

MathWorks AUTOMOTIVE ENGINEERING CONFERENCE 2020

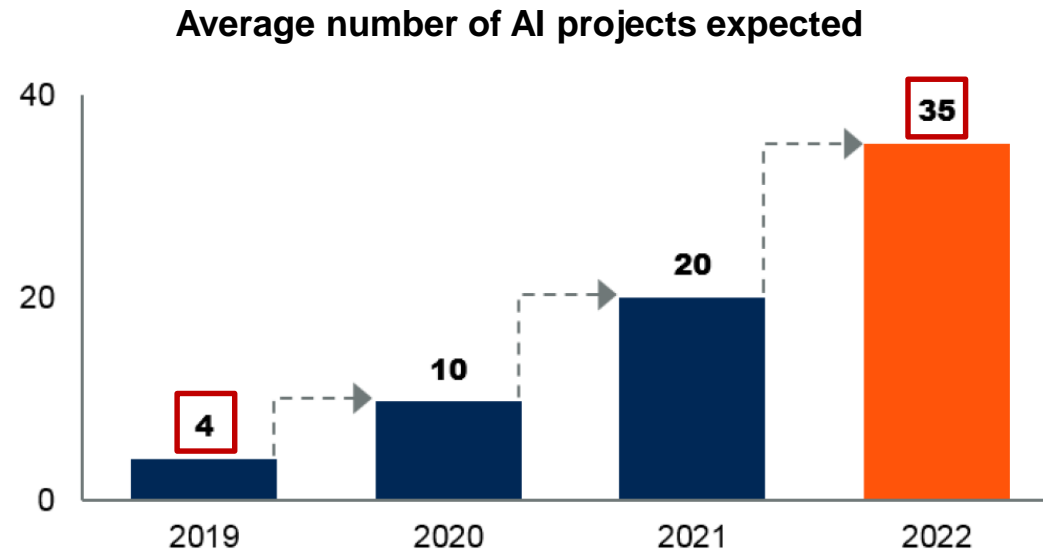
MATLAB & Simulink

The enterprise engineering platform for AI

Seth DeLand



Integrating AI is a priority for companies today...



10x increase in AI projects in three years!

* Source: "AI and ML Development Strategies, Motivators and Adoption Challenges," Gartner Research Note, published 19 June 2019

n = 57 to 63

Gartner Research Circle members with AI/ML projects deployed/in use today, excluding "unsure"

Source: Gartner AI and ML Development Strategies Survey

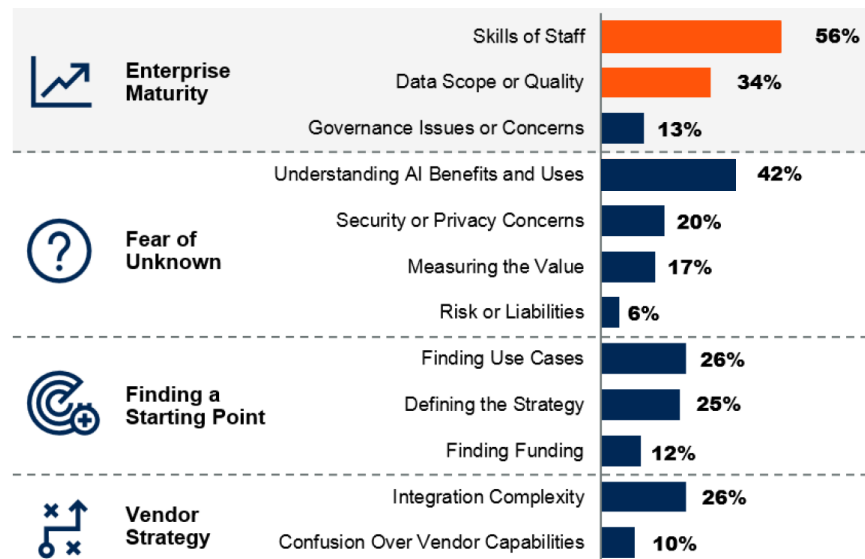
Q. How many projects are deployed/in use today? How many projects do you estimate in zero to 12 months,

12 to 24 months, and 24 to 36 months?

ID: 390794

...but AI skills and data quality are major concerns

Top Three Challenges to AI and ML Adoption



n = 106

Gartner Research Circle members, excluding "unsure"

Source: Gartner AI and ML Development Strategies Survey

Q: What are the top three challenges or barriers to the adoption of AI and ML within your organization?

Rank up to three.

ID: 390794

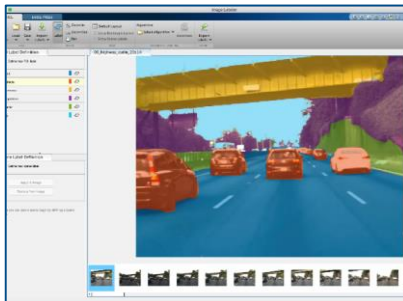
Top barriers to successful adoption of AI

1. Skills of your team
2. Data quality
3. Functional silos

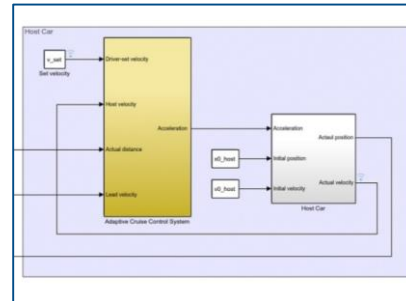
* Source: "AI and ML Development Strategies, Motivators and Adoption Challenges," Gartner Research Note, published 19 June 2019



Empower domain experts to do their best work



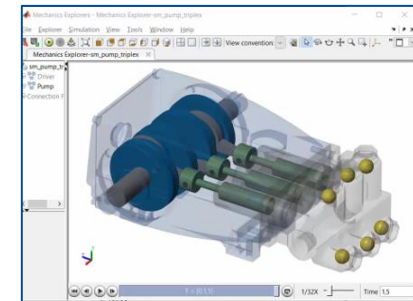
Data selection and prep



Simpler models



Evaluation of results



Failure mode identification



is a **Leader** in the Gartner Magic Quadrant for 2020 Data Science and Machine Learning Platforms

Figure 1. Magic Quadrant for Data Science and Machine Learning Platforms



Source: Gartner (February 2020)

*Gartner Magic Quadrant for Data Science and Machine Learning Platforms, Peter Krensky, Erick Brethenoux, Jim Hare, Carlie Idoine, Alexander Linden, Svetlana Sicular, 11 February 2020 .

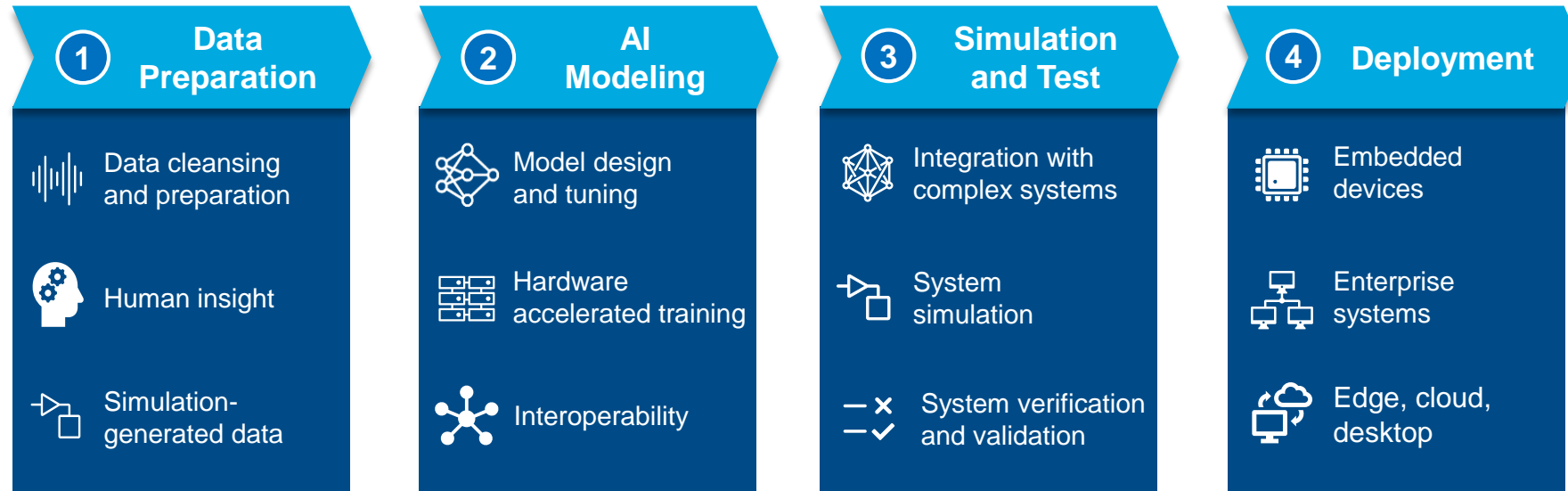
This graphic was published by Gartner, Inc. as part of a larger research document and should be evaluated in the context of the entire document. The Gartner document is available upon request from MathWorks. Gartner does not endorse any vendor, product or service depicted in its research publications, and does not advise technology users to select only those vendors with the highest ratings or other designation. Gartner research publications consist of the opinions of Gartner's research organization and should not be construed as statements of fact. Gartner disclaims all warranties, express or implied, with respect to this research, including any warranties of merchantability or fitness for a particular purpose.



AI-driven system design workflow



AI-driven system design workflow



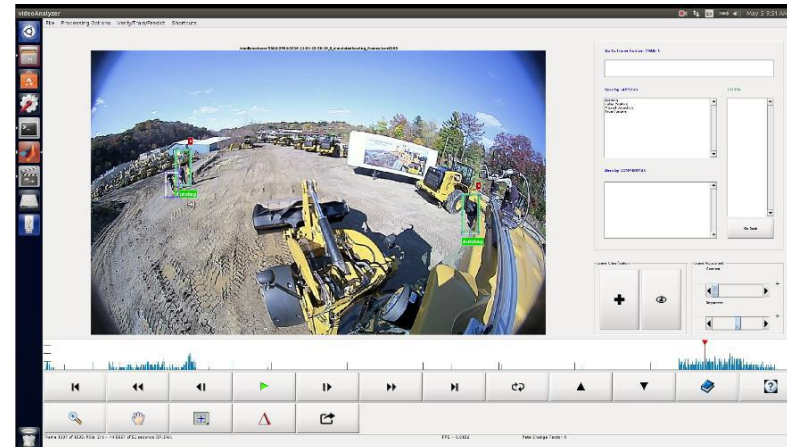
Dramatically reduce human supervision and development time



- Partnered with MathWorks on their big data and machine/deep learning infrastructure
- Automatically ground-truths and labels data, reducing the need for human supervision and development time
- Tight integration with MATLAB for machine/deep learning, visualization, and code generation

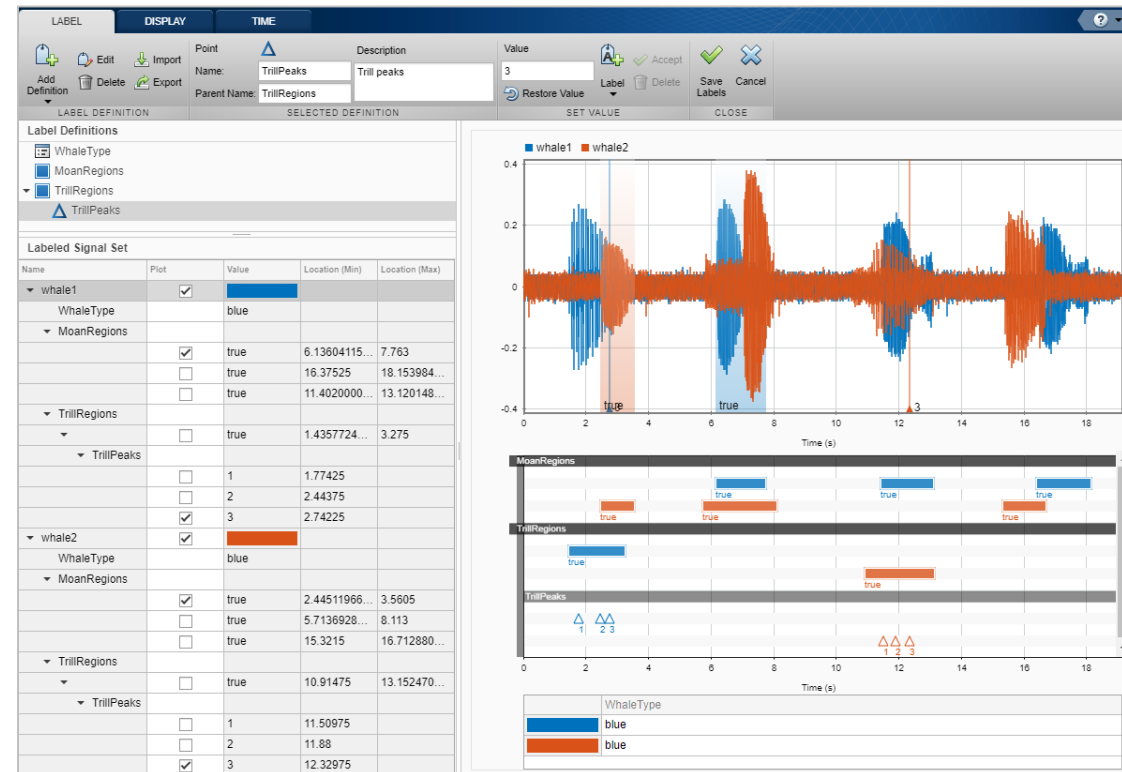
“We were spending way too much time hand-labeling our data...**automatic detection and labeling of our data has been a tremendous advantage in efficiency.**”

— Larry Mianzo, Caterpillar



Automated labeling Apps save you weeks to months

- 1 Data Preparation
- 2 AI Modeling
- 3 Simulation and Test
- 4 Deployment



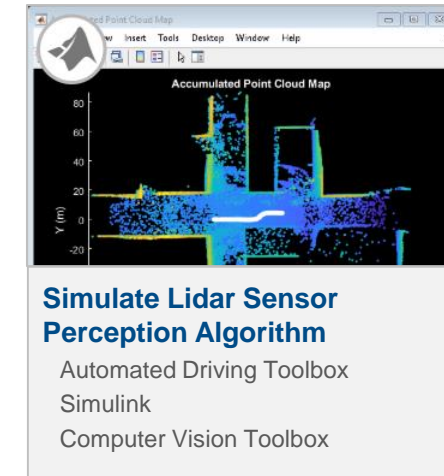
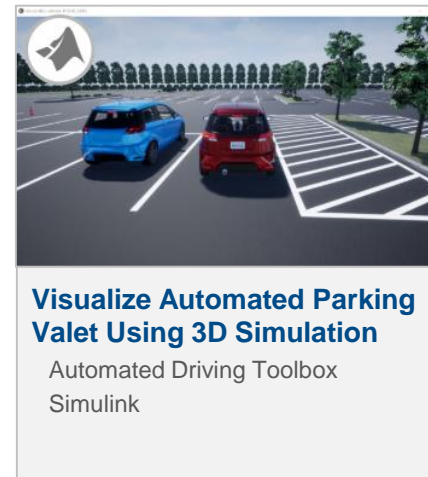
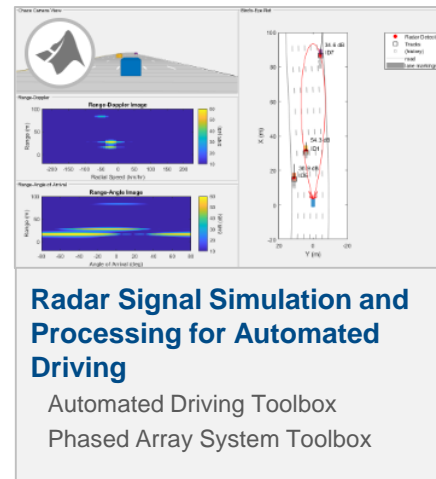
Generate synthetic data from Simulink to improve your datasets

1 Data Preparation

2 AI Modeling

3 Simulation and Test

4 Deployment



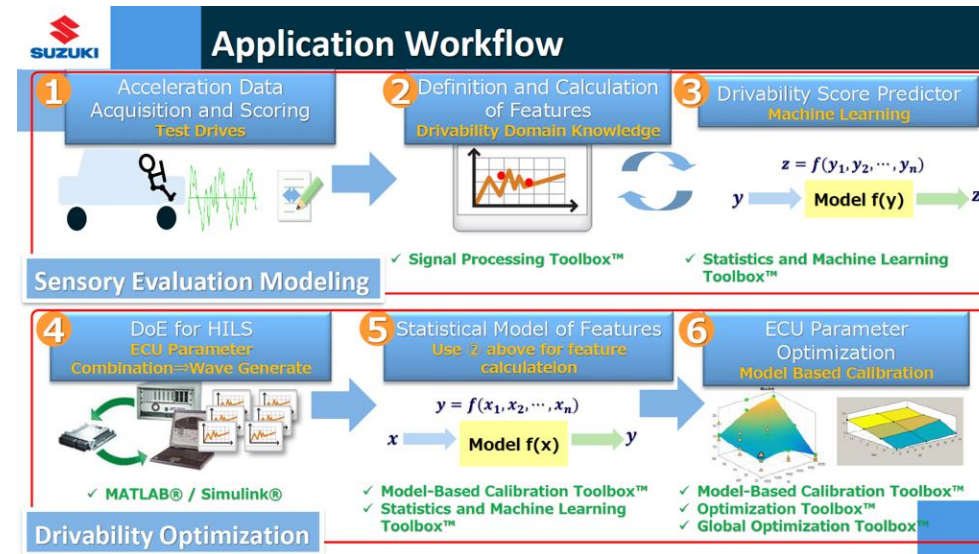
Suzuki leverages Machine Learning as part of a MATLAB-based workflow to optimize control parameters

Optimize control parameters to achieve “Drivability feel”

- Developed machine learning model to predict drivability score
- Optimize LUT parameters taking drivability into account

Challenges

- Model creation required lots of trial and error, need to iterate quickly was important



Source: “Machine Learning Based Sensory Evaluation Modeling for Vehicle Drivability Optimization”. Yoshinao Okajima, Suzuki Motor Corporation
MATLAB EXPO Japan, 2017

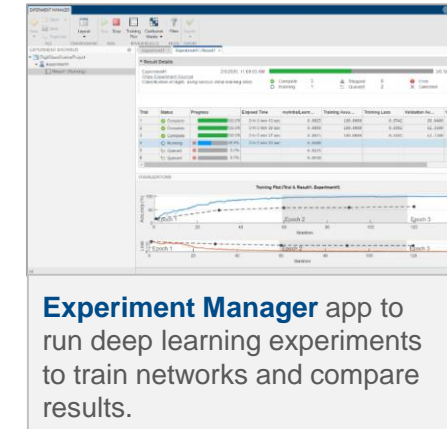
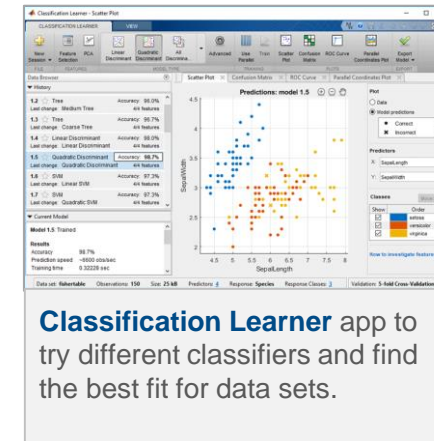
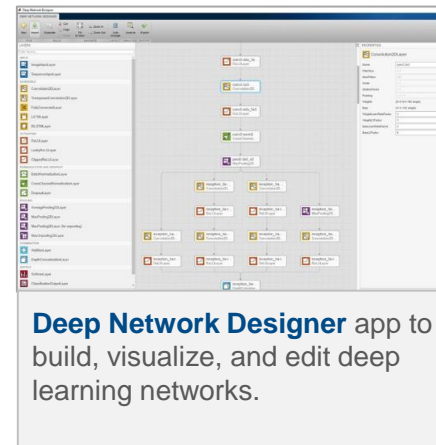
AI modeling Apps automate training, tuning, visualization...

1 Data Preparation

2 AI Modeling

3 Simulation and Test

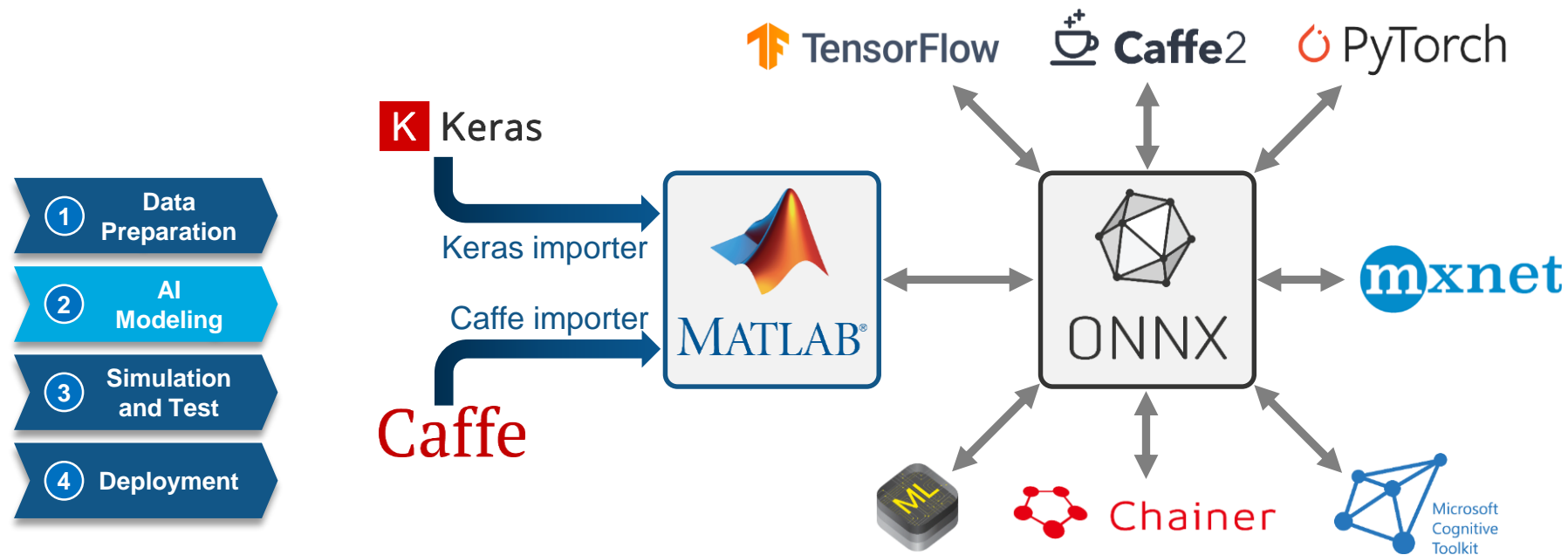
4 Deployment



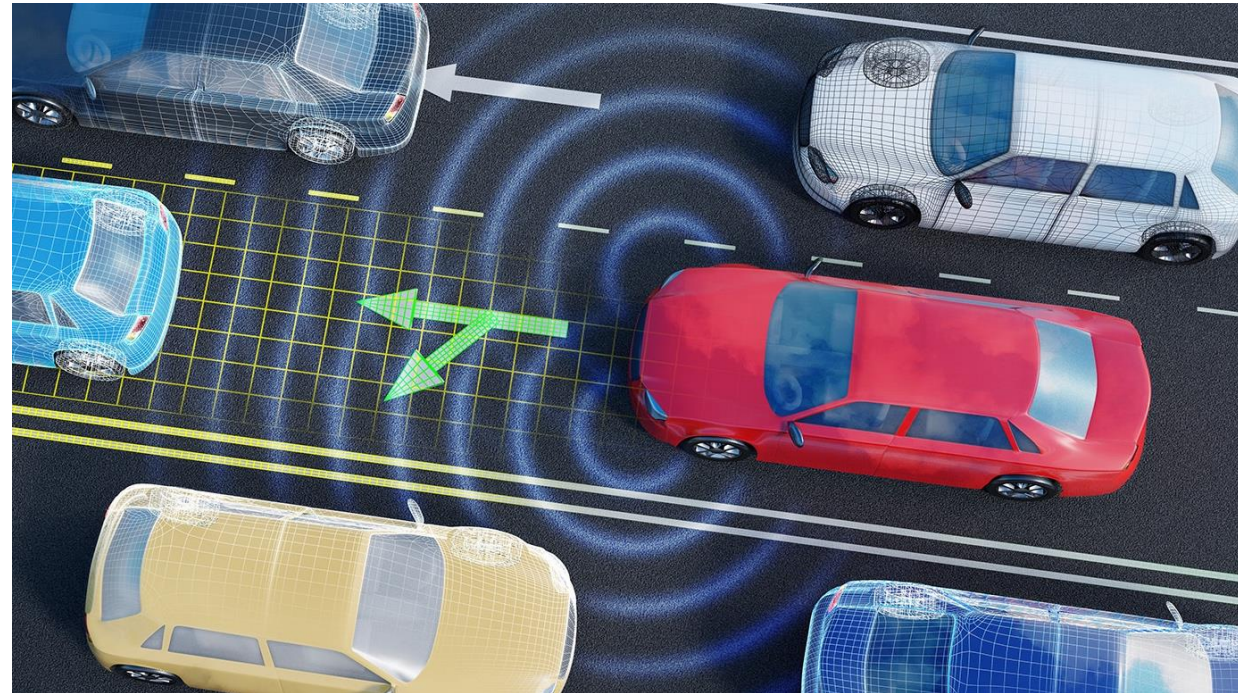
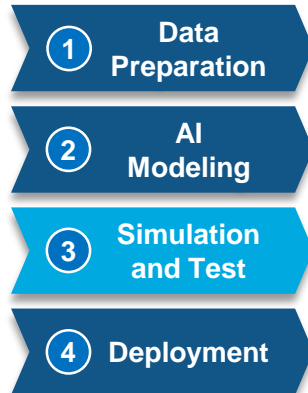
Accelerate AI training on GPUs, cloud, and datacenter resources without specialized programming



Access AI models from the broader AI community



Integrate AI into system-wide context, simulate before moving to hardware, and verify effectiveness



Use Simulink for rapid design iteration and testing



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

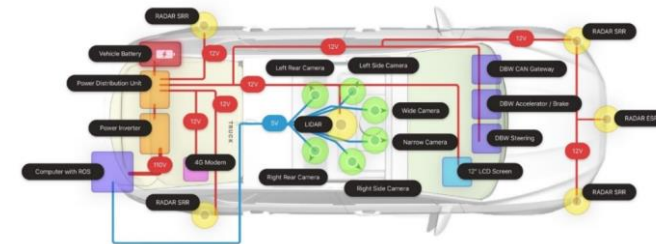
— Alan Mond, Voyage

1 Data Preparation

2 AI Modeling

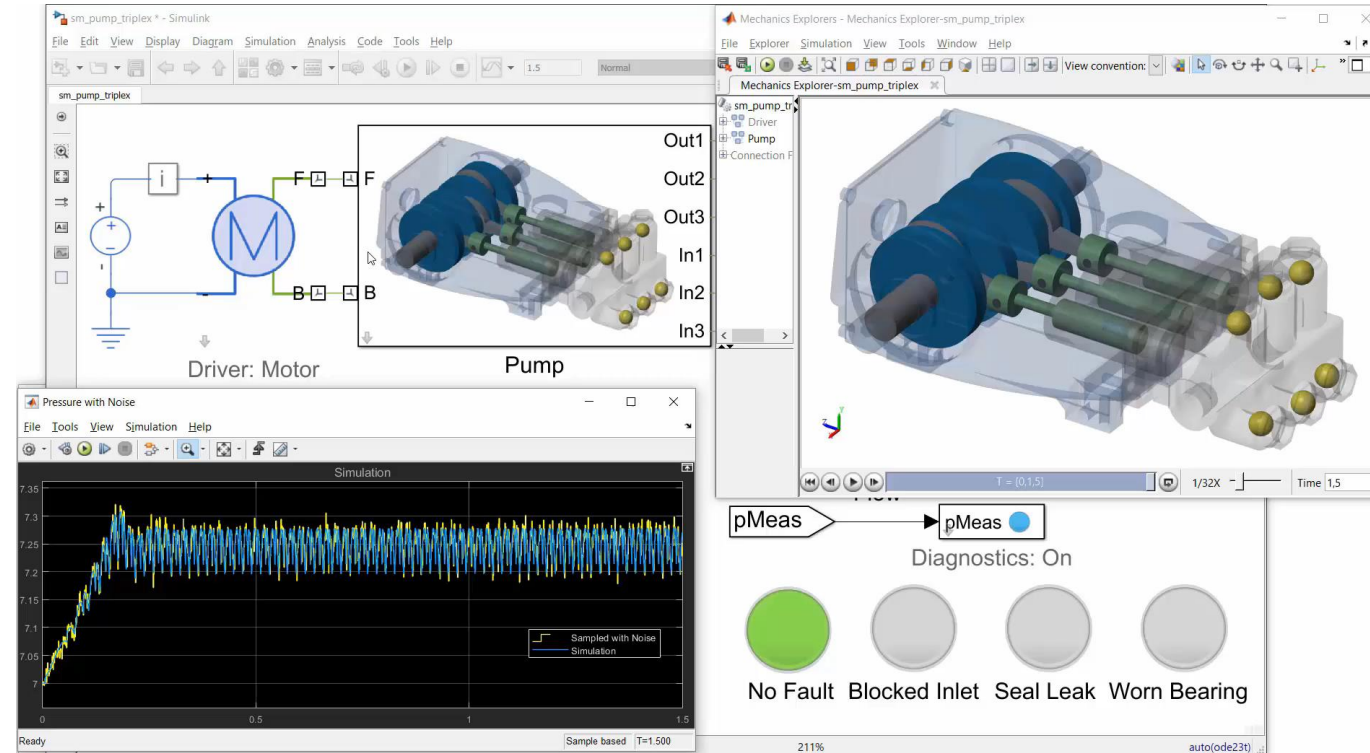
3 Simulation and Test

4 Deployment



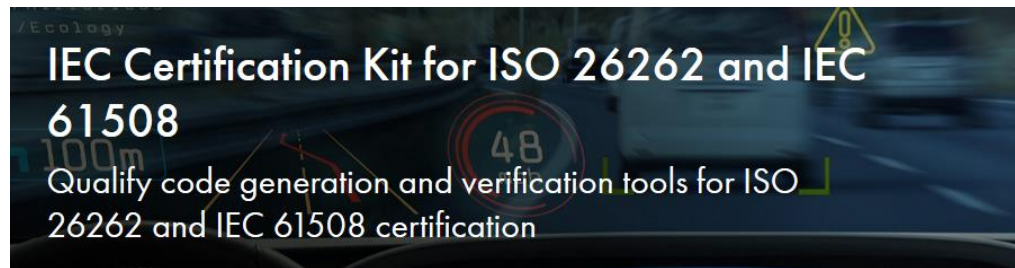
Simulate rare system failures to avoid them in the real world

- 1 Data Preparation
- 2 AI Modeling
- 3 Simulation and Test
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Deep experience in safety-critical certification enables us to drive new standards for AI

Today



Tomorrow



EUROCAE WG-114
“Artificial Intelligence”



SAE G-34 “Artificial
Intelligence in
Aviation”

AI models are useful everywhere

① Data Preparation

② AI Modeling

③ Simulation and Test

④ Deployment



BMW Detects Oversteer with Machine Learning

Detect vehicle oversteer situations more accurately to improve stability control system performance

- Use machine learning to identify oversteer

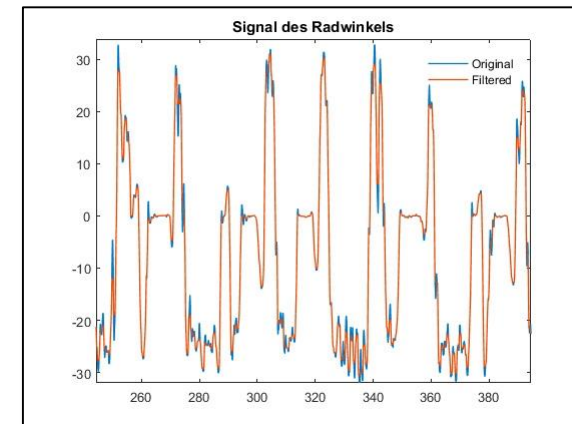
Challenges

- Difficult to detect oversteer, requires many sensors
- Implementing machine learning on ECU

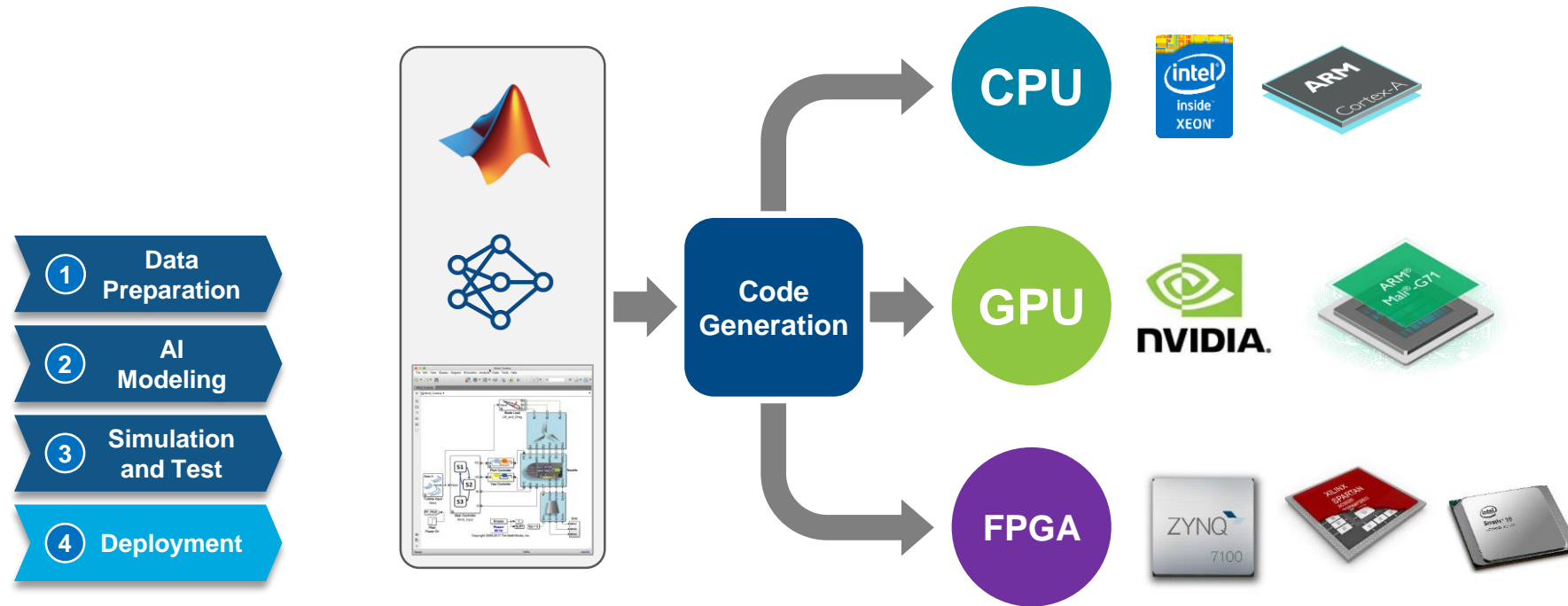
Data sources

- Logged CAN bus data and oversteer records

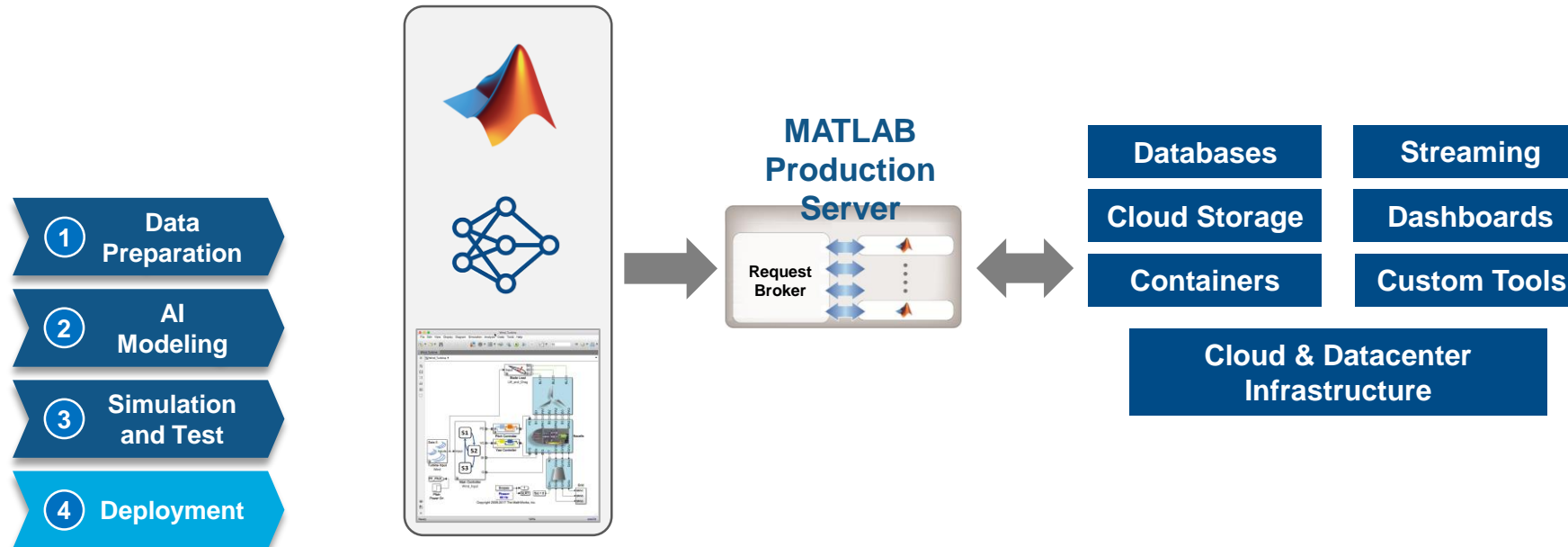
Source: MATLAB Technical Article: *Detecting Oversteering in BMW Automobiles with Machine Learning*
Tobias Freudling, BMW Group



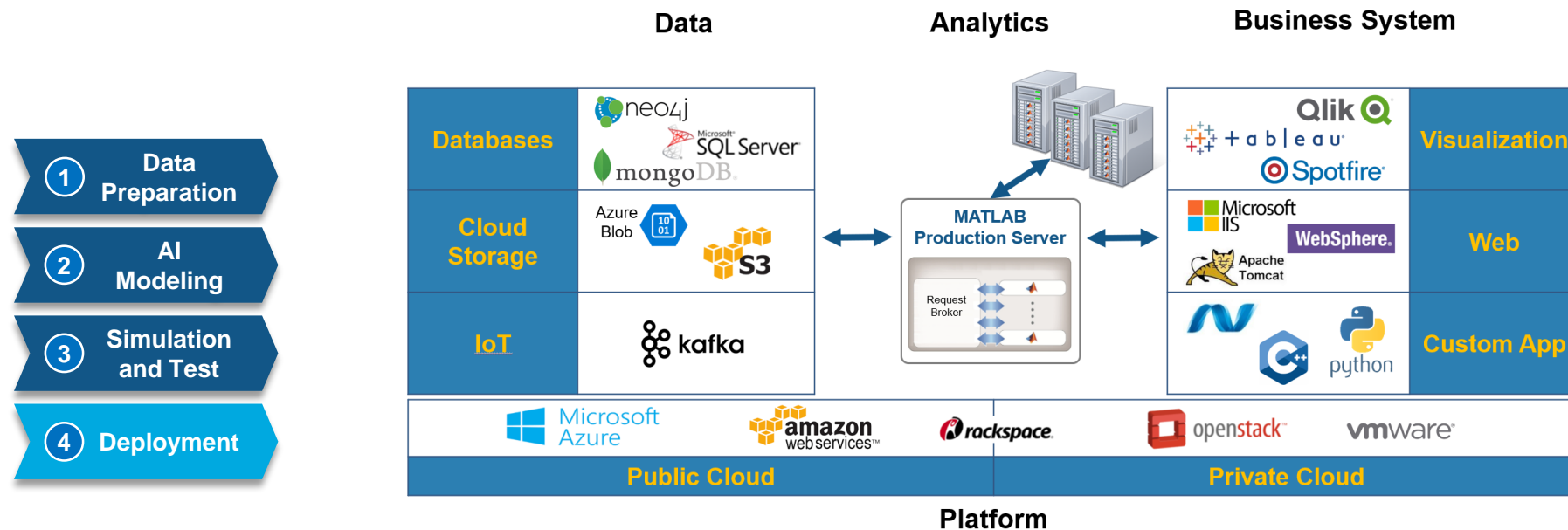
Deploy to any processor with zero coding errors



Deploy to enterprise IT infrastructure

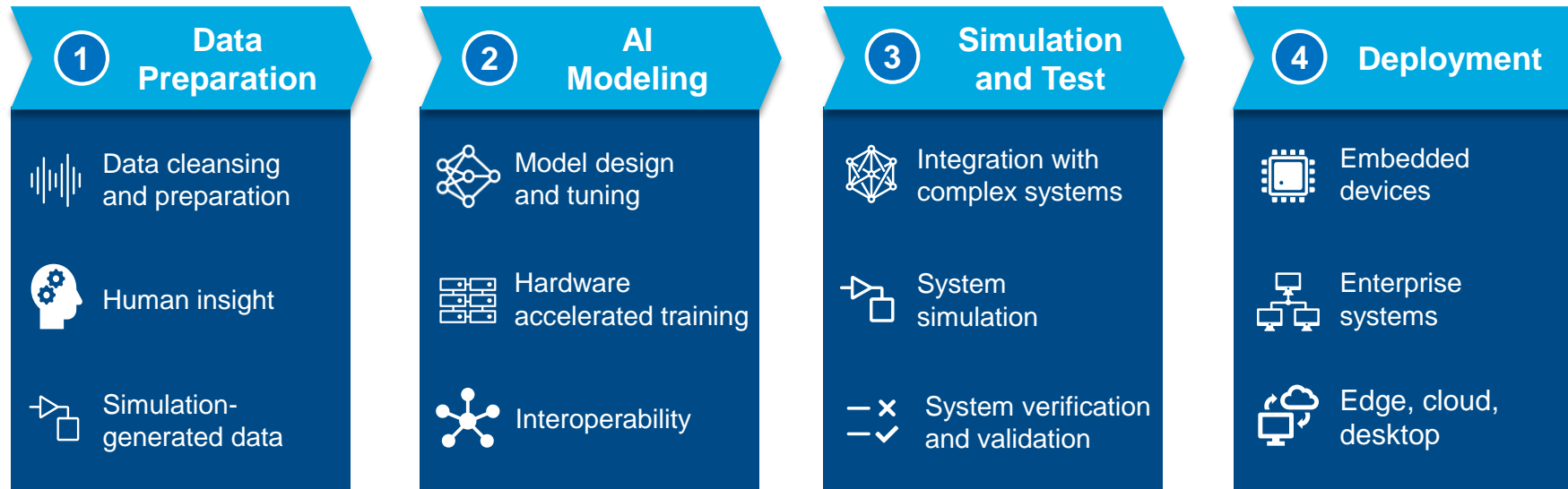


Integrating models with enterprise IT infrastructure



Why MATLAB and Simulink for Artificial Intelligence?

- Empower domain experts, including those with limited AI experience
- Build better data sets with domain-specific tools
- Use modeling and simulation to tackle integration challenges and reduce risk
- Deploy AI models to wherever you need them



Augment Your Knowledge by Upskilling in AI

Get Started for Free



MATLAB Onramp

Get started quickly with the basics of MATLAB®.

» Details and launch



Machine Learning Onramp

An interactive introduction to practical machine learning methods for classification problems.

» Details and launch



Deep Learning Onramp

Get started with deep learning techniques to perform image recognition.

» Details and launch

Training Courses

MATLAB Fundamentals (3 days)

MATLAB for Data Processing and Visualization (1 day)

Processing Big Data with MATLAB (1 day)

Statistical Methods in MATLAB (2 days)

Machine Learning with MATLAB (2 days)

Signal Preprocessing and Feature Extraction with MATLAB (1 day)

Deep Learning with MATLAB (2 days)

Accelerating and Parallelizing MATLAB Code (2 days)

Practical Data Science with MATLAB Specialization

★★★★★ 4.9 14 ratings

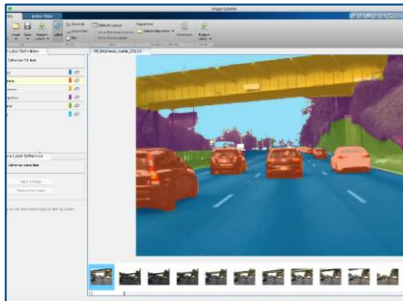
Enroll for Free
Starts Dec 03

Financial aid available

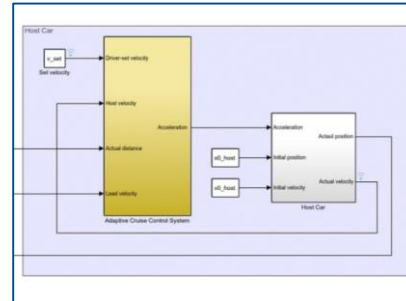
- Exploratory Data Analysis
- Data Processing and Feature Engineering
- Predictive Modeling and Machine Learning
- Data Science Project



Empower domain experts to do their best work



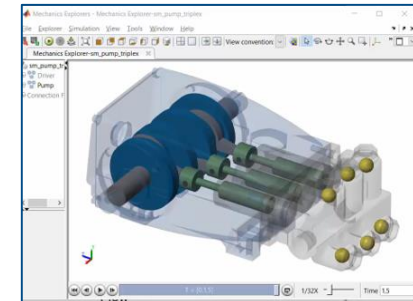
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AGENDA	
12:50	Welcome and Introduction
1:00	Enterprise Engineering Platform for AI <i>Seth DeLand, MathWorks</i>
1:25	Using MATLAB on Apache Spark for ADAS Feature Usage Analysis and Scenario Generation <i>Sanjay Abhyankar, Ford Motor Company</i>
1:50	Tackling Fleet Test Data with MATLAB <i>Will Wilson, MathWorks</i>
2:10	Machine Learning Case Studies for Quality Evaluations <i>Marc Harris, TimkenSteel</i>
2:30	A Perspective on Deploying Reinforcement Learning to Augment Classic Control Design <i>Ali Borhan, Cummins</i>
2:50	Advanced Tool Capabilities for Embedding Machine Learning into ECUs <i>Gokhan Atinc, MathWorks</i>
3:10	Big Data Methods and Computation with Predictive Life Assessments <i>Meaghan Kosmatka, John Deere</i>
3:30	Making MATLAB Data Analytics Accessible Across Enterprise <i>Arvind Hosagrahara, MathWorks</i>
3:50	Technology showcase
4:20	End of Event

Poll

1. What are your biggest challenges in adopting AI?
 - ☐ Lack of data or not "the right" data
 - ☐ Team lacks the required skillset
 - ☐ Not enough bandwidth to investigate AI
 - ☐ Lack clarity of relevant AI use-cases

2. Which part of the AI workflow are you most interested in learning more about?
 - a) Data Preparation for AI
 - b) Building AI Models
 - c) Simulation and Test of AI Models
 - d) Deployment of AI Models