MATLAB EXPO 2018

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

Richard Rovner
Vice President, Marketing
Artificial Intelligence, Google Trends, Germany

Exponential growth!
Alexa –
Write my Expo keynote for me
Alexa –
Play soothing jazz
Artificial Intelligence Is in Early Adoption

Percentage of Respondents

- **14%**: No interest
- **35%**: On the radar, no action planned
- **25%**: In medium- or long-term planning
- **21%**: In short-term planning/actively experimenting
- **4%**: Have already invested and deployed

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

- Data
- Program
- COMPUTER
- Output
There are two ways to get a computer to do what you want.

Machine Learning

- Data
- Output

Computer

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

Machine Learning

Data → COMPUTER → Model

Output

Artificial Intelligence    Machine Learning
Are you ready for AI?

Data
Output
Model
Are you ready for AI?
Are you ready for AI?

Access Data
Analyze Data

Data
Output
Model
Are you ready for AI?

Data

Output

Model

Access Data

Analyze Data

Develop

Deploy
Are you ready for AI?

Access Data
Analyze Data
Develop
Deploy

Data
Output
Model

EVERYTHING ELSE
Are you ready for AI?

<table>
<thead>
<tr>
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Are you ready for AI?

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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?
What is crispiness?

Crispy

Crispy Enough

Soggy
Replicating human perception with machine learning
Technical University of Munich

Machine Learning Workflow

Data → Feature extraction → Classification

- Crispy
- Crispy enough
- Soggy
Replicating human perception with machine learning
Technical University of Munich

Classification Learner
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

Machine Learning Workflow

Data → Feature extraction → Classification

- Crispy
- Crispy enough
- Soggy
Use deep learning to identify features automatically

Machine Learning Workflow

Data → Feature extraction → Classification

Deep Learning Workflow

Data → Deep neural network → Classification

Crispy
Crispy enough
Soggy
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

Split into sub-images

Label each sub-image

<table>
<thead>
<tr>
<th>Image</th>
<th>Weathering Alteration (1-4)</th>
<th>Fracture Spacing (1-5)</th>
<th>Fracture State (1-5)</th>
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Efficient tunnel drilling with deep learning
Obayashi Corporation

Transfer learning

AlexNet
PRETRAINED MODEL

Ice cream  Teapot  Goose

Custom Network

Weathering alteration: 4
Fracture spacing: 3
Fracture state: 2
Efficient tunnel drilling with deep learning
Obayashi Corporation

Transfer learning

MATLAB Production Server

AlexNet PRETRAINED MODEL

Custom Network

Ice cream  Teapot  Goose

Weathering alteration: 4
Fracture spacing: 3
Fracture state: 2
Are you ready for AI if you can’t identify features in your data?

- Deep learning

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

Predictive Maintenance Toolbox

Measured data

Modified model

Failure signals

Failure characteristics

Simulink model
Predictive maintenance with synthetic failure data with MATLAB & Simulink

Find out more: Prädiktive Wartung eines digitalen Zwillingss

Steve Miller, MathWorks:
Session “Mechatronische Systeme”
2:30 p.m.
Low-carbon homes

• Generate power with fuel cell and solar panels
• Store power in battery
• Buy power when needed; sell when extra
• Record data on environment and energy usage
Low-carbon homes
- Generate power with fuel cell and solar panels
- Store power in battery
- Buy power when needed; sell when extra
- Record data on environment and energy usage

Goals
- Minimize energy cost
- Use EV battery for additional storage
Optimizing home energy management system

Denso
Optimizing home energy management system
Denso

- Electricity prices
- Predicted vehicle use
- Home Energy Controller
- Generated and consumed power
- Battery command
- Stored energy
- Model predictive control
- Mixed integer linear programming
- Simscape Power Systems
Optimizing home energy management system

Denso

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# Optimizing home energy management system

## Denso

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<td>Optimization</td>
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“The effort would have taken significantly longer if we had used disparate tools.

[MATLAB] enabled our team of domain experts, who lacked formal training in data science, machine learning, and parallel computing, to incorporate all these areas in our design process.”

Akira Ito and Ryu Matsumoto
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
<table>
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<td>Transfer learning works with less data</td>
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<tr>
<td>Question</td>
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<tr>
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<td>AI tools fit into existing workflow</td>
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With MATLAB and Simulink, you ARE ready for AI!