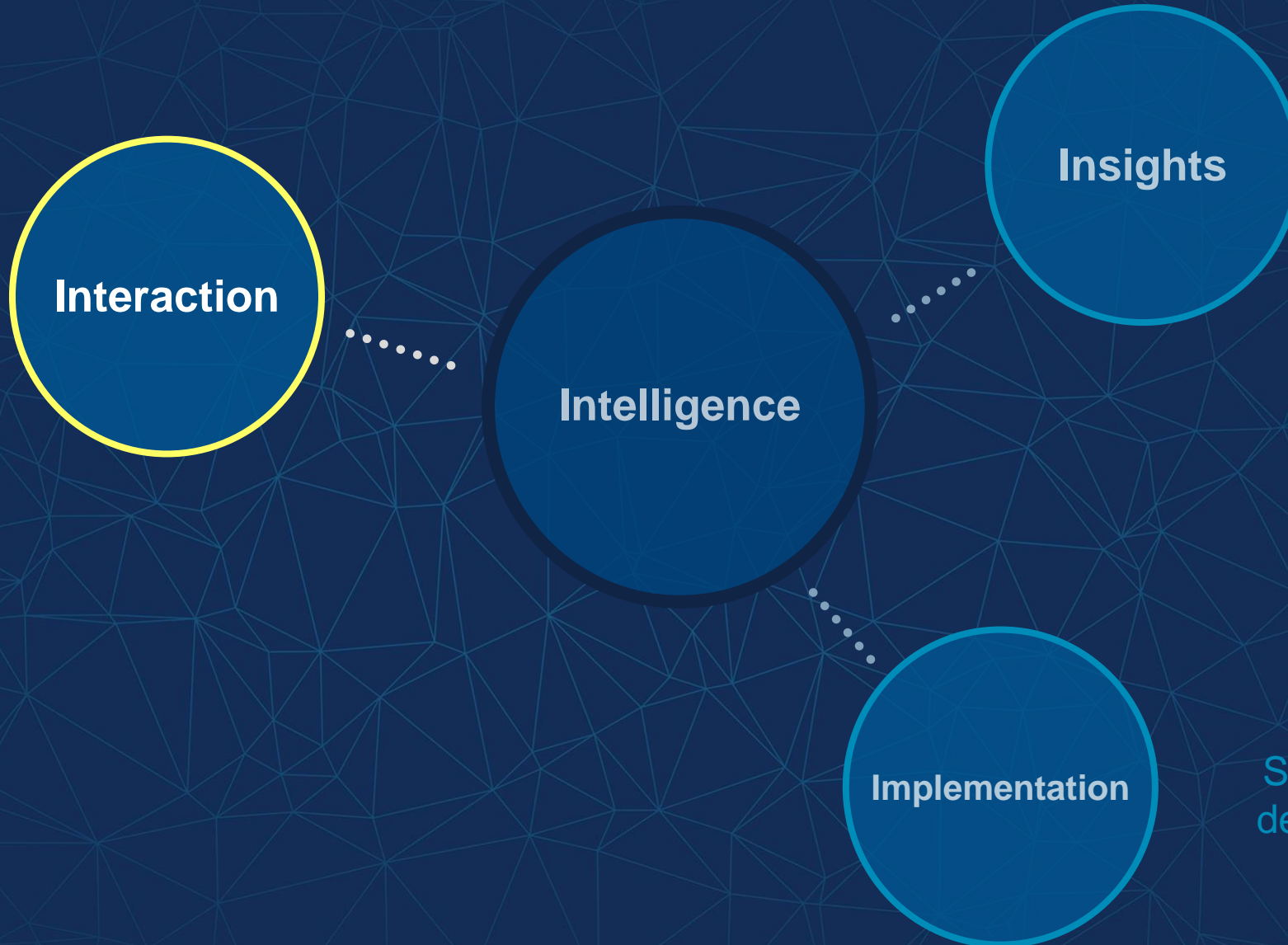
Intelligence

Insights

Apply domain
expertise

Implementation

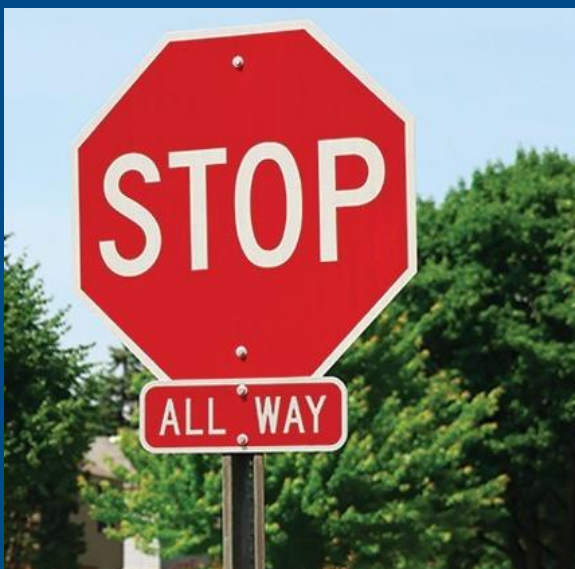
Span the entire
design workflow



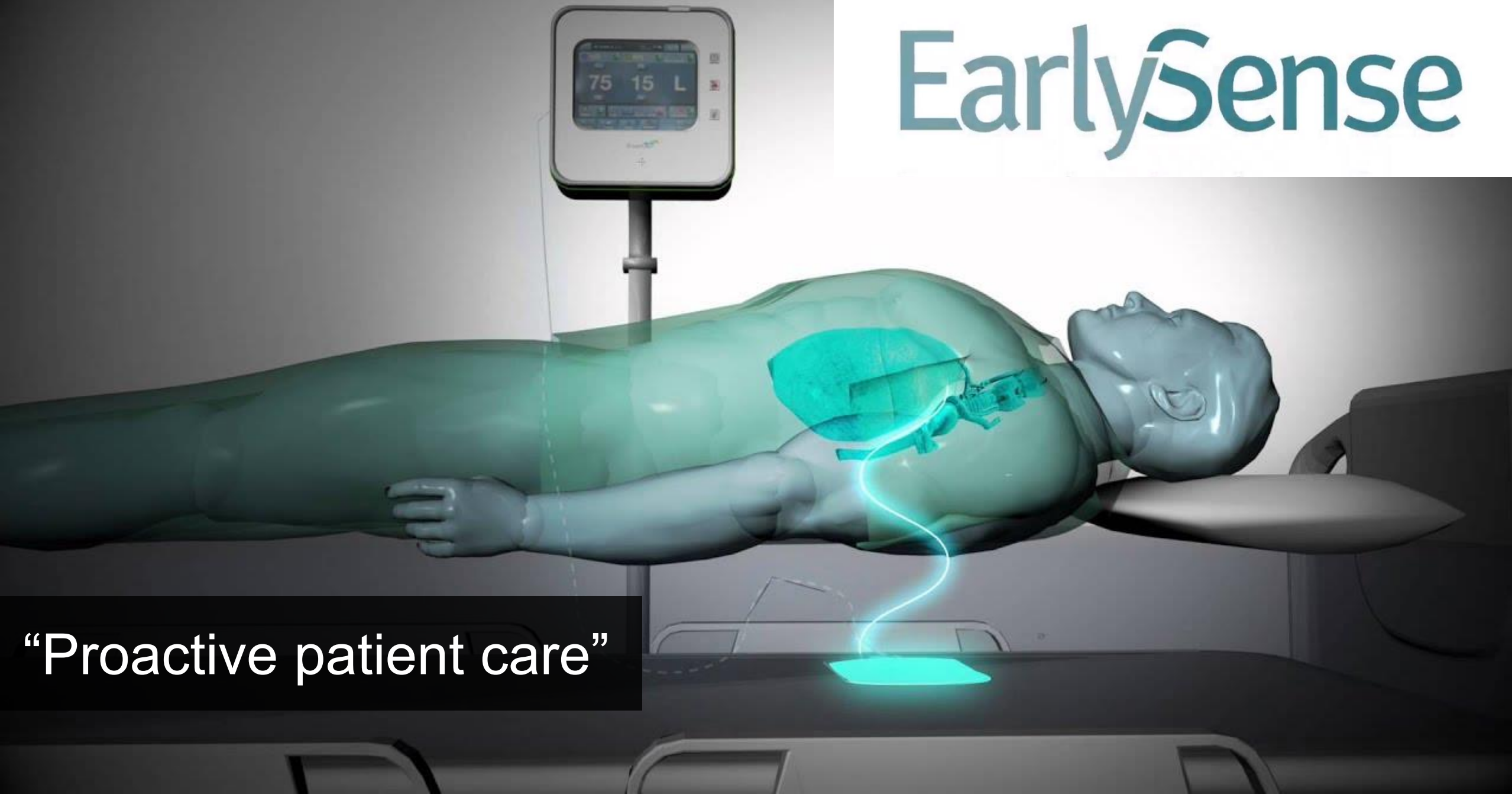


Interaction within complex environments

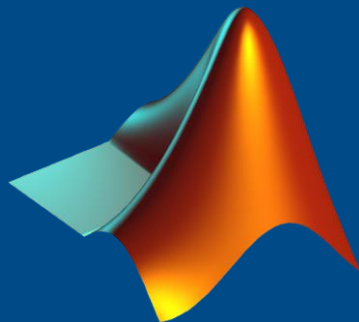
What was the larger system the vehicle had to operate in?



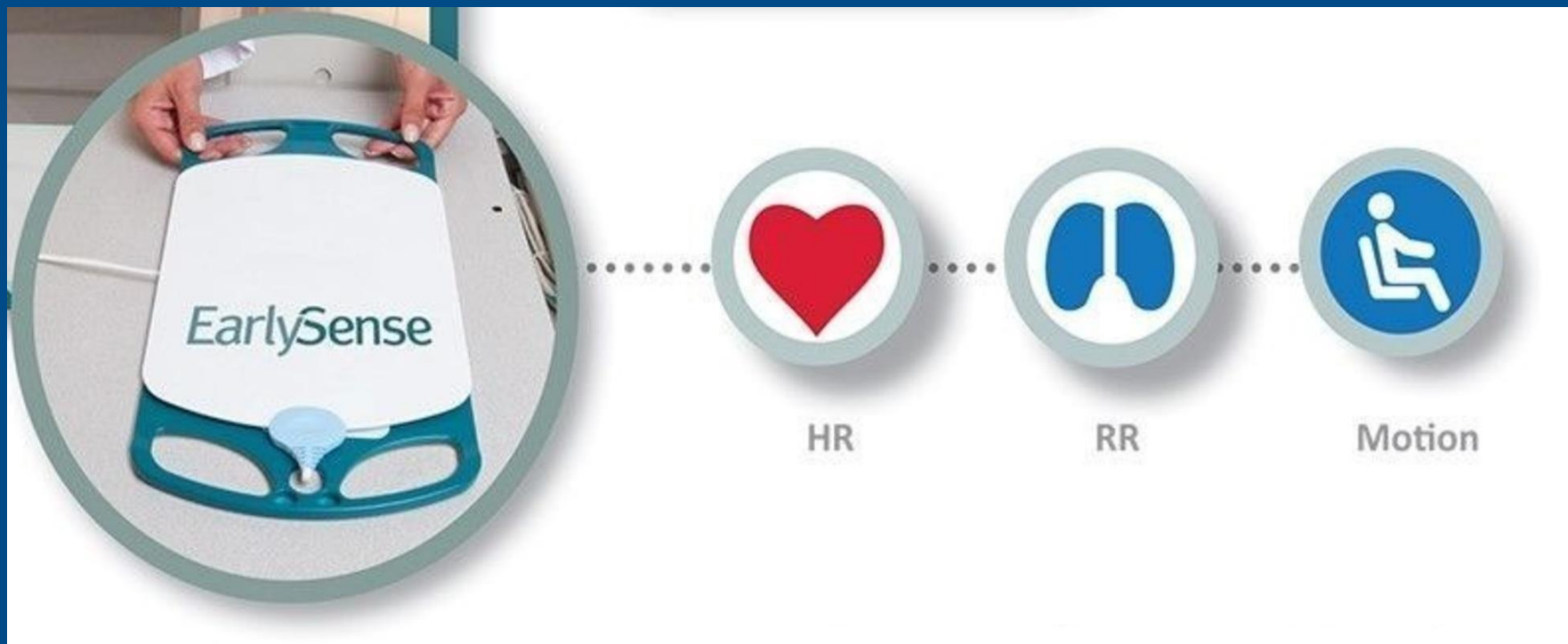
EarlySense



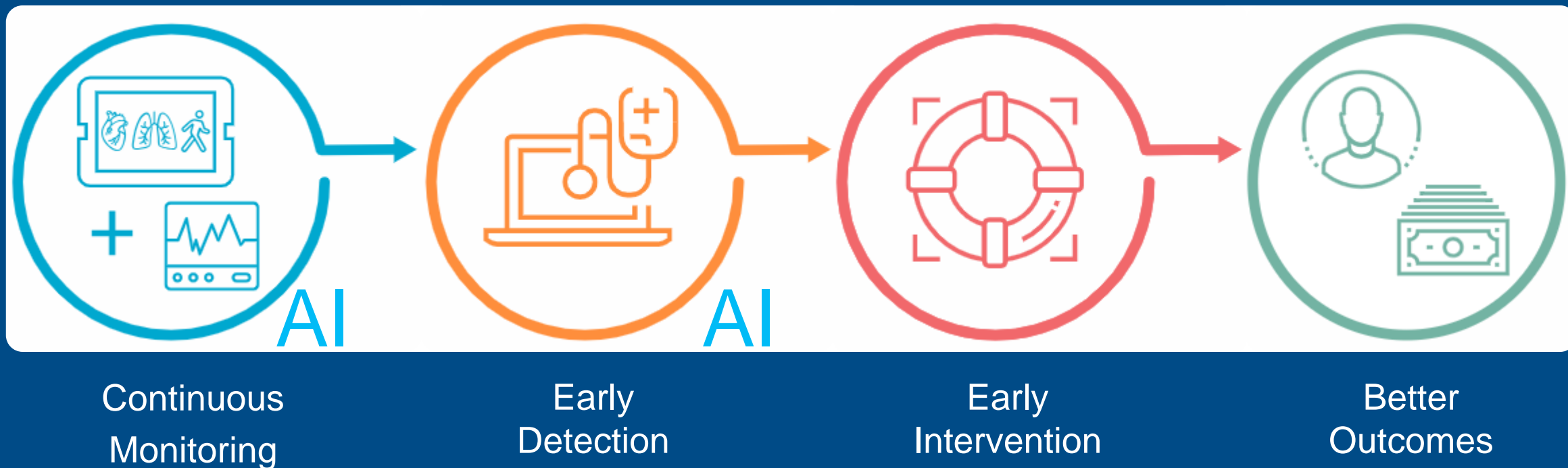
“Proactive patient care”



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



EarlySense's AI can **predict critical events** before they happen



Dashboards at nurses' stations and on hallway monitors



Alerts on hand-held
devices carried by staff





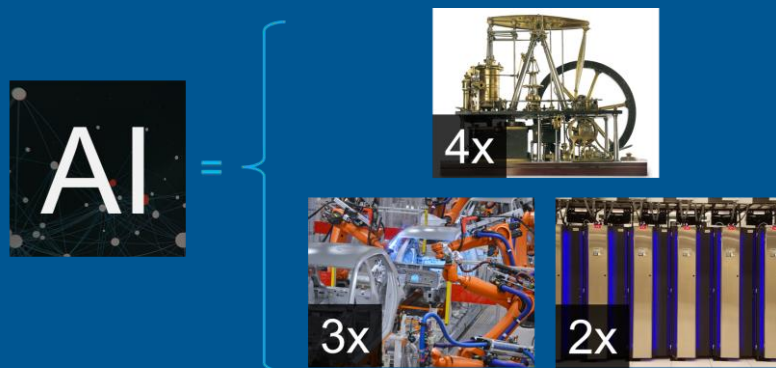
Address problems before they become emergencies

To be successful with AI, we must ...

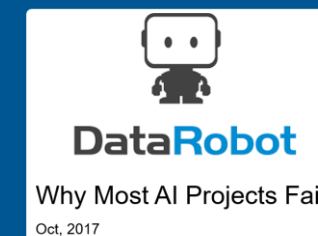
Design how our systems will integrate
and **interact within their environment**

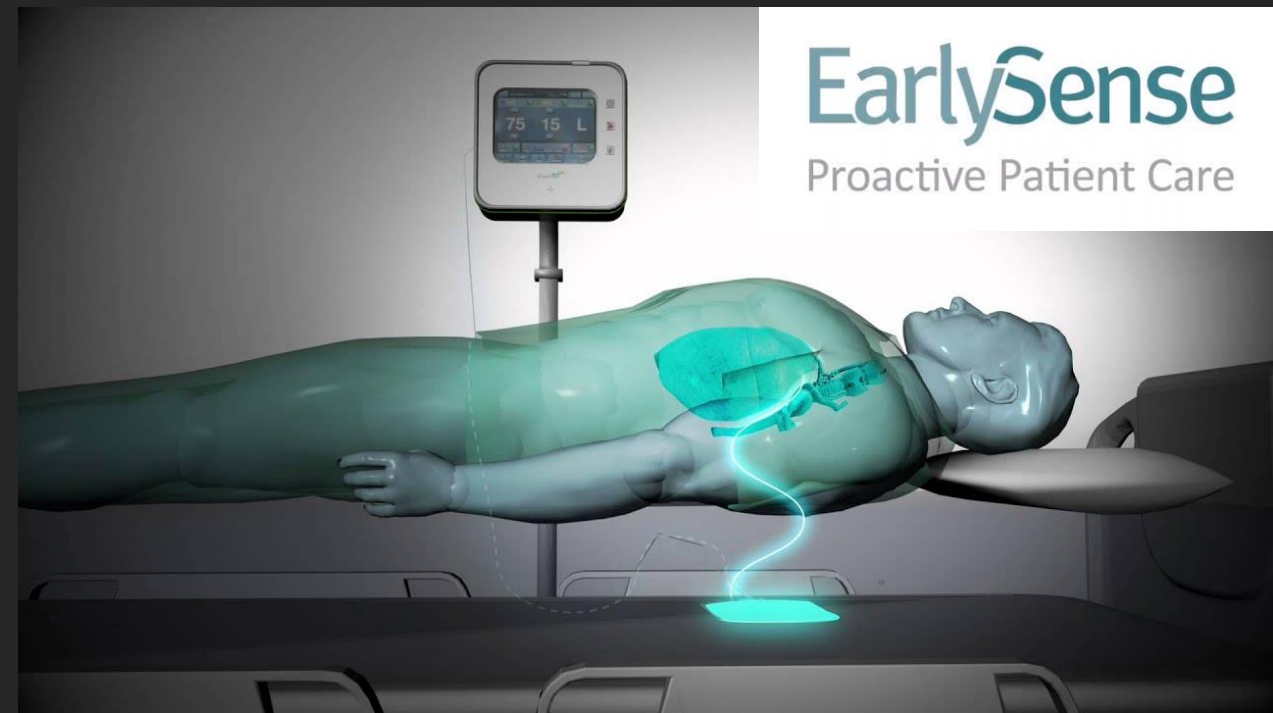
Success requires more than just intelligence

AI is a transformative technology



But AI projects can and do fail





Operate within
their environment

Interaction

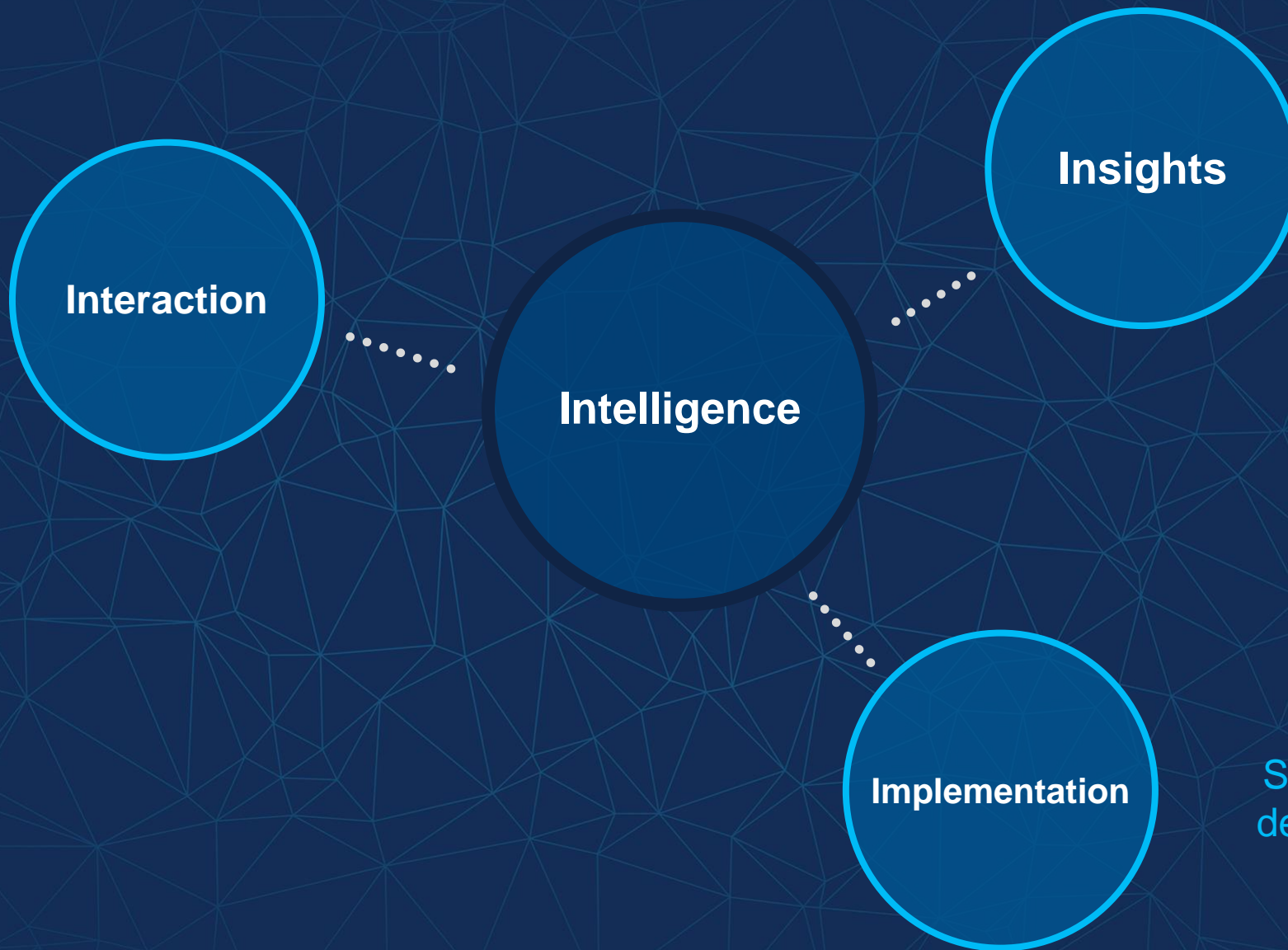
Intelligence

Insights

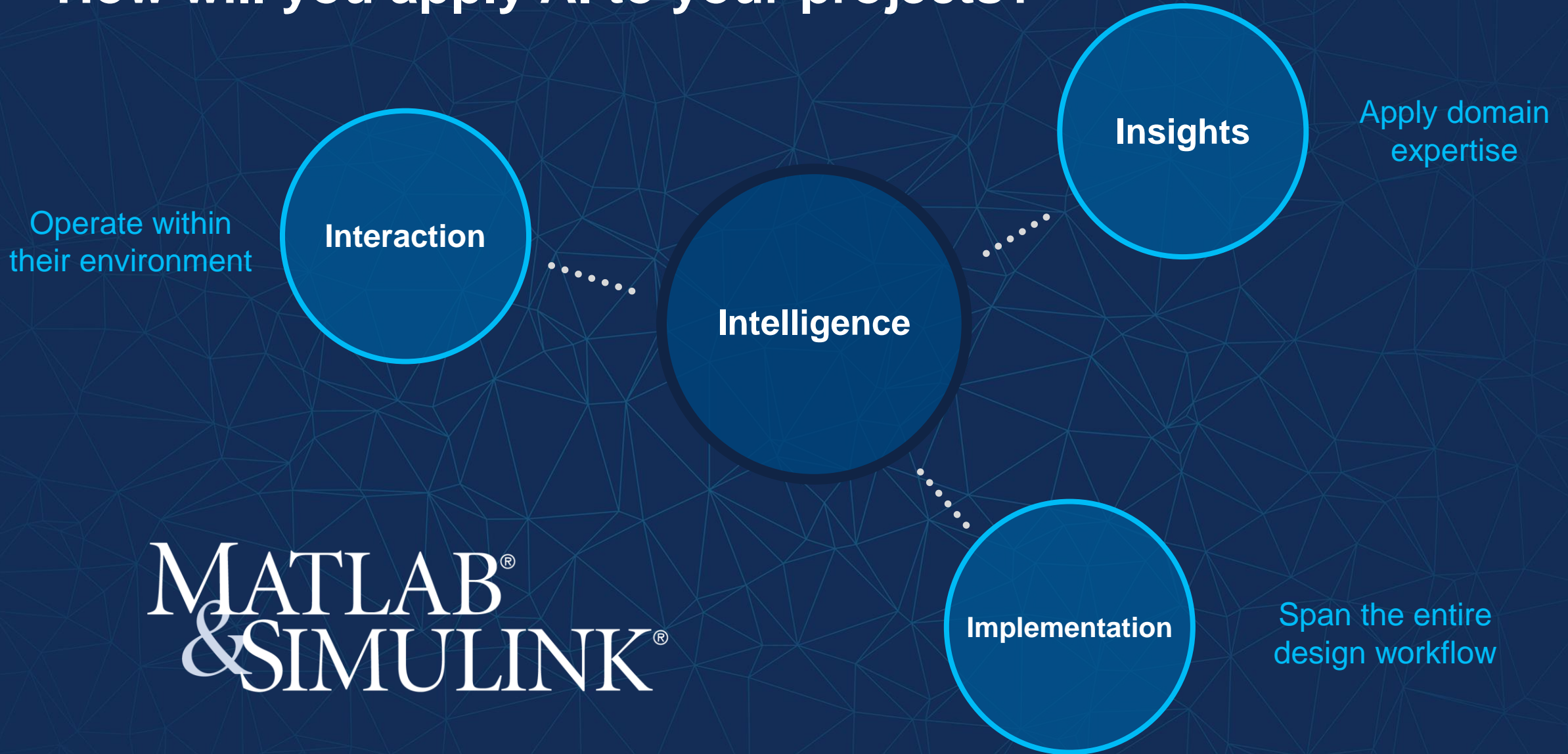
Apply domain
expertise

Implementation

Span the entire
design workflow



How will you apply AI to your projects?



MATLAB Expo 2019

Go Beyond the “I” in AI

MATLAB[®]
& SIMULINK[®]