MATLAB EXPO 2019
Beyond the “I” in AI

Loren Shure
Watt Steam Engine
Artificial intelligence is a transformative technology

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

McKinsey Global Institute, September 2018
Yet AI is struggling

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

DataRobot
Why Most AI Projects Fail
Oct, 2017

CMS WiRE
3 Common Reasons Artificial Intelligence Projects Fail
May, 2018
There are many ways Artificial Intelligence can **fail**

- No data scientists
- Beyond the skill of the team
- Can’t interact 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

- **Interaction**: Operate within their environment
- **Insights**: Apply domain expertise
- **Implementation**: Span the entire design workflow

Intelligence

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Bring human insights into AI

- Select data
- Make tradeoffs
- Evaluate results
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

Raw Milk → Continuous Plant Process → Powdered Milk

Days later
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

- Millions of data points
- 6 years
- 3 plants
But…

Data

- Raw Milk
- Plant Process
- Powdered Milk

AI model
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
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**
Intelligence

Interaction
Operate within their environment

Insights
Apply domain expertise

Implementation
Span the entire design workflow
Intelligence

Interaction

Operate within their environment

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.

Try it in MATLAB
Injected simulated vehicles to interact with while driving
Deployed controller as ROS node and generated code
Train your AI faster with tight simulation loops

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

Traditional deep learning workflow
- Record
- Label
- AI model

Simulation-based 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, we must …

Use tool chains that span the entire design workflow
Operate within their environment

Interaction

Intelligence

Insights

Implementation

Apply domain expertise

Span the entire design workflow
Interaction within complex environments
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.

- 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

Most AI Projects Fail. Here’s How to Make Yours Successful.
July, 2016

Why Most AI Projects Fail
Oct, 2017
Intelligence

Interaction
Operate within their environment

Insights
Apply domain expertise

Implementation
Span the entire design workflow
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