

MATLAB EXPO 2018

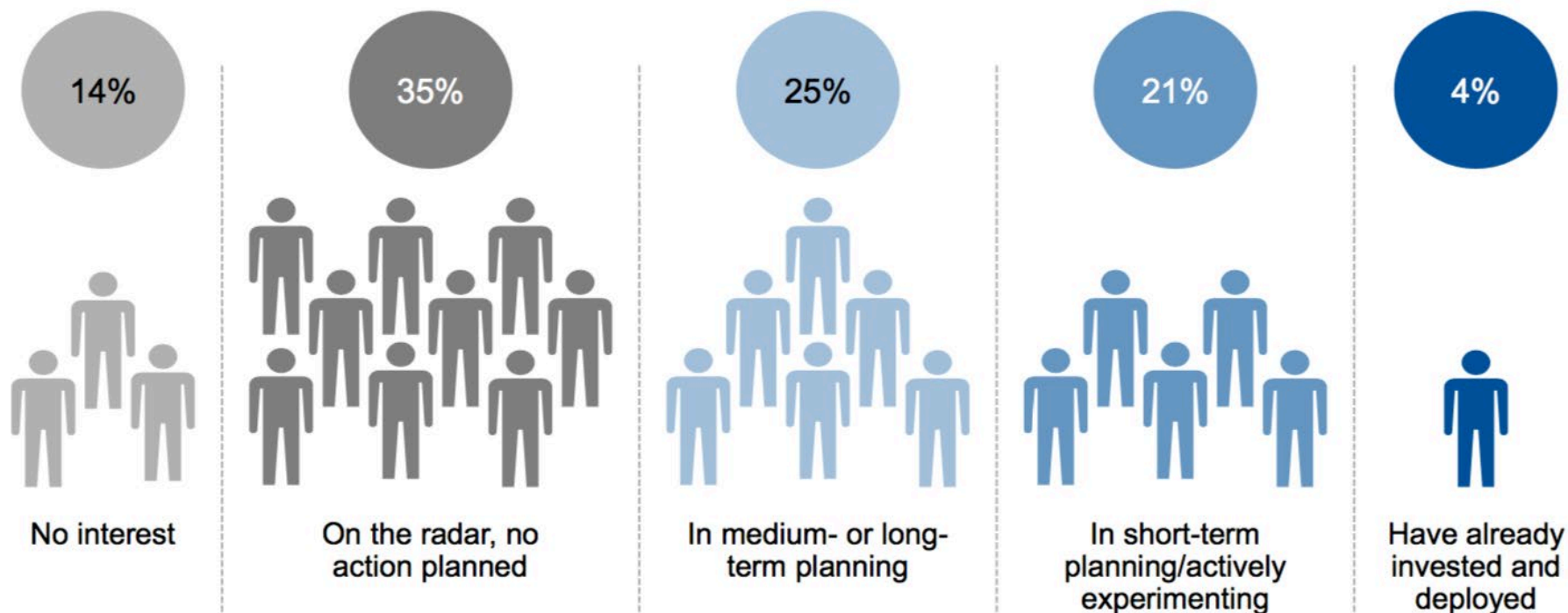
Are *you* ready for *AI*?
Is *AI* ready for *you*?

Richard Rovner
Vice President, Marketing



Artificial Intelligence Is in Early Adoption

Percentage of Respondents



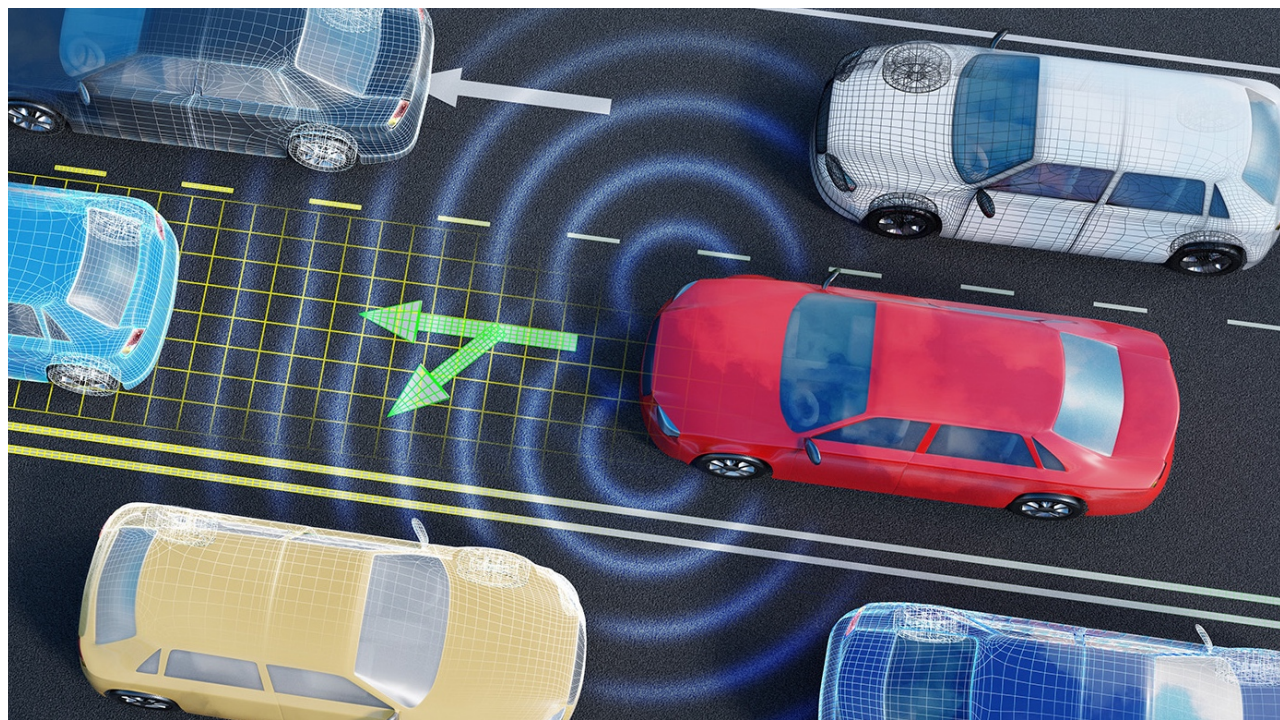
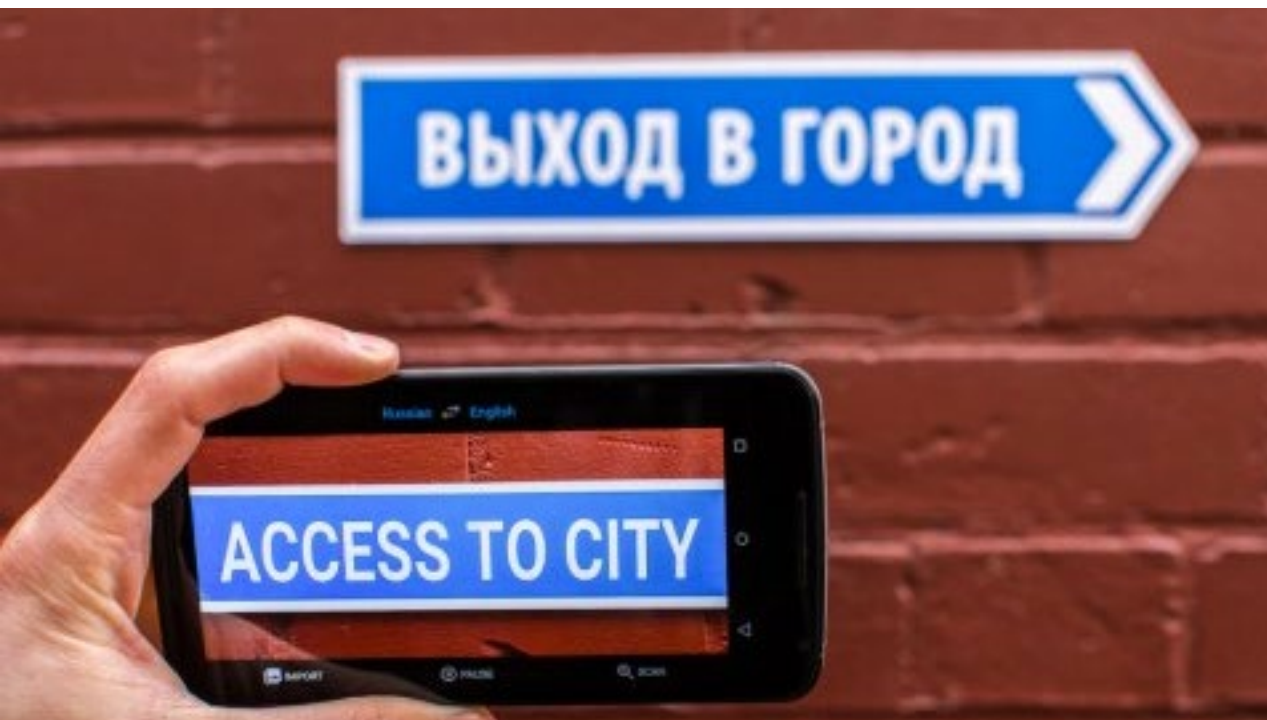
Q: What are your organization's plans in terms of artificial intelligence?

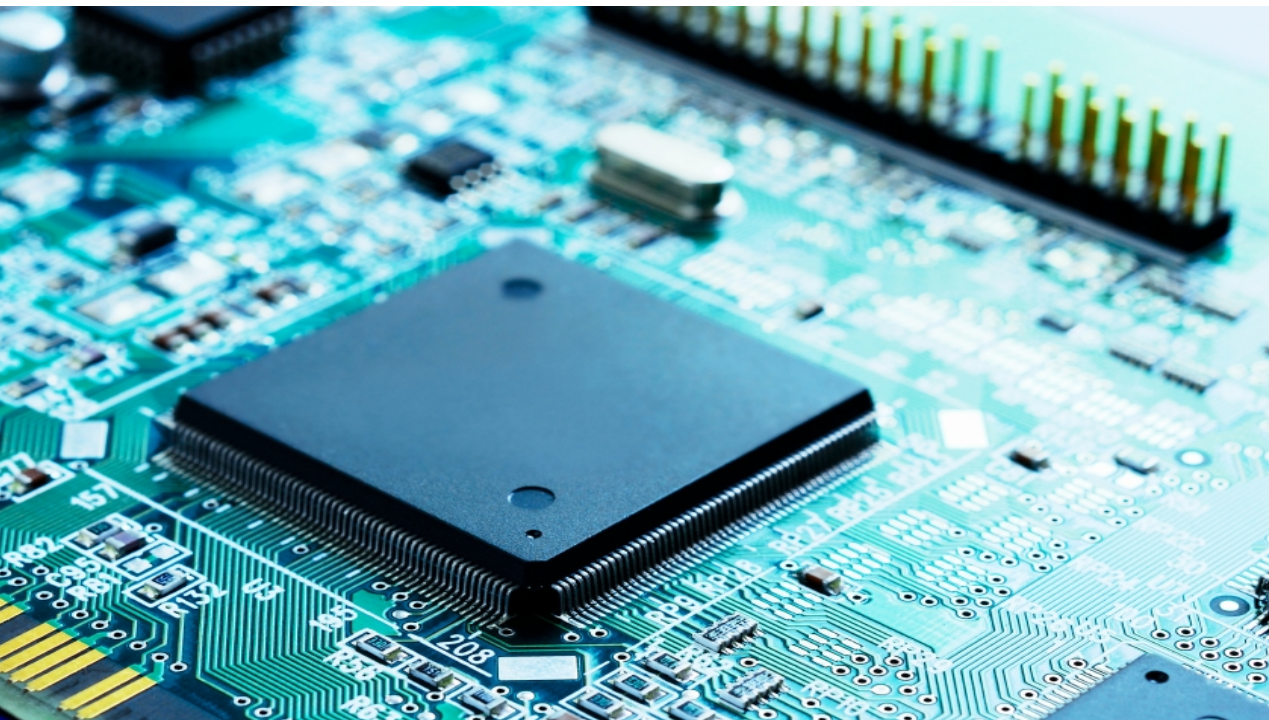
Base: All Answering, n = 3.138

Source: Gartner 2018 CIO Survey

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Source: Gartner, *Real Truth of Artificial Intelligence* by Whit Andrews
Presented at Gartner Data & Analytics Summit 2018, March 2018





Artificial Intelligence

The capability of a machine to imitate intelligent human behavior

Artificial Intelligence

*The capability of a machine to **exceed** intelligent human behavior*

Artificial Intelligence Today

*The capability of a machine to **exceed**
intelligent human behavior
by training a machine to learn the desired behavior*

There are two ways to get a computer to do what you want

Traditional Programming



There are two ways to get a computer to do what you want

Machine Learning



There are two ways to get a computer to do what you want

Machine Learning



Artificial Intelligence

Machine Learning

Are you ready for AI?



Data



Output



Model



Are you ready for AI?



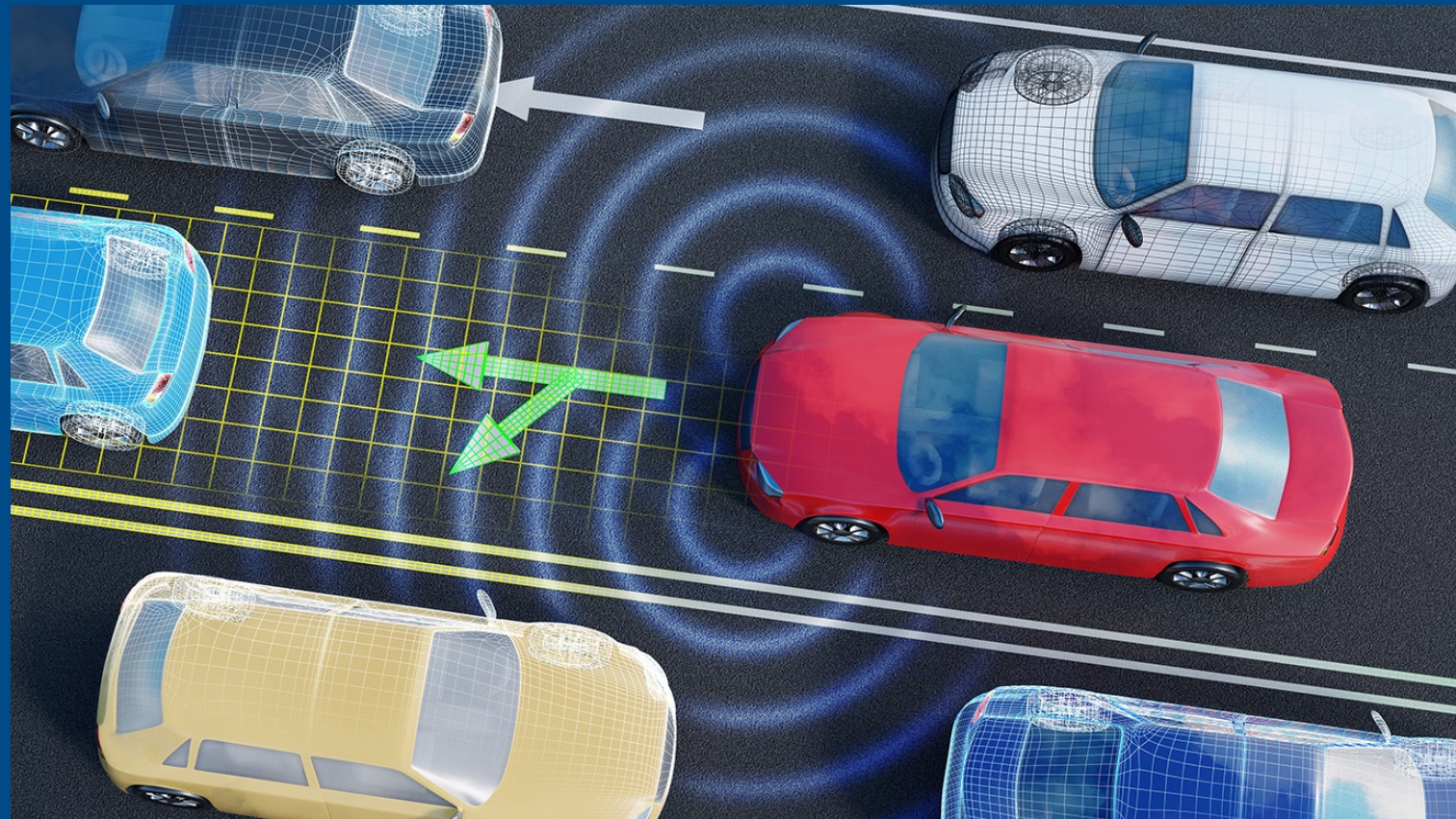
Data



Output



Model



Are you ready for AI?

Access Data

Analyze Data



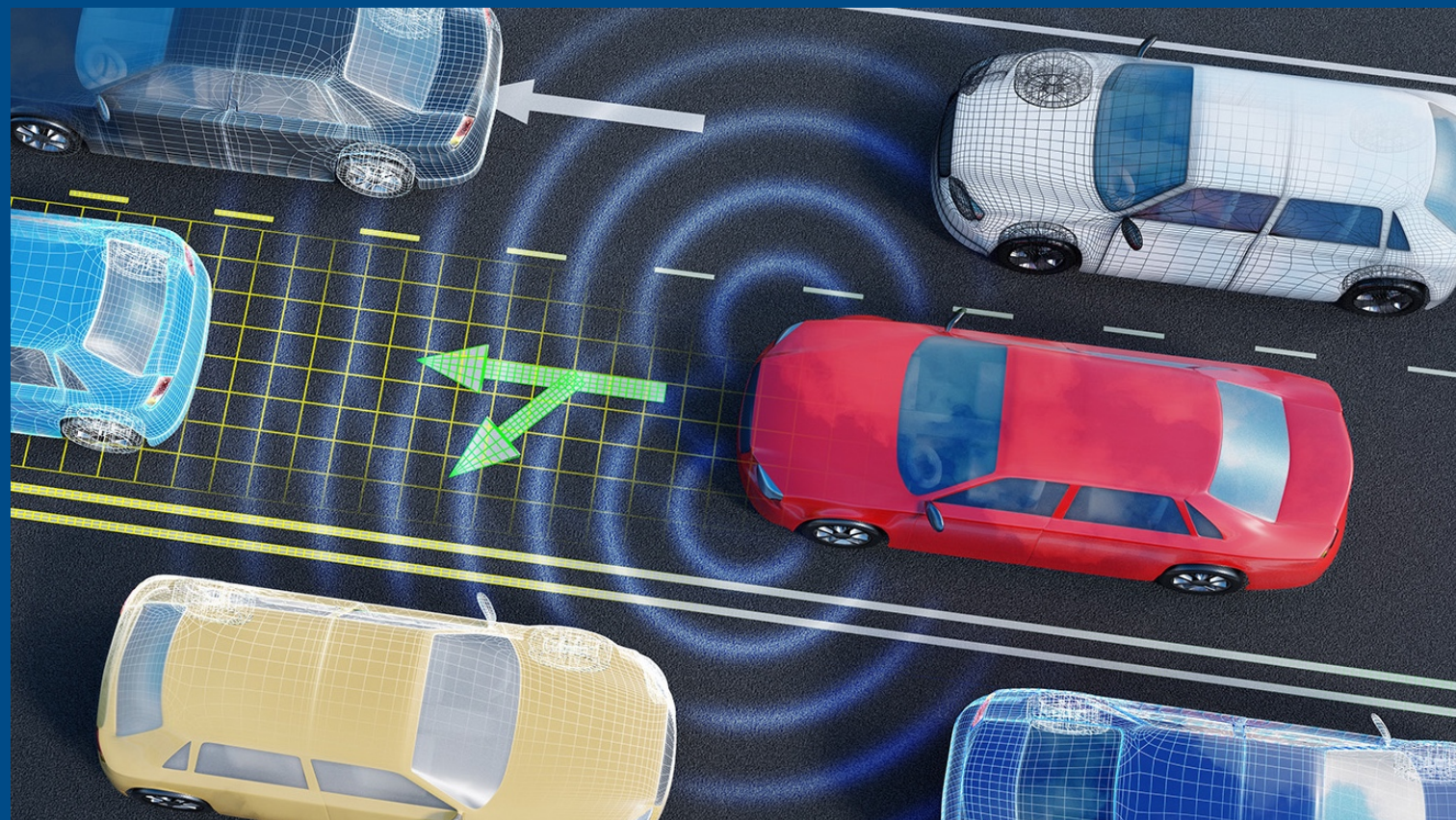
Data



Output



Model



Are you ready for AI?

Access Data

Develop

Analyze Data

Deploy



Data



Output



Model

Find out more:
**Automated Driving Development
with MATLAB and Simulink**

Avinash Nehemiah, MathWorks
**Signal Processing, Computer Vision,
and Wireless Technology**



Are you ready for AI?

Access Data

Develop

Analyze Data

Deploy



Data



Output



Model

EVERYTHING

ELSE

Are you ready for AI?

Access Data

Analyze Data

Develop

Deploy



AI model



Output



Model

Are you ready for AI?

Access Data



Sensors



Files



Databases

Analyze Data



Data exploration



Preprocessing



Domain-specific algorithms

Develop



AI model



Algorithm development



Modeling & simulation

Deploy

Are you ready for AI?

Access Data



Sensors



Files



Databases

Analyze Data



Data exploration



Preprocessing



Domain-specific algorithms

Develop



AI model



Algorithm development



Modeling & simulation

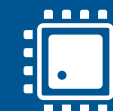
Deploy



Desktop apps



Enterprise systems



Embedded devices

Are you ready for AI?



Access Data



Sensors



Files



Databases

Analyze Data



Data exploration



Preprocessing



Domain-specific algorithms

Develop



AI model



Algorithm development



Modeling & simulation

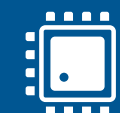
Deploy



Desktop apps

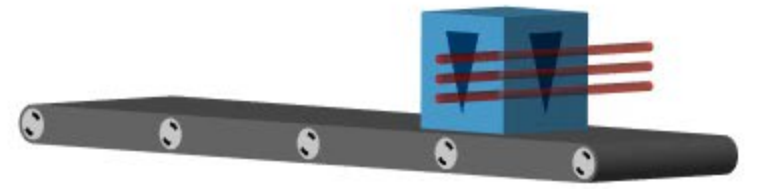


Enterprise systems



Embedded devices

Do you need AI?





AI for Predictive Maintenance

- Measure the wear of each robot
- Predict and fix failures before they happen
- AI handles uncertainty and variability

Are you ready for AI if ...

You've never used machine learning?

Twisties

Cheese

FAT 12.5g
Df 31%
SAT FAT 3.1g
Df 13%
SUGARS 1.6g
Df 2%
SODIUM 245mg
Df 11%

90g e NET
Flavoured snack



Twisties

Chicken

FAT 7.4g
Df 11%
SAT FAT 3.6g
Df 15%
SUGARS 0.7g
Df 1%
SODIUM 213mg
Df 9%

90g e NET
Flavoured snack

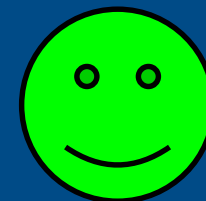
What is crispiness?



Crushing Sound



Crushing Force



Crispy



Crispy Enough

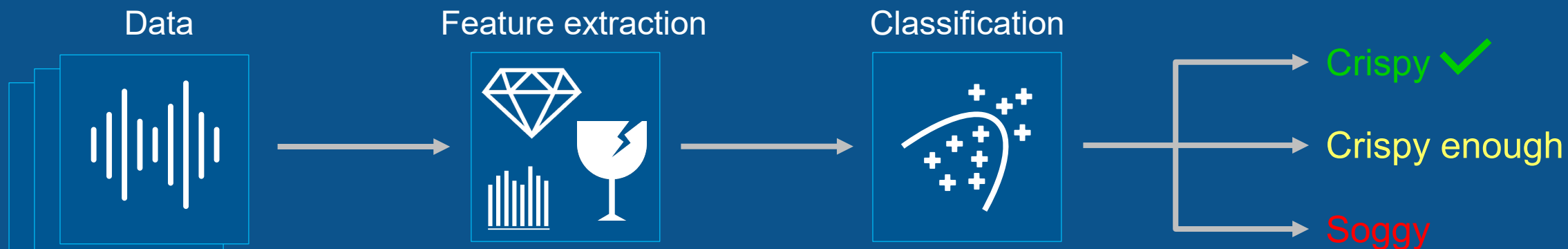


Soggy

Replicating human perception with machine learning

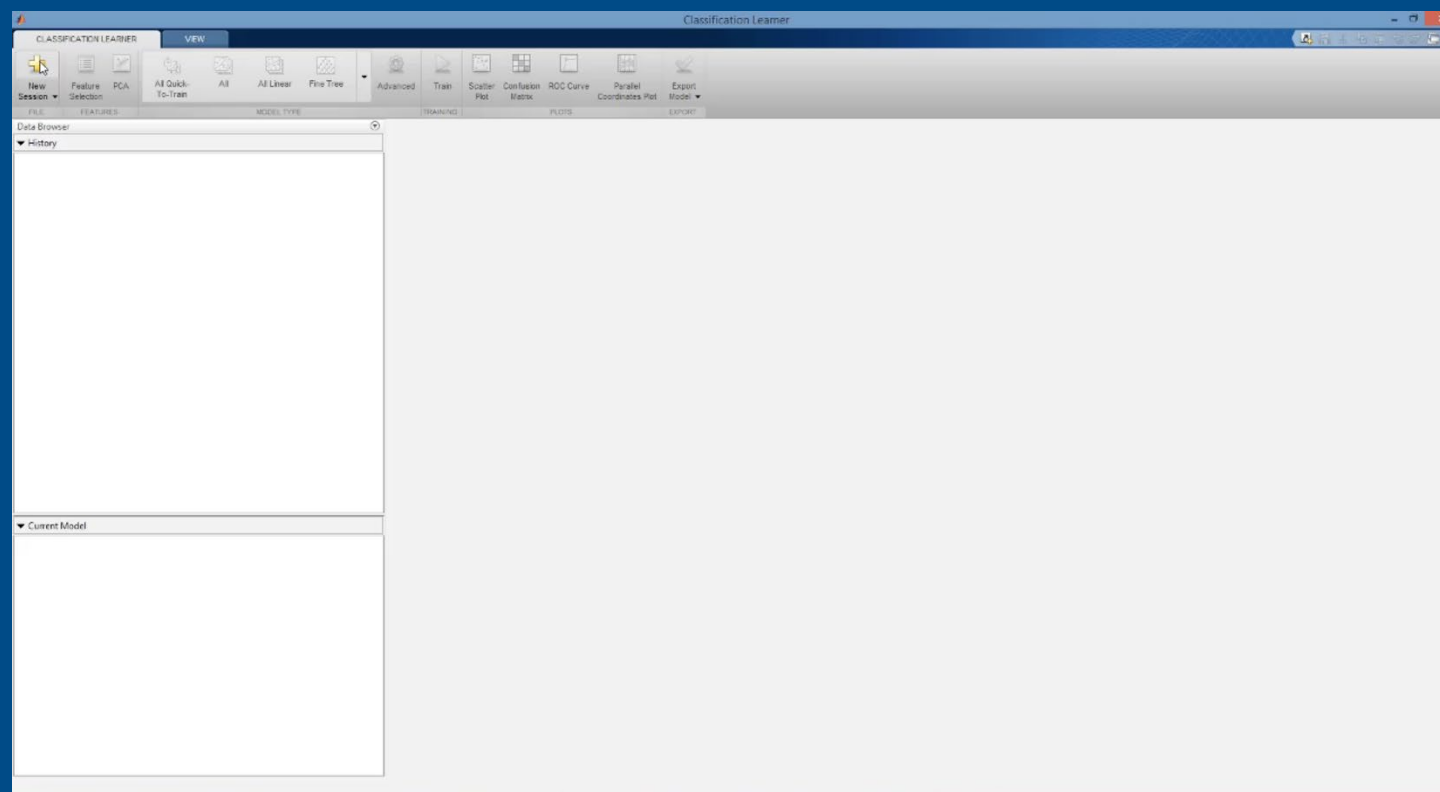
Technical University of Munich

Machine Learning Workflow

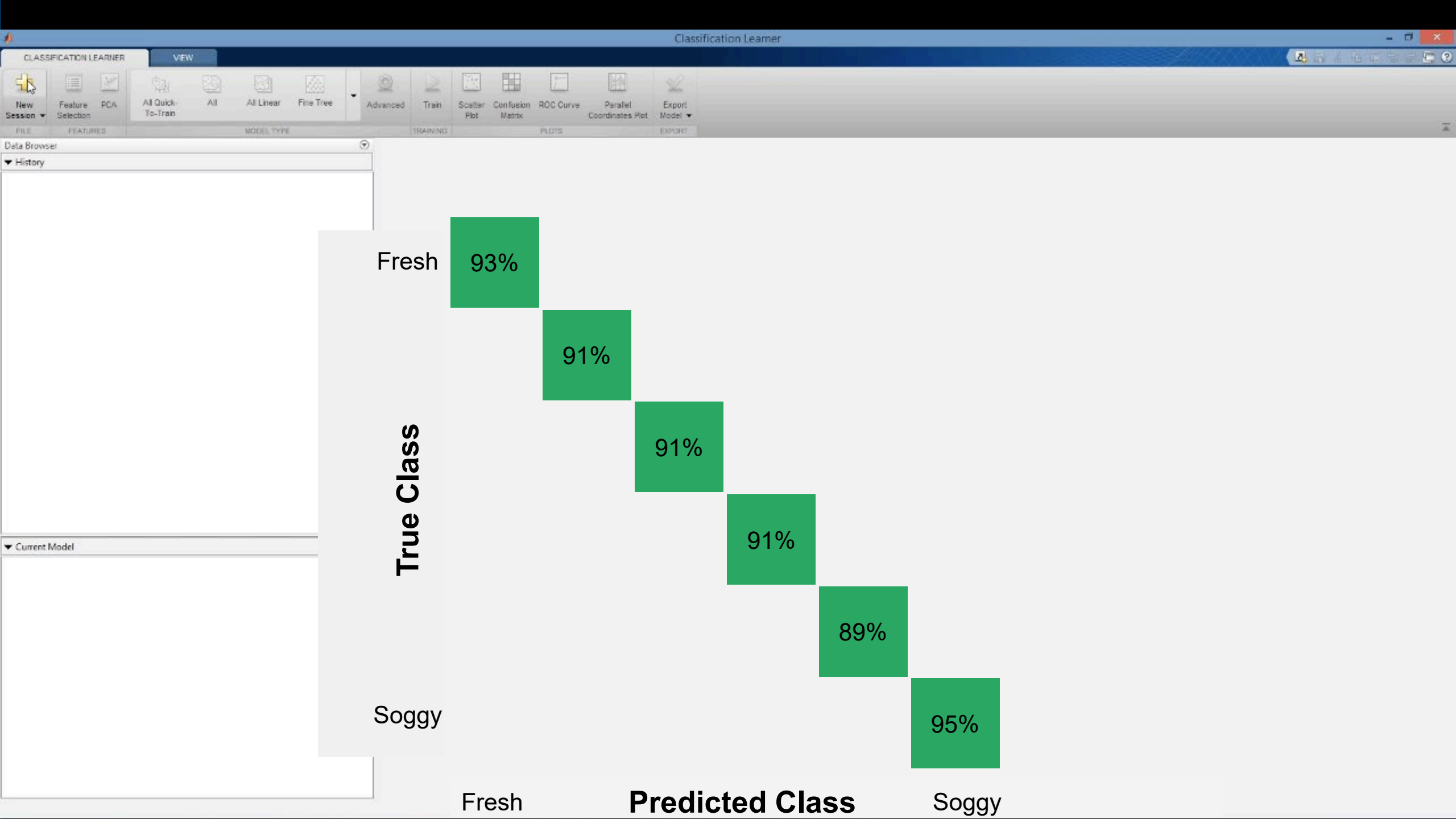


Replicating human perception with machine learning

Technical University of Munich



Classification Learner

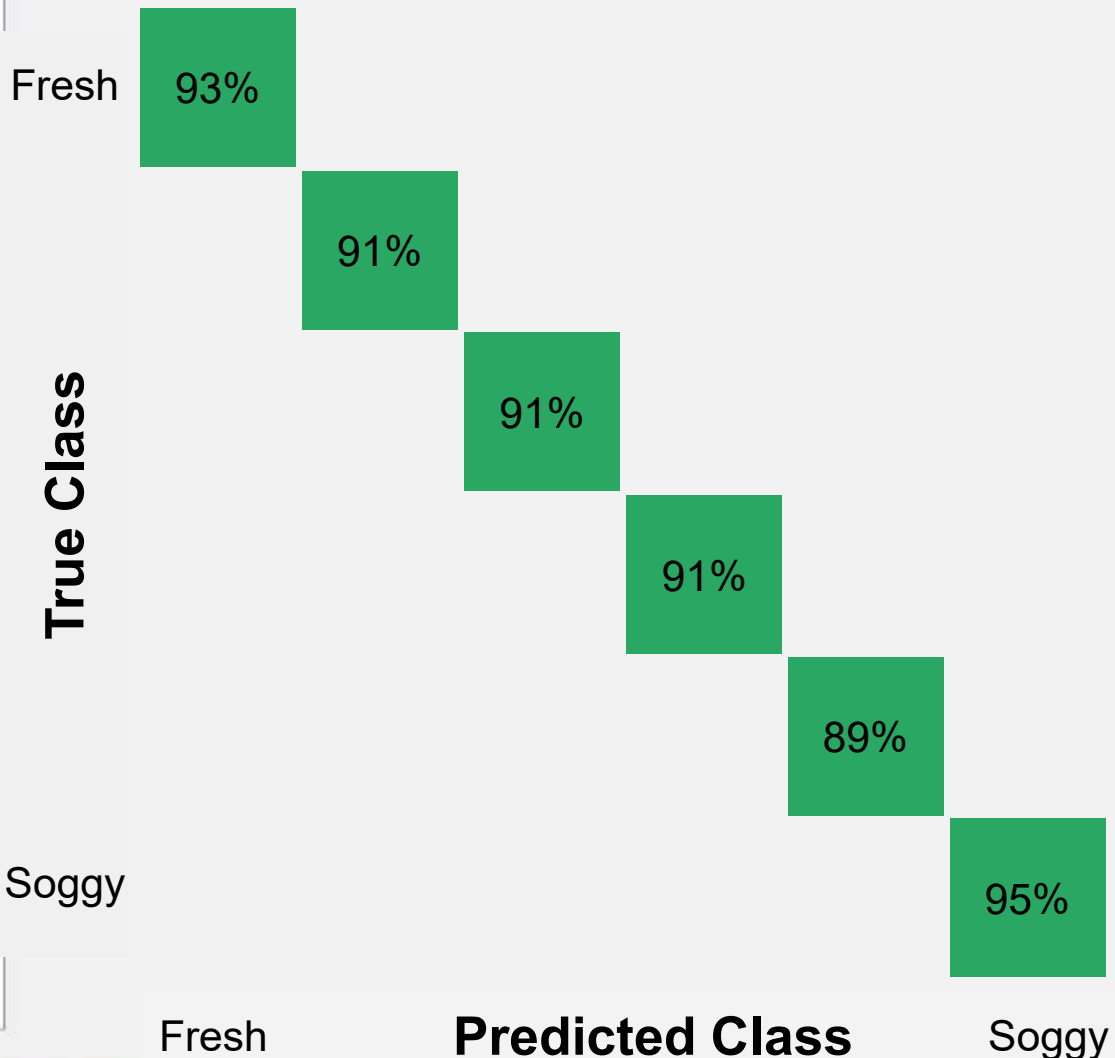


Navigation and toolbars including: New Session, Feature Selection, PCA, All Quick-To-Train, All, All Linear, Fine Tree, Advanced, Train, Scatter Plot, Confusion Matrix, ROC Curve, Parallel Coordinates Plot, Export Model.

Data Browser

▼ History

▼ Current Model



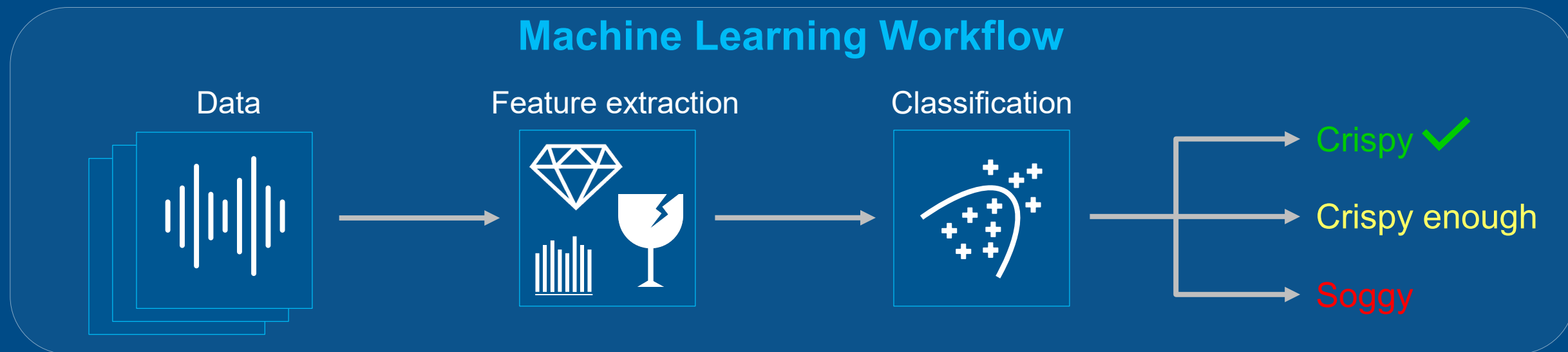
Are you ready for AI if you've never used machine learning?

- No experience required
- Use apps to try out all possible models
- Use domain expertise and familiar tools to prepare data

Are you ready for AI if ...

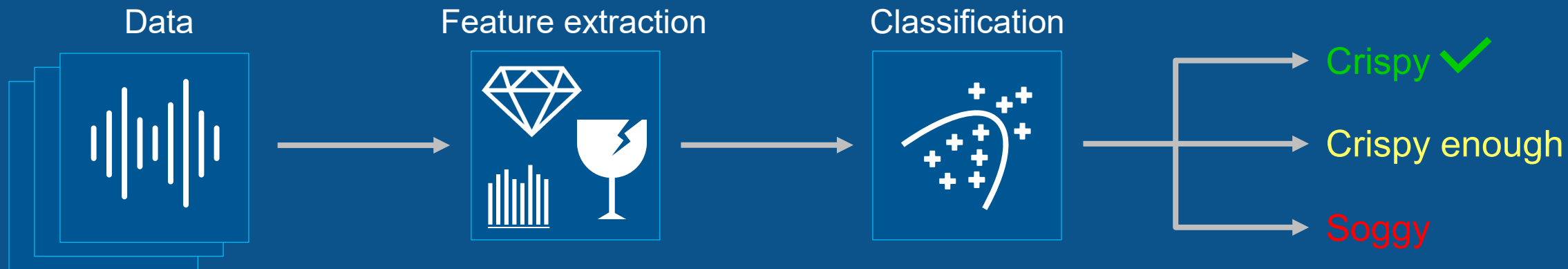
You can't identify features in your data?

Use deep learning to identify features automatically

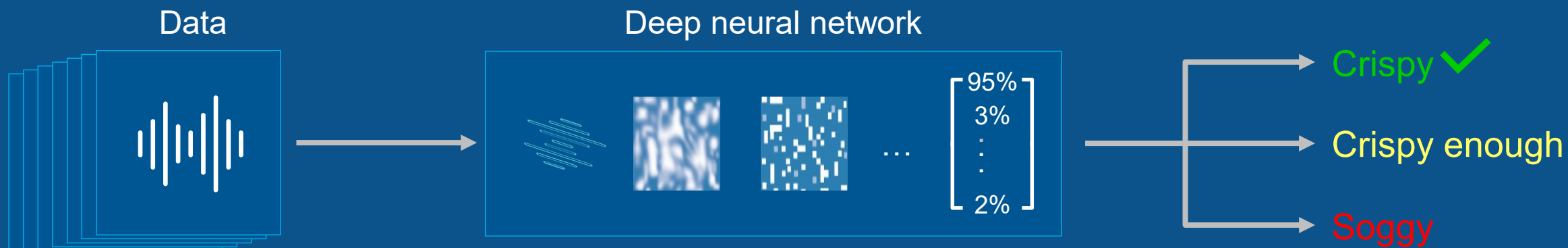


Use deep learning to identify features automatically

Machine Learning Workflow



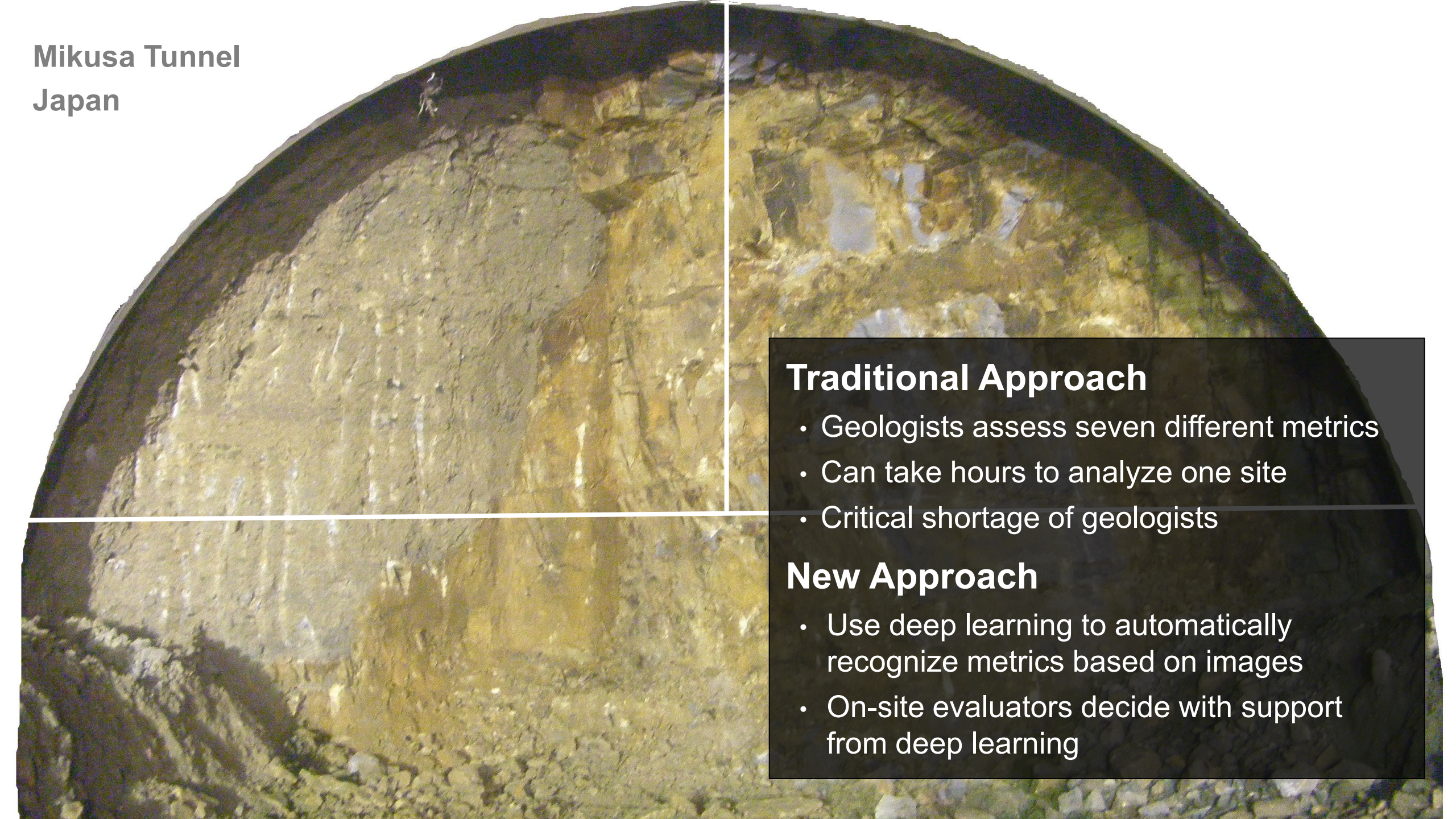
Deep Learning Workflow





Mikusa Tunnel
Japan





Mikusa Tunnel
Japan

Traditional Approach




- Geologists assess seven different metrics
- Can take hours to analyze one site
- Critical shortage of geologists

New Approach

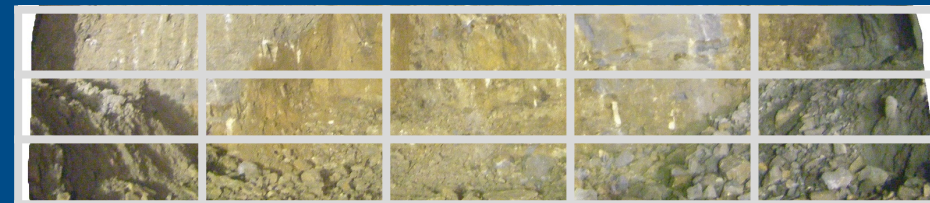
- Use deep learning to automatically recognize metrics based on images
- On-site evaluators decide with support from deep learning

Efficient tunnel drilling with deep learning

Obayashi Corporation

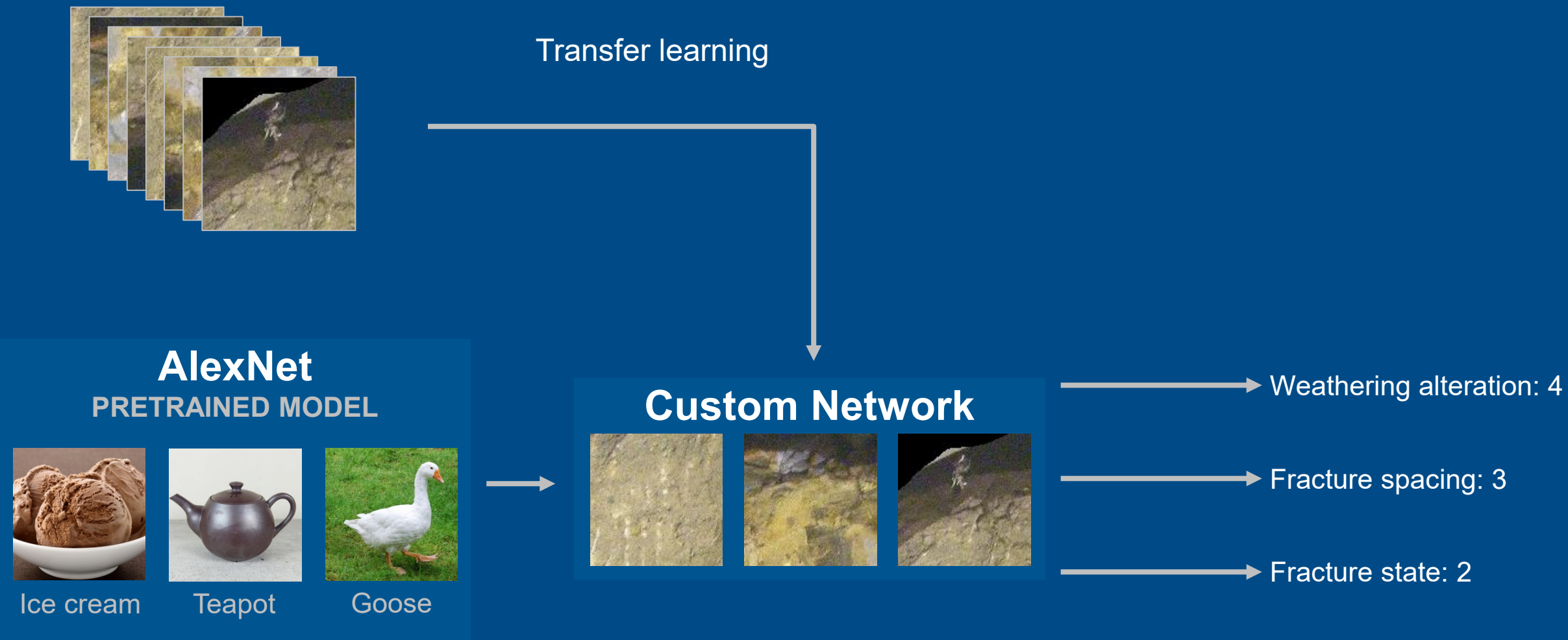
Image	Weathering Alteration (1-4)	Fracture Spacing (1-5)	Fracture State (1-5)
	3	3	2
	4	1	1
	2	3	2
⋮	⋮	⋮	⋮

Split into
sub-images



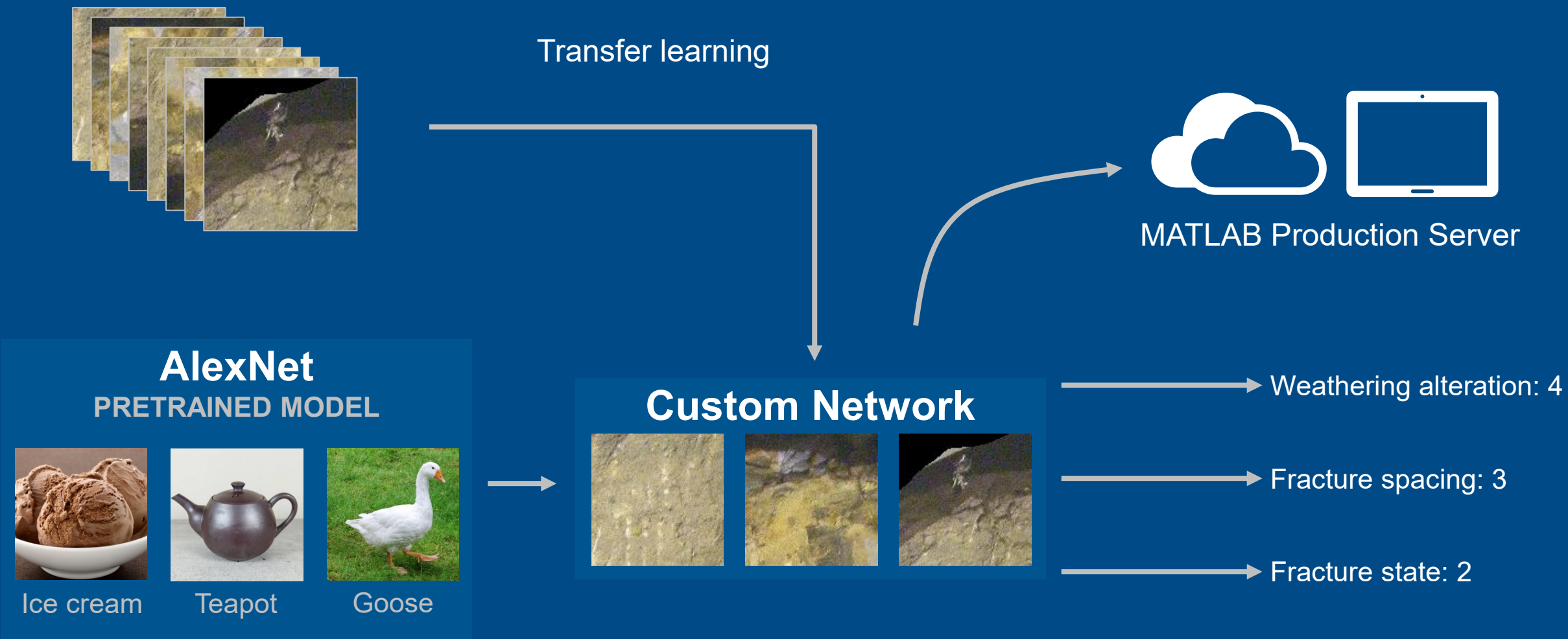
Efficient tunnel drilling with deep learning

Obayashi Corporation



Efficient tunnel drilling with deep learning

Obayashi Corporation



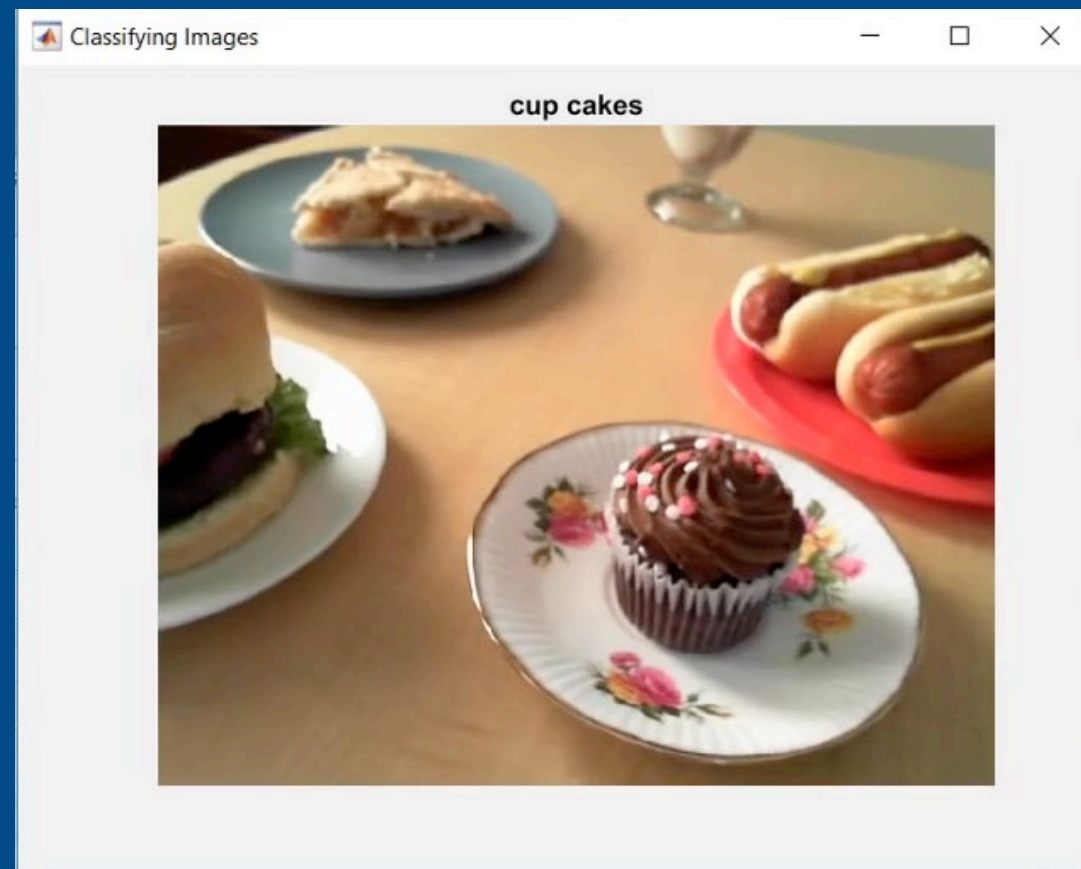
Are you ready for AI if you can't identify features in your data?

- Deep learning

```
nnet = alexnet;  
  
cam = webcam;  
picture = snapshot(cam);  
picture = imresize(picture,[227 227]);  
  
label = classify(nnet, picture)
```



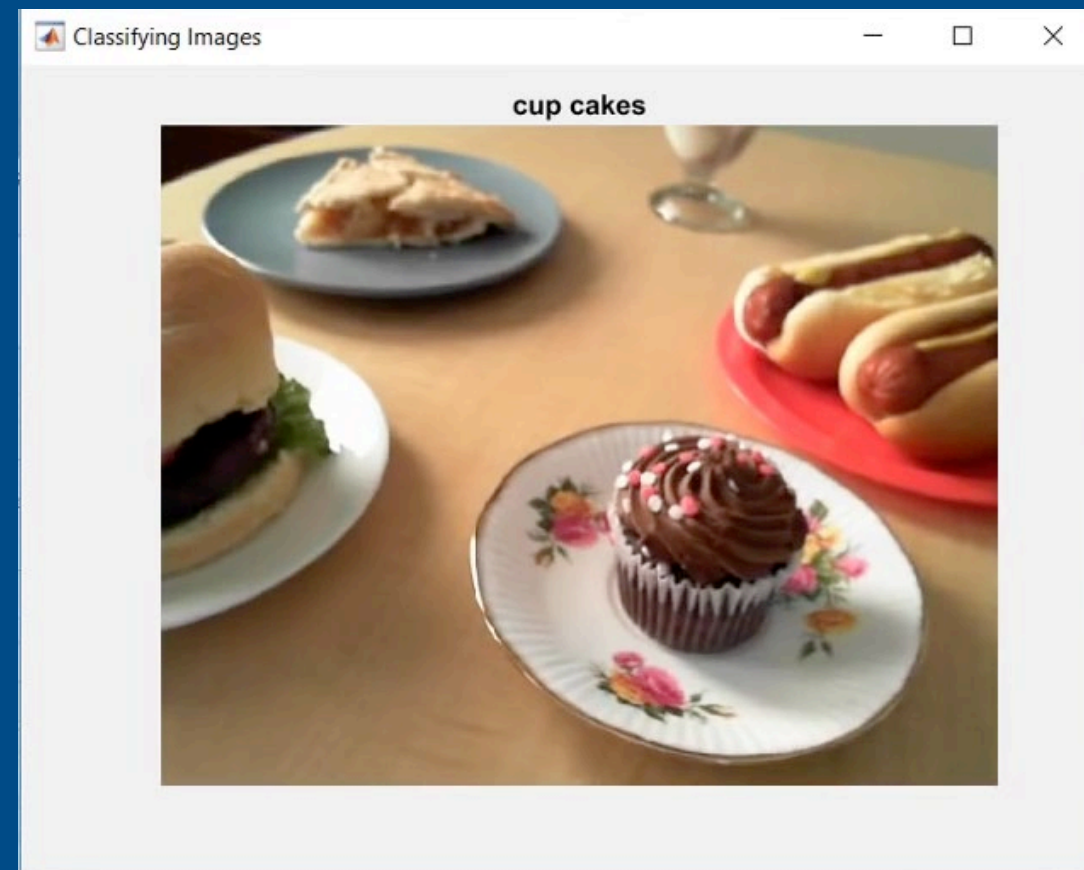
Deep learning in 5 lines of code



Are you ready for AI if you can't identify features in your data?

- Deep learning
- Transfer learning





Deep learning in 5 lines of code

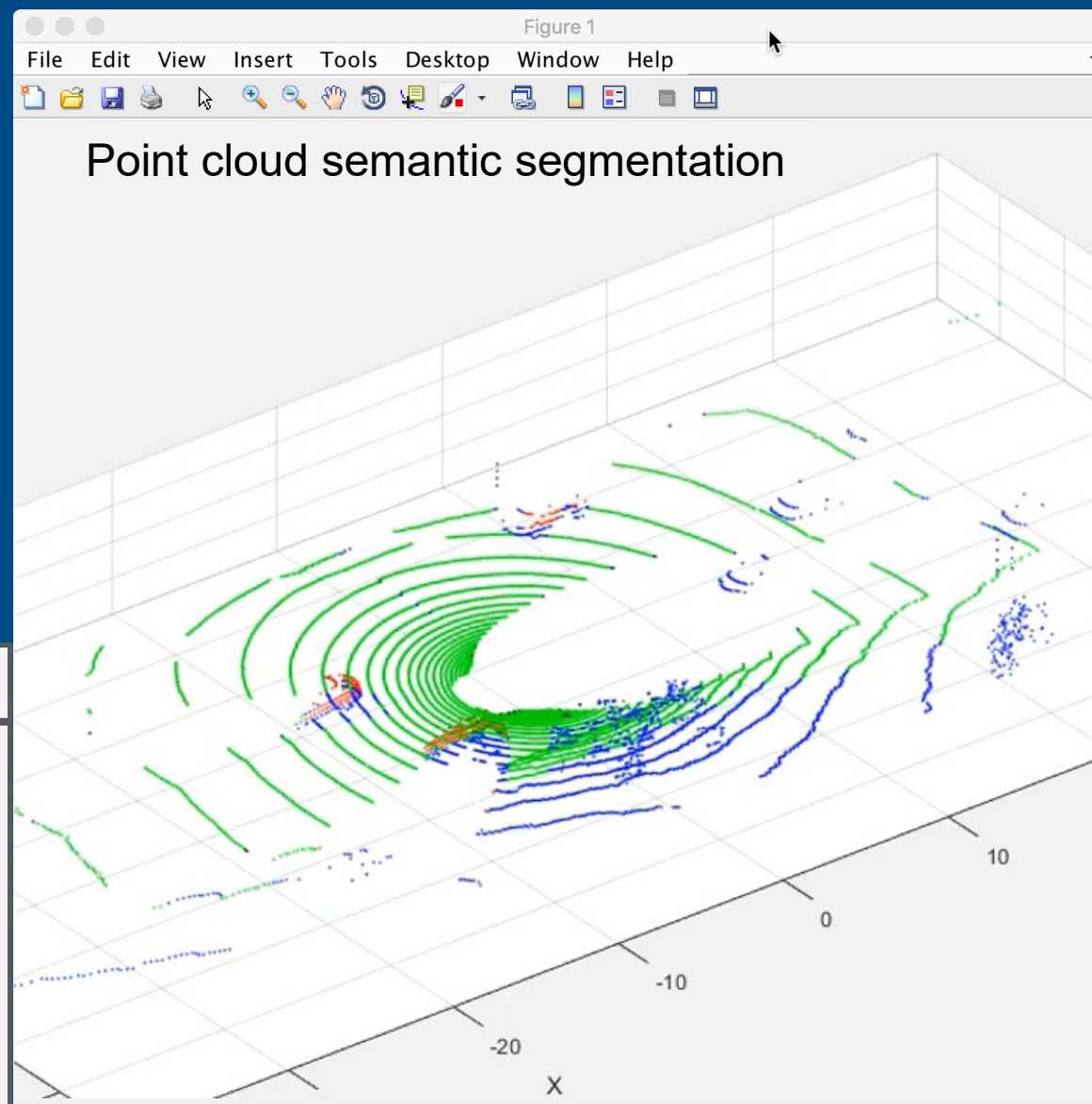


Are you ready for AI if you can't identify features in your data?

- Deep learning
- Transfer learning
- Automation and AI to label data



Classification	
Car	
Truck	
Background	
Ground	

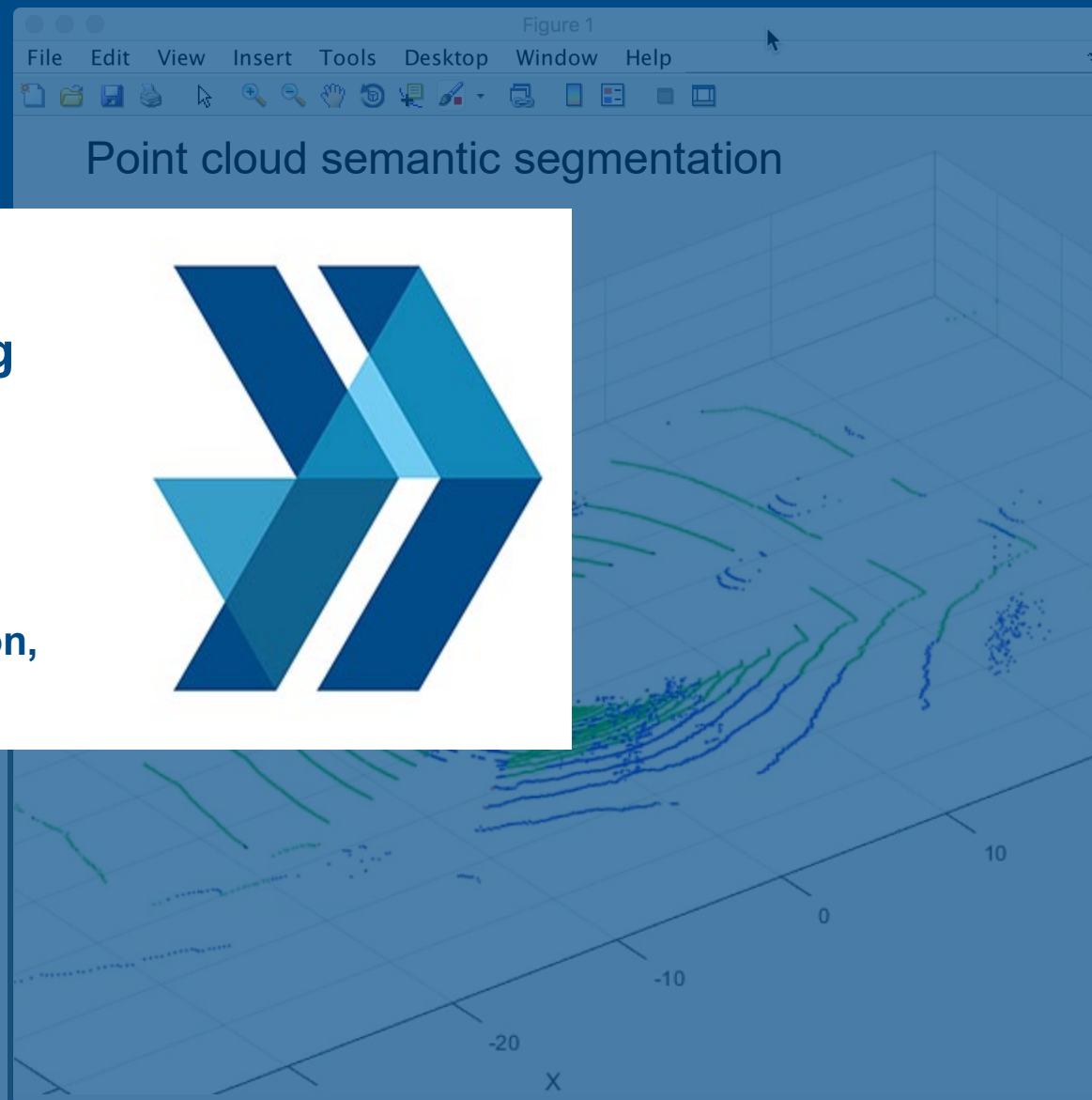


Are you ready for AI if you can't identify features in your data?

- Deep learning
- Transfer learning
- Automation and

Find out more:
Demystifying Deep Learning

Pitambar Dayal, MathWorks
Signal Processing, Computer Vision,
and Wireless Technology



Autoliv

Are you ready for AI if ...

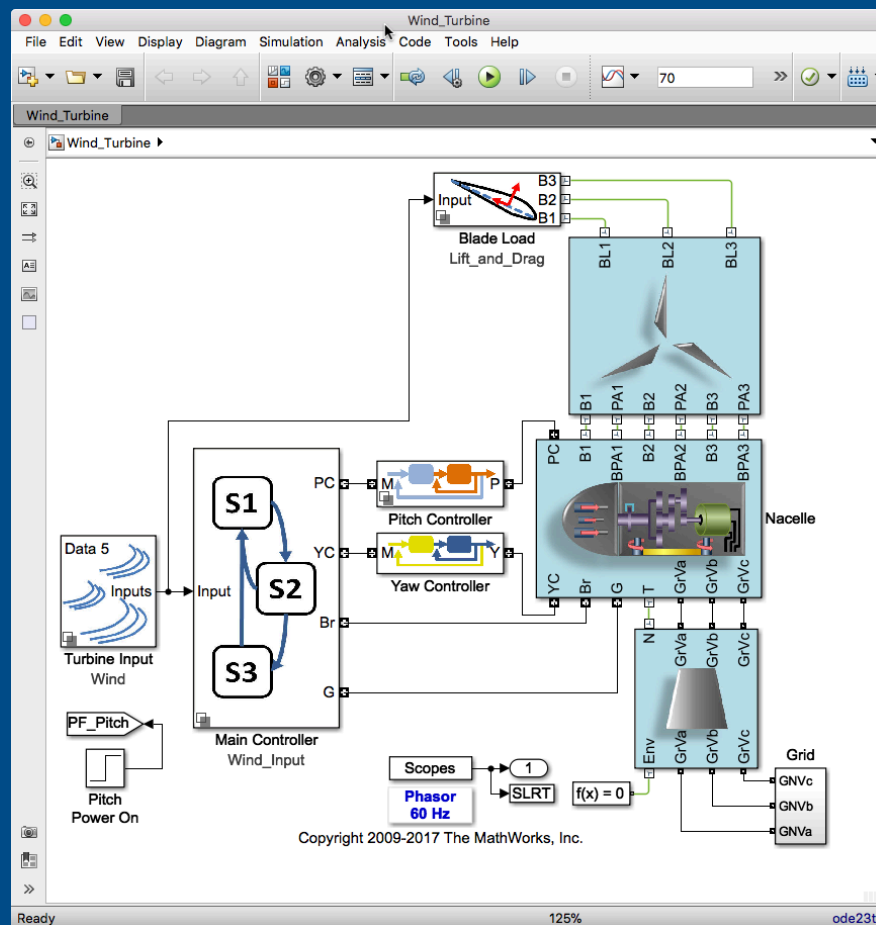
If you don't have the right data?



AI for Predictive Maintenance

- Measure the wear of each blade
- Predict and fix failures before they happen
- Can't rely on failures in the field

Predictive maintenance with synthetic failure data with MATLAB & Simulink



Simulink model

Predictive maintenance with synthetic failure data with MATLAB & Simulink

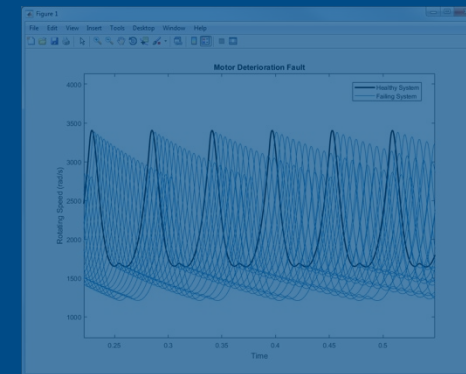
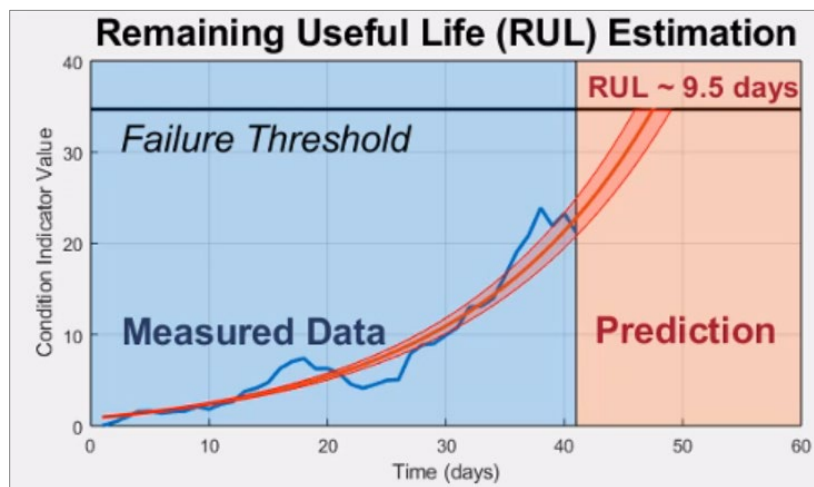
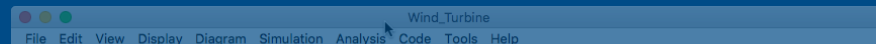


Measured data

Re

Predictive Maintenance Toolbox

R2018a

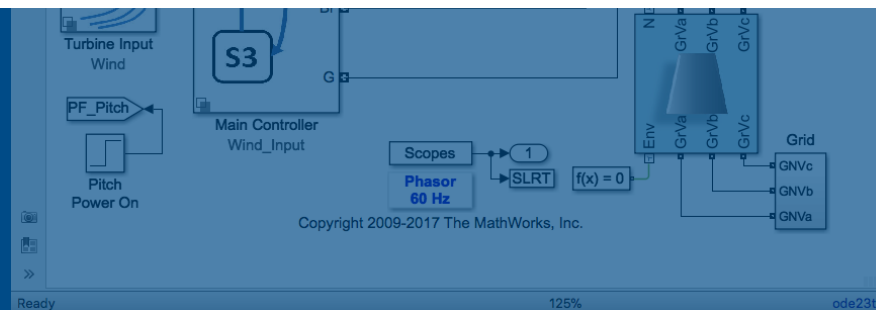


Failure signals



Failure characteristics

Modify model



Simulink model

Predictive maintenance with synthetic failure data with MATLAB & Simulink



Measured data

Re

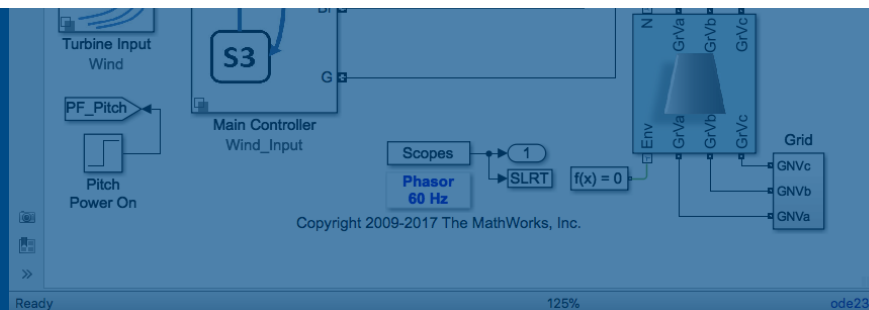
Find out more:
Predictive Maintenance:
From Development to IOT
Deployment

Mehernaz Savai, MathWorks
Technical Computing and Data Analytics

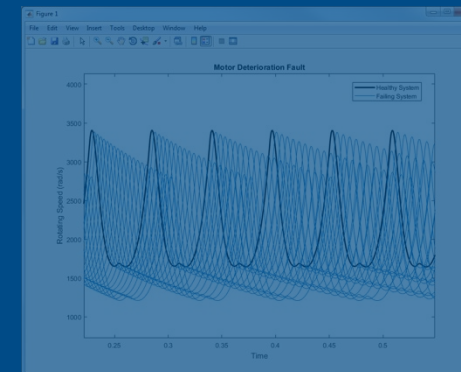


Failure characteristics

Modify model



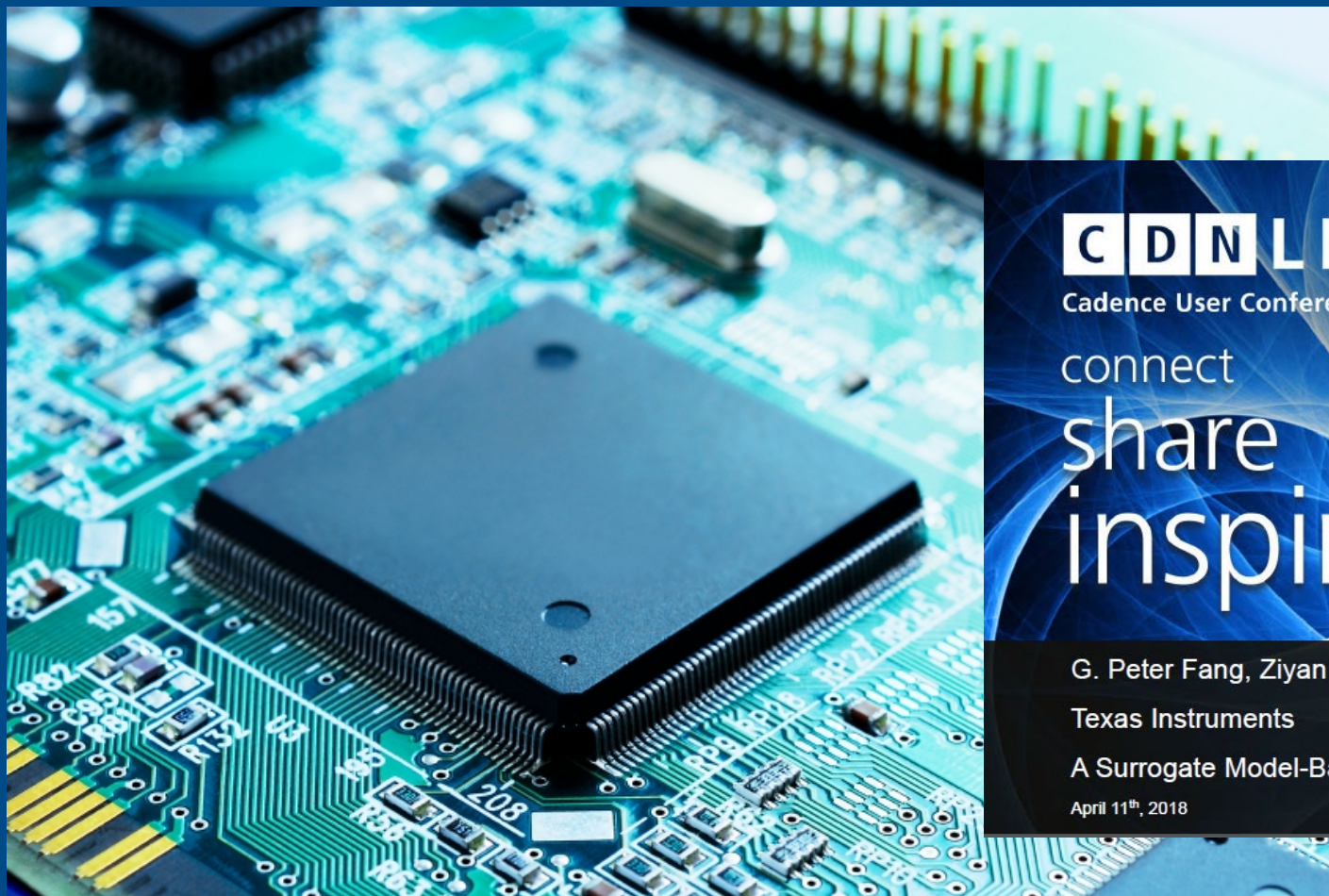
Simulink model



Failure signals

Surrogate Models and Optimization for IC Sizing

Texas Instruments



CDN LIVESM
Cadence User Conference 2018

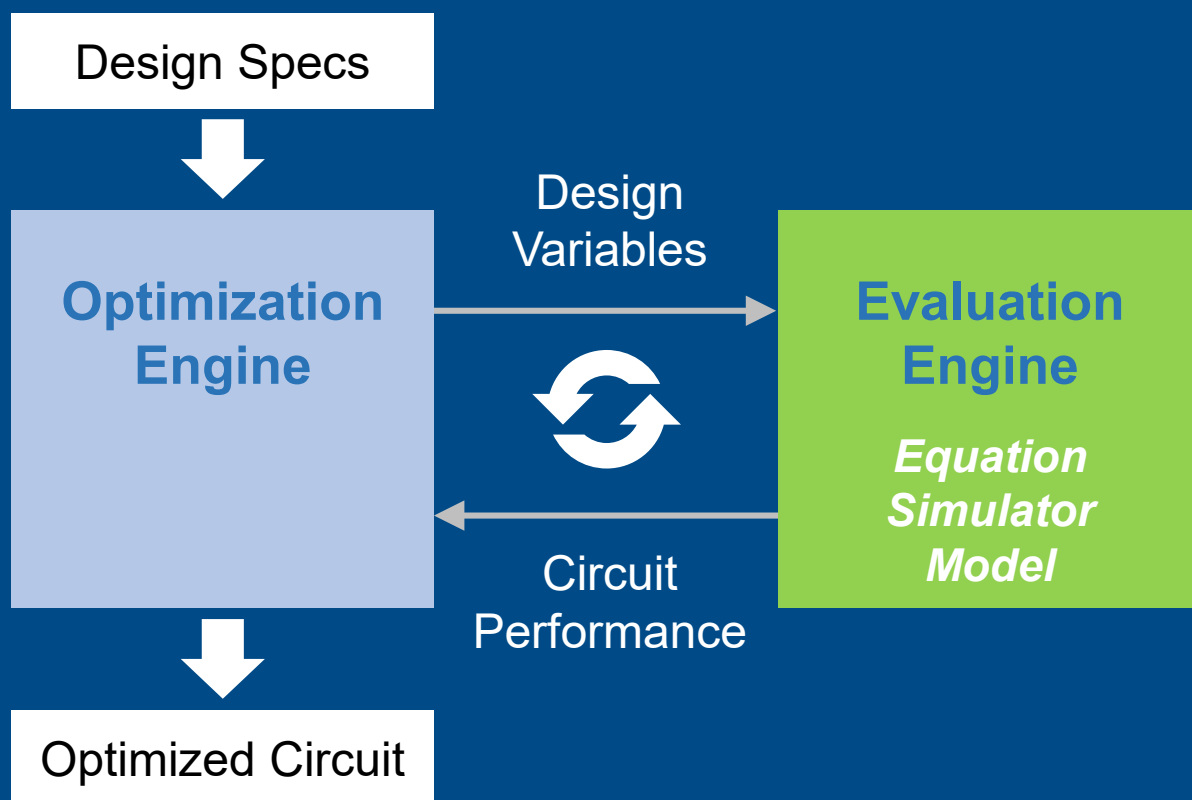
connect
share
inspire

cādence[®]

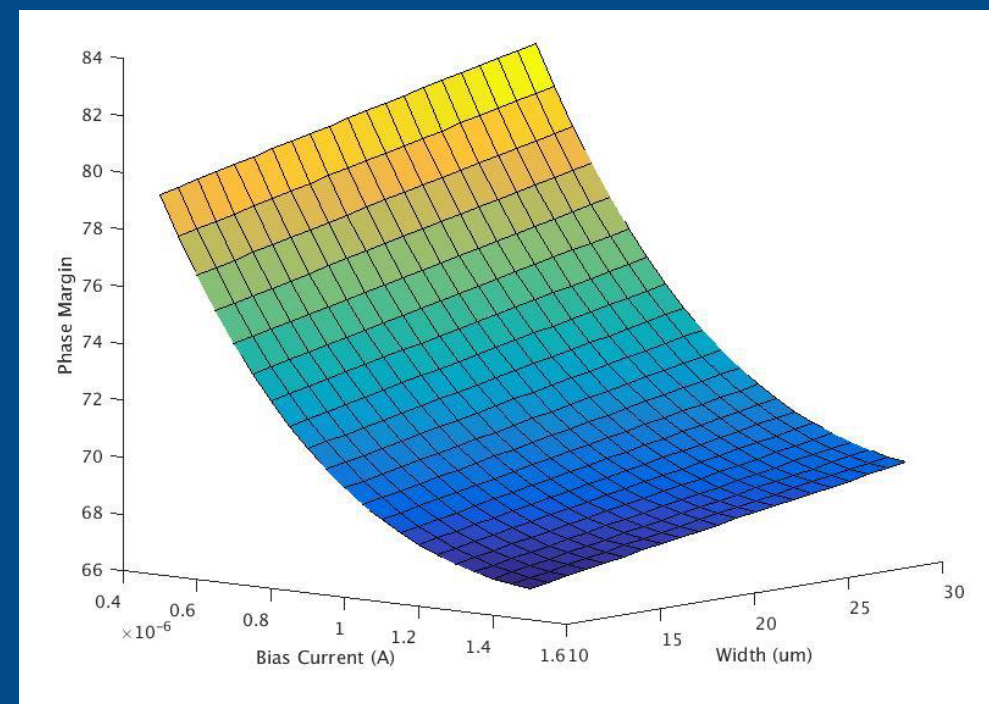
G. Peter Fang, Ziyang Wang, Wei Dong, Yong Xie
Texas Instruments
A Surrogate Model-Based Optimization Flow for Analog IC Sizing
April 11th, 2018

Surrogate Models and Optimization for IC Sizing

Texas Instruments



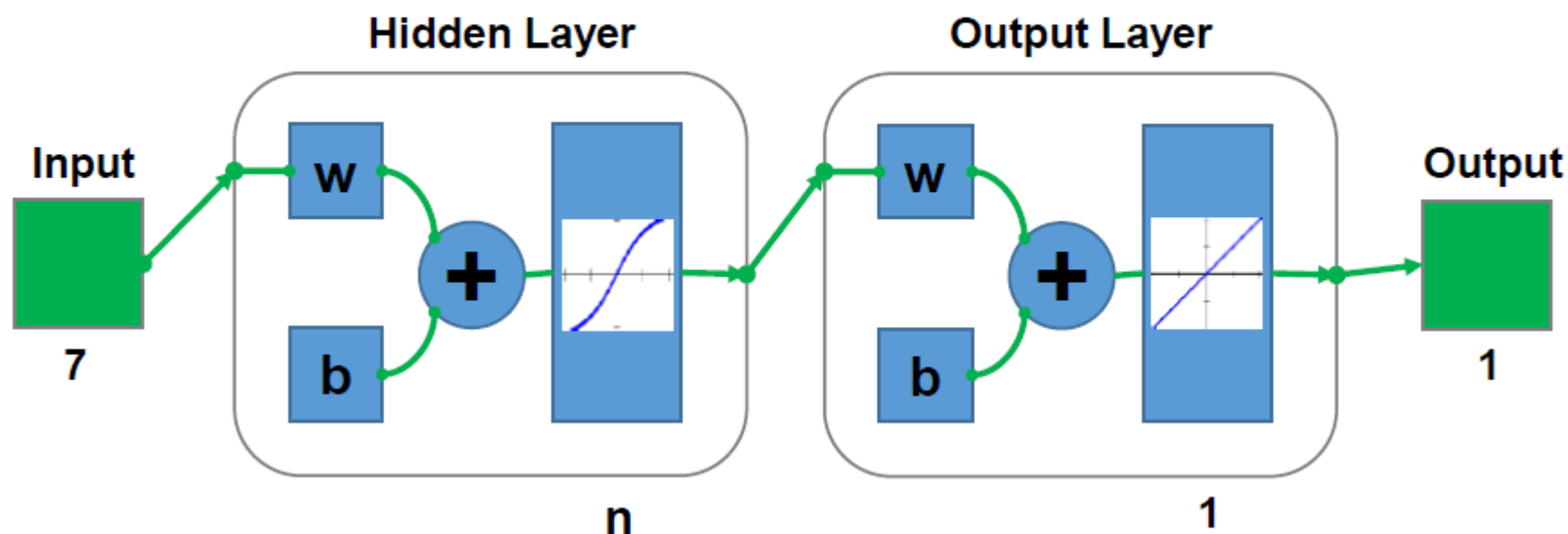
Surrogate Model



Deep Learning Toolbox Used to Create Surrogate Model

Two-Layer Feed Forward Neural Network

- We use Neural Fitting app (nftool) in Matlab to create the surrogate models.



Several Valid Options for the Designer

	Phase Margin	DC Gain	Voltage Offset	Unit Gain Bandwidth	Bias Current	Area
Original	70.9	39.9	425u	48.4M	1u	140
#1	68.5	41.9	83.9u	89.8M	1.5u	160
#2	68.8	41.5	31.1u	77.5M	1.5u	144
#3	77.5	34.1	522u	21.6M	0.5u	122

Solutions: Low Offset High Power or High Offset Low Power



Primary

Autonomous



EMG (Muscle) Control

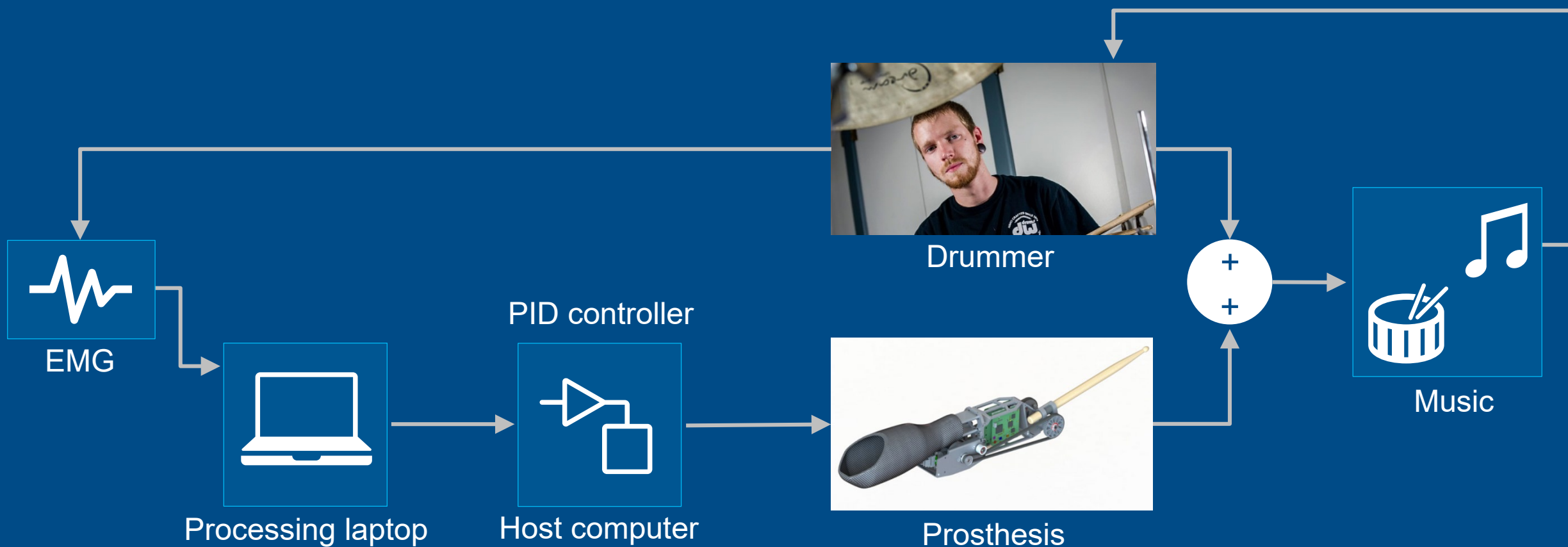
A close-up photograph of a custom-built robotic drumstick player. The device is mounted on a metal stand and features two wooden drumsticks. One stick is positioned vertically, and the other is angled towards a large, circular brass cymbal. The mechanism includes a green printed circuit board (PCB) with various electronic components, a black gear, and a silver pneumatic cylinder. The background is dark and out of focus.

Autonomous

Primary

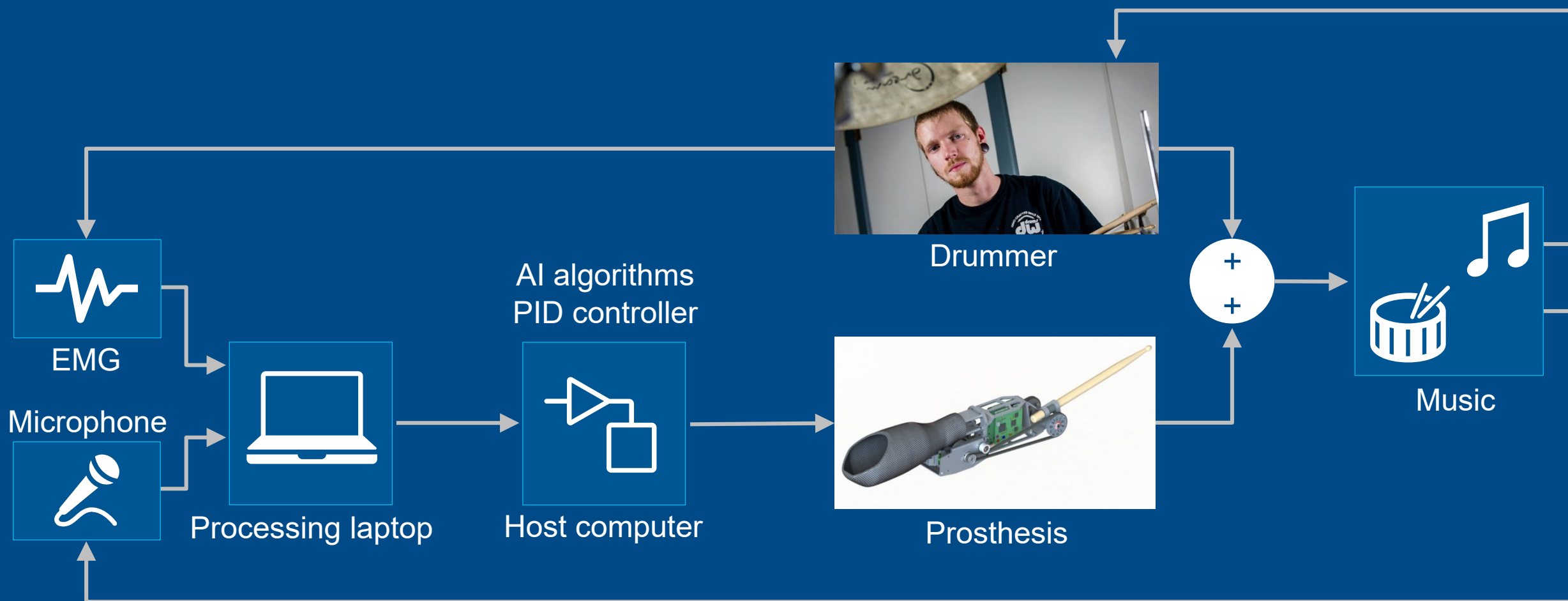
Exceeding human capabilities with a robotic drumming prosthesis

Georgia Tech Center for Music Technology



Exceeding human capabilities with a robotic drumming prosthesis

Georgia Tech Center for Music Technology





Are you ready for AI if ...

You've never used machine learning?

Easy programming

Apps

Domain expertise to prepare data

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Domain expertise to prepare data

You can't identify features in your data?

Deep learning identifies features for you

Transfer learning works with less data

Use AI to label data

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You don't have the right data?

Generate failure data with simulations

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You want to use existing workflows?

AI tools fit into existing workflow

With MATLAB and Simulink, you ARE ready for AI!