Beyond the “I” in AI

Chris Hayhurst
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
Yet AI is struggling

Most AI Projects Fail. Here’s How to Make Yours Successful.
July, 2018

Why Most AI Projects Fail
Oct, 2017

3 Common Reasons Artificial Intelligence Projects Fail
May, 2018
TayTweets AI project taken down within 24 hours

The New York Times

Microsoft Created a Twitter Bot to Learn From Users. It Quickly Became a … Jerk.

March 24, 2016
There are many ways Artificial Intelligence can fail

- No data scientists
- Beyond the skill of the team
- Can’t integrate with other systems
- Too much data
- Not enough data
- Incomplete tools
- Poor ROI
- Problem is a poor fit for AI
- Problem is unsolvable
AI is more than just the intelligence of the algorithm

- Integration
- Insights
- Implementation

Connect with other systems
Apply domain expertise
Span the entire design workflow
Bring human insights into AI

Select data

Make tradeoffs

Evaluate results

AI
Improving New Zealand Dairy Processing

- University of Auckland
- Auckland University of Technology
Continuous Plant Process

Raw Milk → Continuous Plant Process → Powdered Milk

Days later
Powdered Milk

Plant Variables

AI model

Predict Results

Near real-time
They had lots of data

- Millions of data points
- 3 plants
- 6 years

Raw Milk
Plant Variables
Powdered Milk
But…

- Raw Milk
- Plant Variables
- Powdered Milk

AI model
Key Insights Made

1. Predictions were wrong
Key Insights Made

1. Predictions were wrong

2. Need to build a separate model for each plant

Plants behaved differently from each another
Key Insights Made

1. Predictions 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
Key Insights Made

1. Predictions 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.”

- David Wilson, Industrial Information and Control Centre
To be successful with AI, you must …

Combine AI model building with **scientific and engineering insights**
Intelligence

Integration
Connect with other systems

Insights
Apply domain expertise

Implementation
Span the entire design workflow
Intelligence

Integration

Connect with other systems

Insights

Apply domain expertise

Implementation

Span the entire design workflow
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
But they needed to connect the AI to the rest of the system
Started with Simulink example that they could build upon

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.
Started with Simulink example that they could build upon

Find out more:
자동차시스템을 위한 센서 융합 및 추적
센서 신호처리 및 무선 기술
서기환
Deployed controller as ROS node and generated code

Robotics System Toolbox
Embedded Coder
Train your AI faster with tight simulation loops

Field Data → Synthetic Data → Better Algorithms → Simulated Usage → Usage → Field Data
One example of leveraging simulation for data synthesis

**Traditional workflow**
- Record
- Label
- AI model

**Simulation workflow**
- Simulate
- Auto-label
- Preliminary AI model
- Transfer Learning
“Simulink + ROS allowed us to deploy a Level 3 autonomous vehicle in less than 3 months.”

– Alan Mond, Voyage
To be successful with AI, you must …

Use tool chains that span the entire design workflow
Intelligence

Integration

Connect with other systems

Implementation

Span the entire design workflow

Insights

Apply domain expertise
Intelligence

Integration
- Connect with other systems

Insights
- Apply domain expertise

Implementation
- Span the entire design workflow
Integration with complex systems
What was the larger system the vehicle had to operate in?
“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.
Integrate into nurses’ stations and hallway monitors
Integrate with hand-held devices carried by staff
Address problems before they become emergencies
To be successful with AI, you must …

Find out more:
딥러닝과 강화학습

인공지능과 딥러닝
김종남
Summary

- AI is a transformative technology

- But AI projects can and do fail

- Success requires more than just intelligence
Intelligence

Integration
Connect with other systems

Insights
Apply domain expertise

Implementation
Span the entire design workflow
How will you apply AI to your projects?

We have the right tools → MATLAB and Simulink

– Discover and apply insights to fully understand your system
– Implement your complete system across the entire workflow
– Design the systems which will integrate into a larger world