MathWorks
@MathWorks

Share the EXPO experience
#MATLABEXPO

Welcome to this session!

Tell us about you!

MATLAB EXPO

Preparing Engineers for the Growing AI Workforce

Gaby Arellano-Bello, MathWorks

Maria E. Gavilan-Alfonso, MathWorks

MathWorks

Company “Administrador del Mercado Mayorista” Develops AI-Based Models for Predicting Electricity Demand

Challenge

Forecast electricity demand across Guatemala to increase grid stability, maximize power generated from renewable resources, and lower energy costs

Solution

Use MATLAB to develop machine learning and deep learning algorithms that use historical load measurements, outside temperatures, and other data to predict hour-by-hour demand

Results

- Prediction error halved
- Models updated rapidly for pandemic-related changes
- Production tool developed and deployed in 6 months

Demand prediction tool.

“Before starting this project, we had no experience with AI and little experience with programming in MATLAB. Machine learning and deep learning are complex topics, but MATLAB made the project straightforward for us with toolboxes that are easy to learn and use.”

- Lead engineer, Administrador del Mercado Mayorista

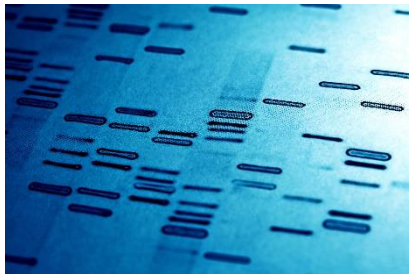
Link to user story

Key Industries

Aerospace and Defense

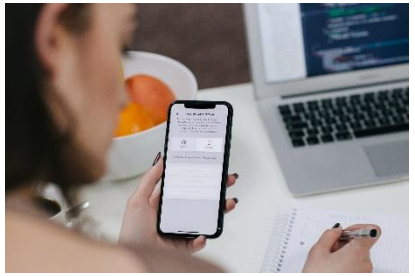
Automotive

Biological Sciences



Biotech and Pharmaceutical

Communications



Electronics

Energy Production

Financial Services

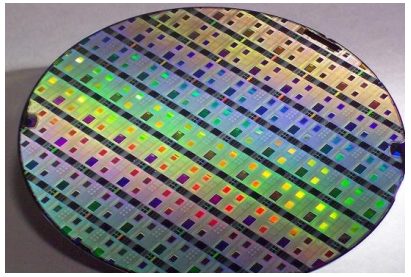
Industrial Machinery

Medical Devices

Metals, Materials, Mining

Neuroscience

Railway Systems



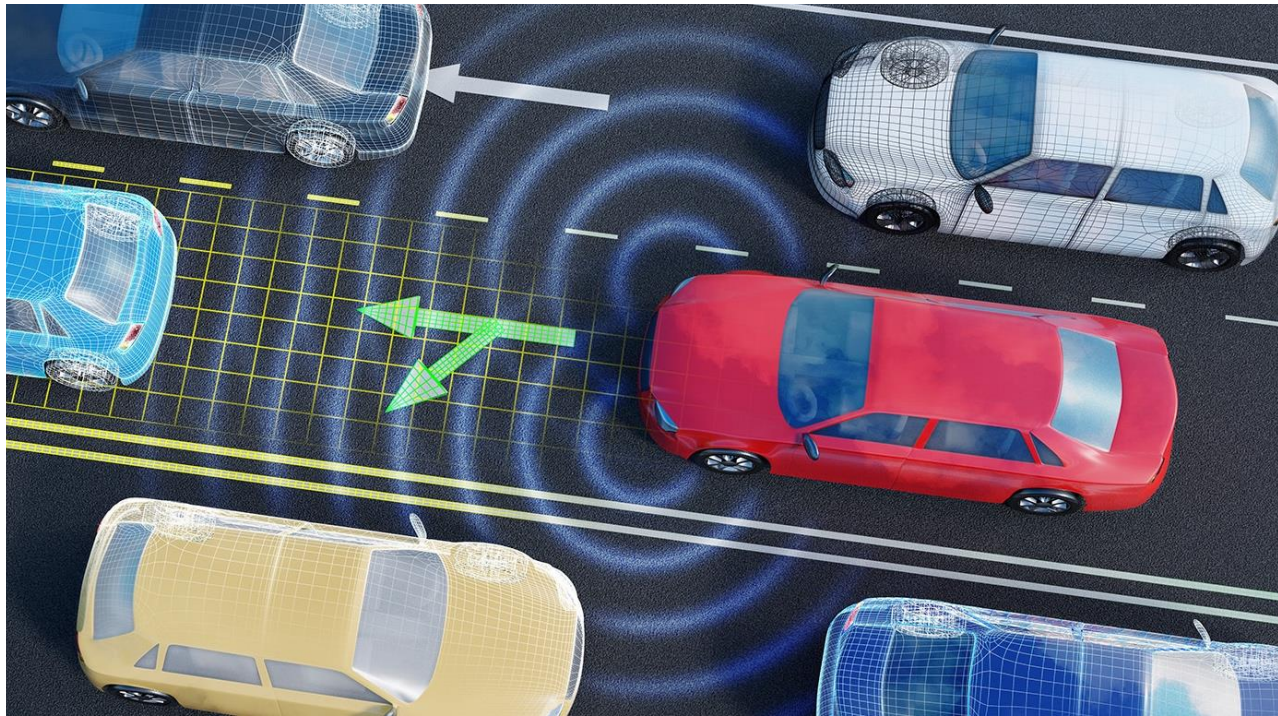
Semiconductors

Software and Internet

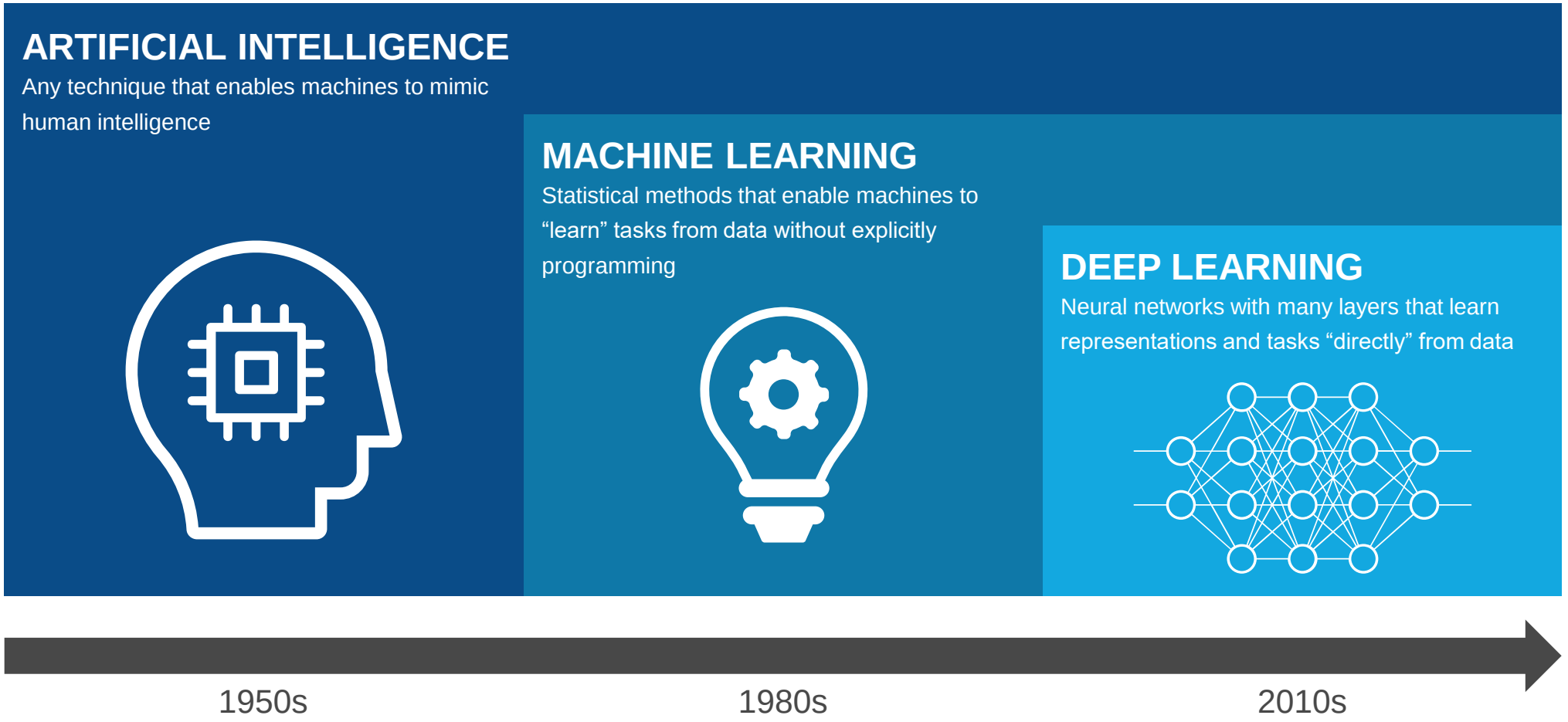

amazon


Luke Skywalker
94.5%


도시로의 접근
ACCESS TO CITY



AI megatrend



MathWorks is your AI partner

Your People

Helping you build an agile workforce today and preparing tomorrow's engineers

The Platform

MATLAB, Simulink, and over 100 add-on products for specialized applications

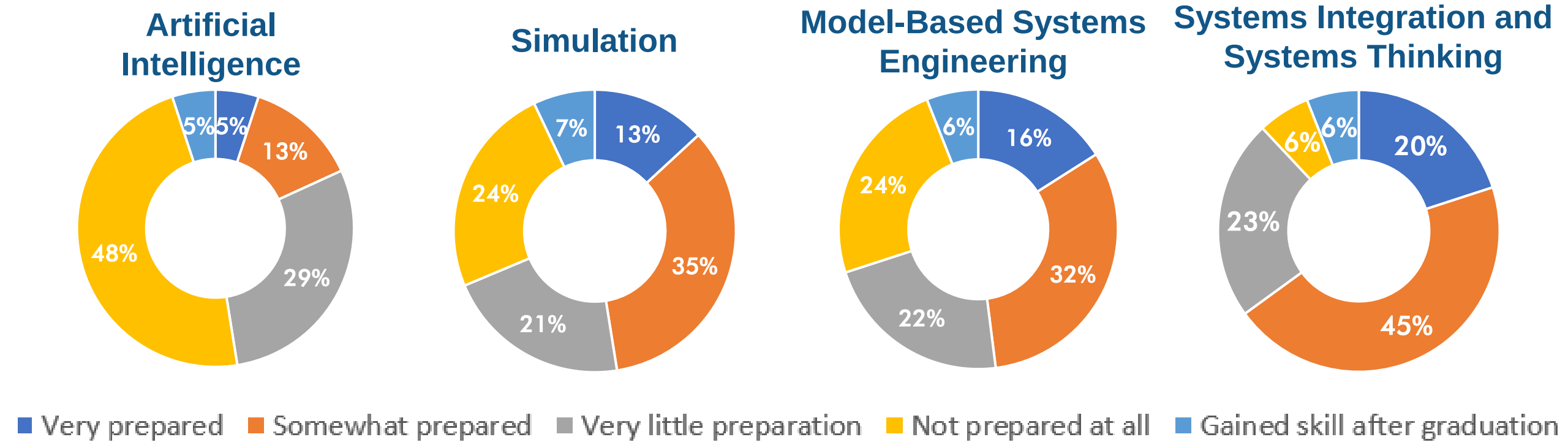
Our Expertise

From onboarding and implementation to solving advanced engineering challenges

What are the gaps between the skills of new engineers and what the industry requires?

Technical Skills – Existing gaps

According to the Survey for Skills Gaps in Recent Engineering Graduates (ASEE, 2020):



https://www.asee.org/documents/cmc/2020-SURVEY-FOR-SKILLS-GAPS-IN-RECENT-ENGINEERING-GRADUATES.pdf

Teaching AI + X

- Audio Processing
- Signal Processing
- Image Processing
- Biomedicine
- Robotics
- …

Lecture

- 1 – 2 classes
- Overview on theory
- Domain-specific applications

Pre-work

- Readings
- Self-paced courses

Assignment

- **[Problem]** Continue problem from class on MATLAB Online
- **[Guided project]** Work on examples of AI problems in the course domain

Deep Learning + Image Processing

Image denoising using deep learning

(C) Oge Marques, PhD - 2020

Goal: Build and evaluate image denoising solutions using deep learning architectures.

Learning objecti

- Learn hov
- Learn hov
- Get acqua

Table of Content

Part 1: Noise type
Effects of differ
Assess differer
Your turn (st
Part 2: Denoising
Your turn (st
Your turn (st
Part 3: Training y
Your turn (st
Part 4: (OPTIONA
Your turn (st

Part 1: Nois

Effects of diff

`imnoise()` allows

Semantic image segmentation using deep learning

(C) Oge Marques, PhD - 2020

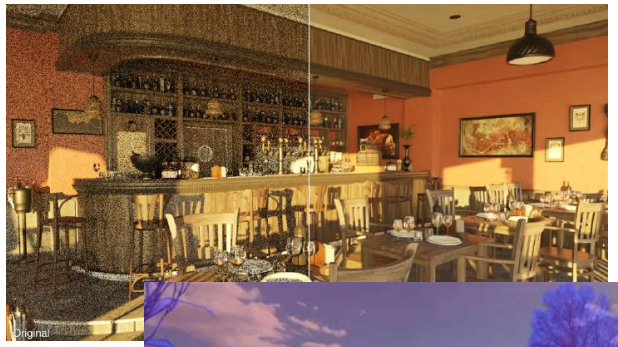
Goal: Build and evaluate semantic image segmentation solutions using deep learning architectures.

Learning objectives:

- Learn how to implement an image segmentation workflow in MATLAB
- Learn how to implement and evaluate contemporary (deep-learning-based) semantic image segmentation techniques in MATLAB
- Get acquainted with representative datasets and problems in image segmentation

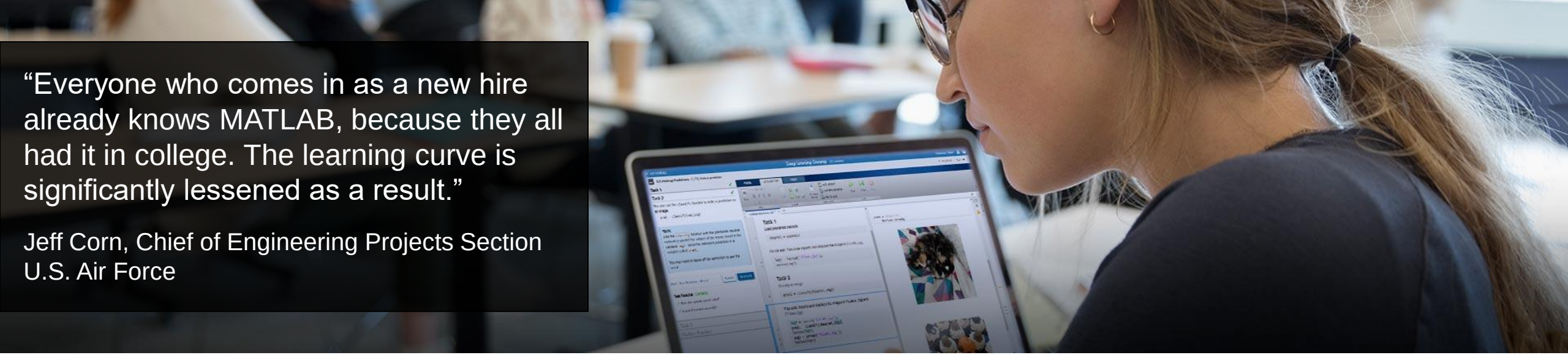
Table of Contents

Deep Learning Onramp



In collaboration with Dr. Oge Marques

https://github.com/MathWorks-Teaching-Resources/deep-learning-for-image-processing



"Everyone who comes in as a new hire already knows MATLAB, because they all had it in college. The learning curve is significantly lessened as a result."

Jeff Corn, Chief of Engineering Projects Section
U.S. Air Force

MathWorks is building the AI workforce of tomorrow

MATLAB and Simulink are the tools of inspiration and innovation used by students, educators, and researchers around the world.

6500+

colleges and universities teach with our software

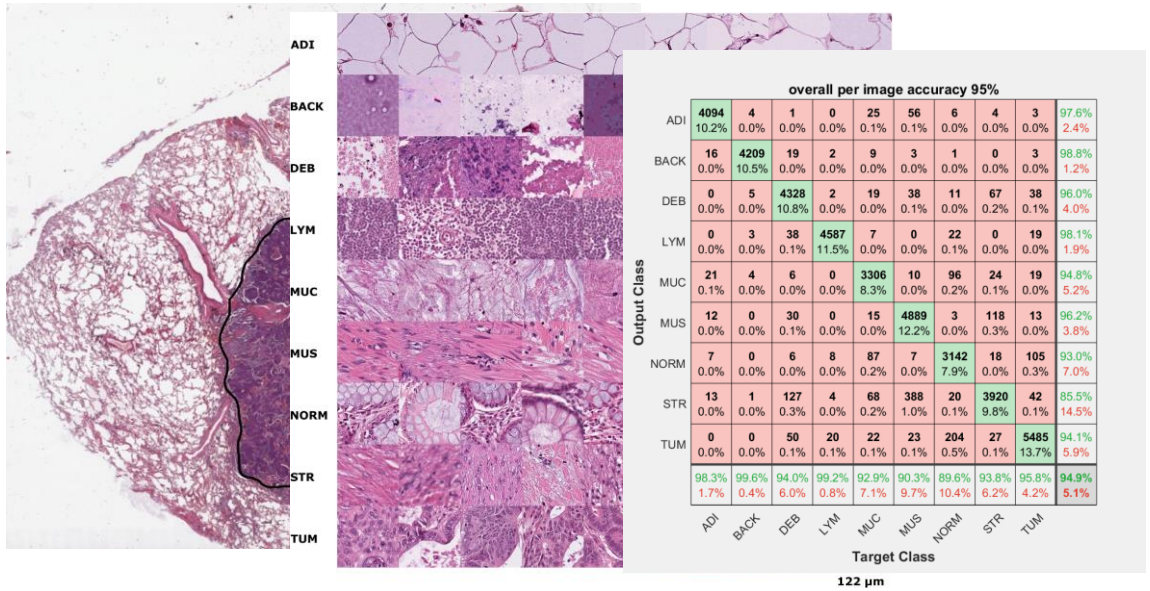
1+ million

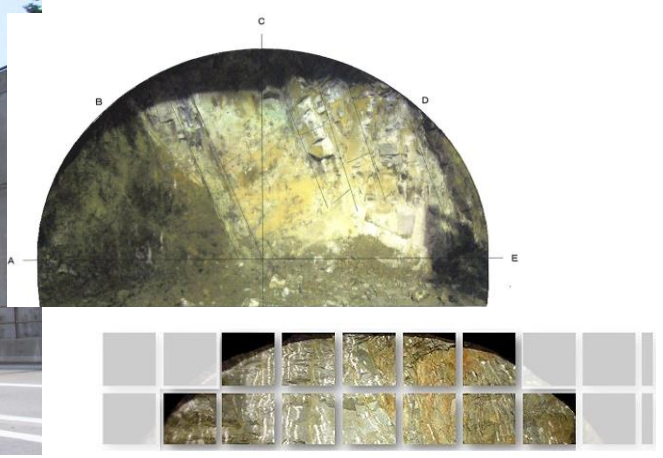
enrollments in online courses and trainings each year

Tens of Thousands

of skilled graduates enter the workforce each year

Today, we see AI applications in all fields of engineering





AI is more than just a model…

Success with AI requires more than data and training an AI model. You need high-quality data, staff with skills for AI work, and an end-to-end AI workflow. **Start with the workflow.**

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

AI is more than just a model…

1 Data Preparation

- Data cleansing and preparation
- Human insight
- Simulation-generated data

2 AI Modeling

- Model design and tuning
- Hardware accelerated training
- Interoperability

3 Simulation and Test

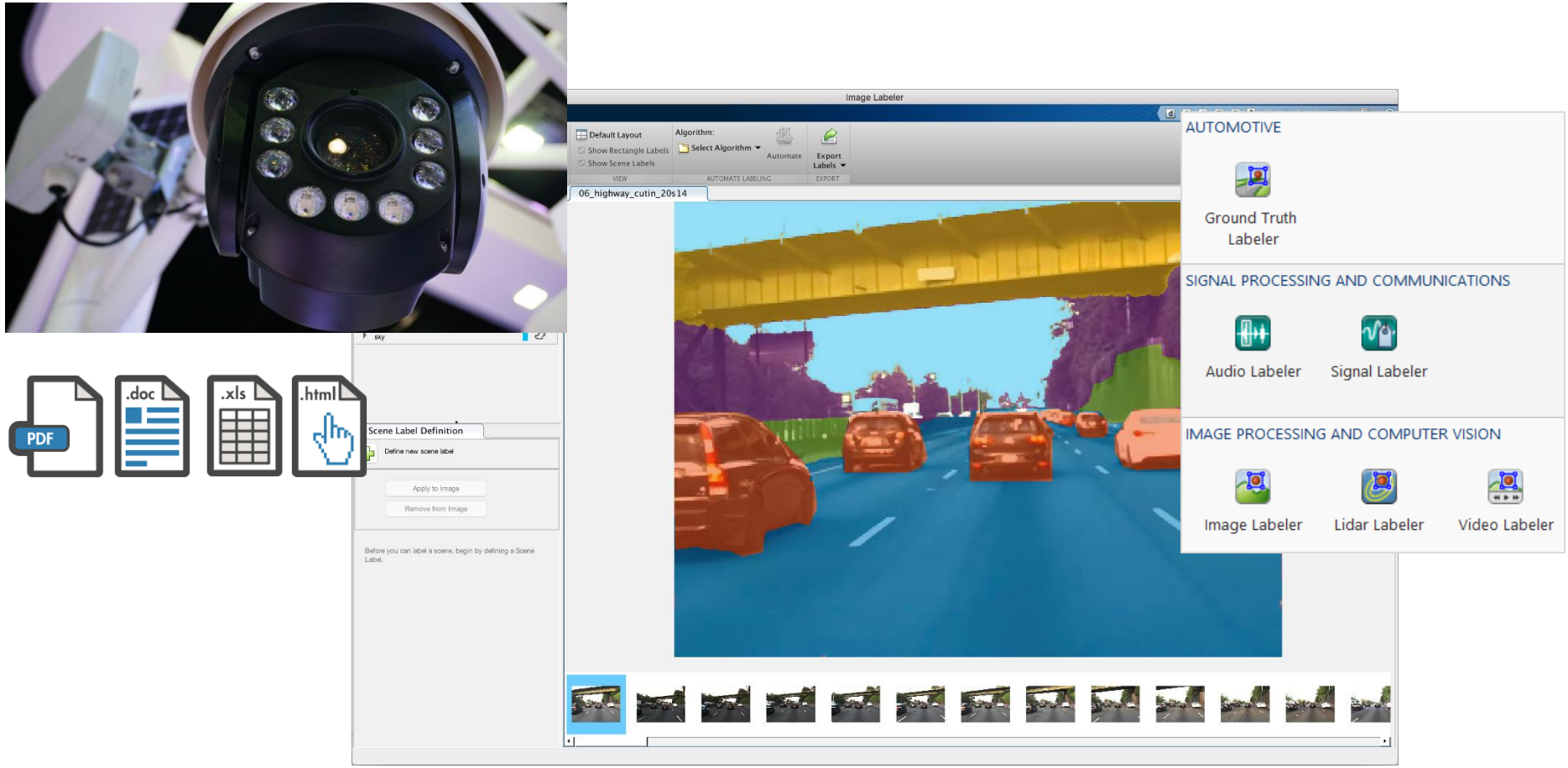
- Integration with complex systems
- System simulation
- System verification and validation

4 Deployment

- Embedded devices
- Enterprise systems
- Edge, cloud, desktop

Data preparation is crucial for the success of AI

1. Data Preparation
2. AI Modeling
3. Simulation and test
4. Deployment



Use labeling apps for deep learning workflows like semantic segmentation

Start with a complete set of algorithms, examples and apps

1. Data Preparation
2. AI Modeling
3. Simulation and test
4. Deployment

Algorithms

Machine learning
Deep learning
Reinforcement learning
Regression
Unsupervised learning
Predictive maintenance
Bayesian optimization

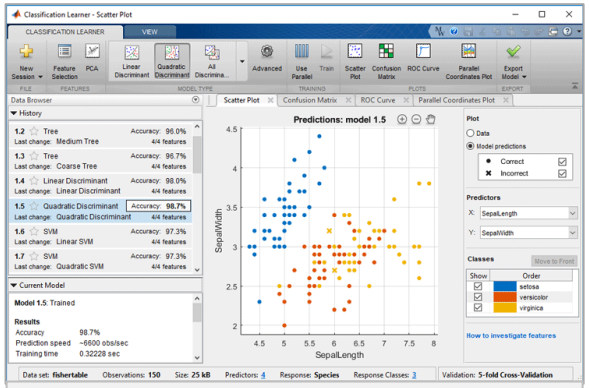
Reference examples

Object detection: Vehicles, pedestrians, faces…

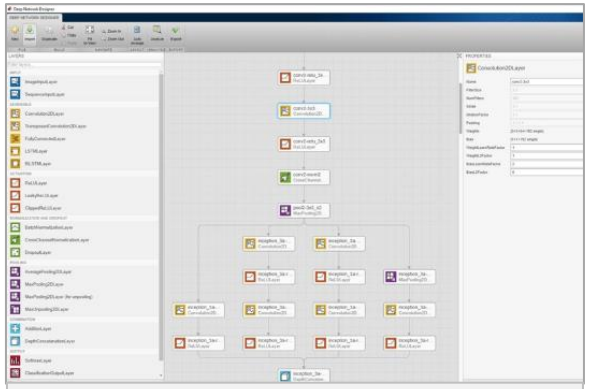
Semantic segmentation: Roadway detection, land cover classification, tumor detection…

Signal and speech processing: Denoising, music genre recognition, keyword spotting, radar waveform classification…

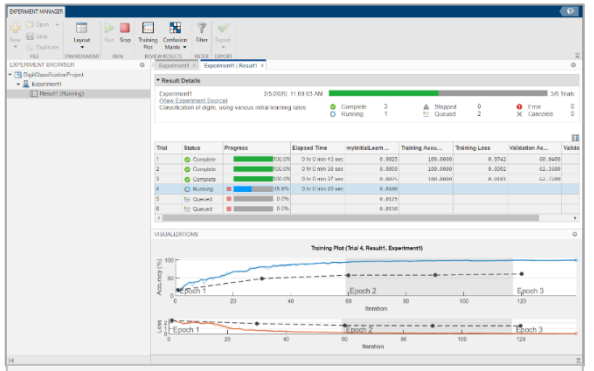
…and more…



Classification Learner app to try different classifiers and find the best fit for data sets.



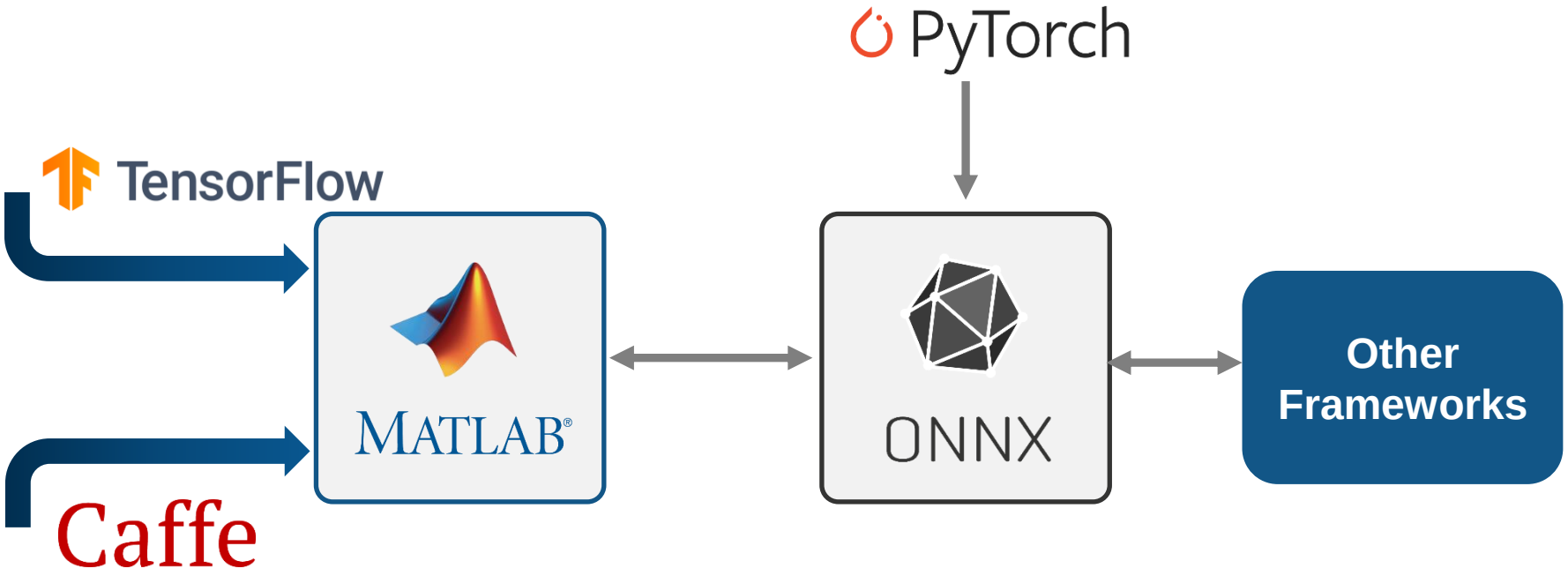
Deep Network Designer app to build, visualize, and edit deep learning networks.



Experiment Manager app to run deep learning experiments to train networks and compare results.

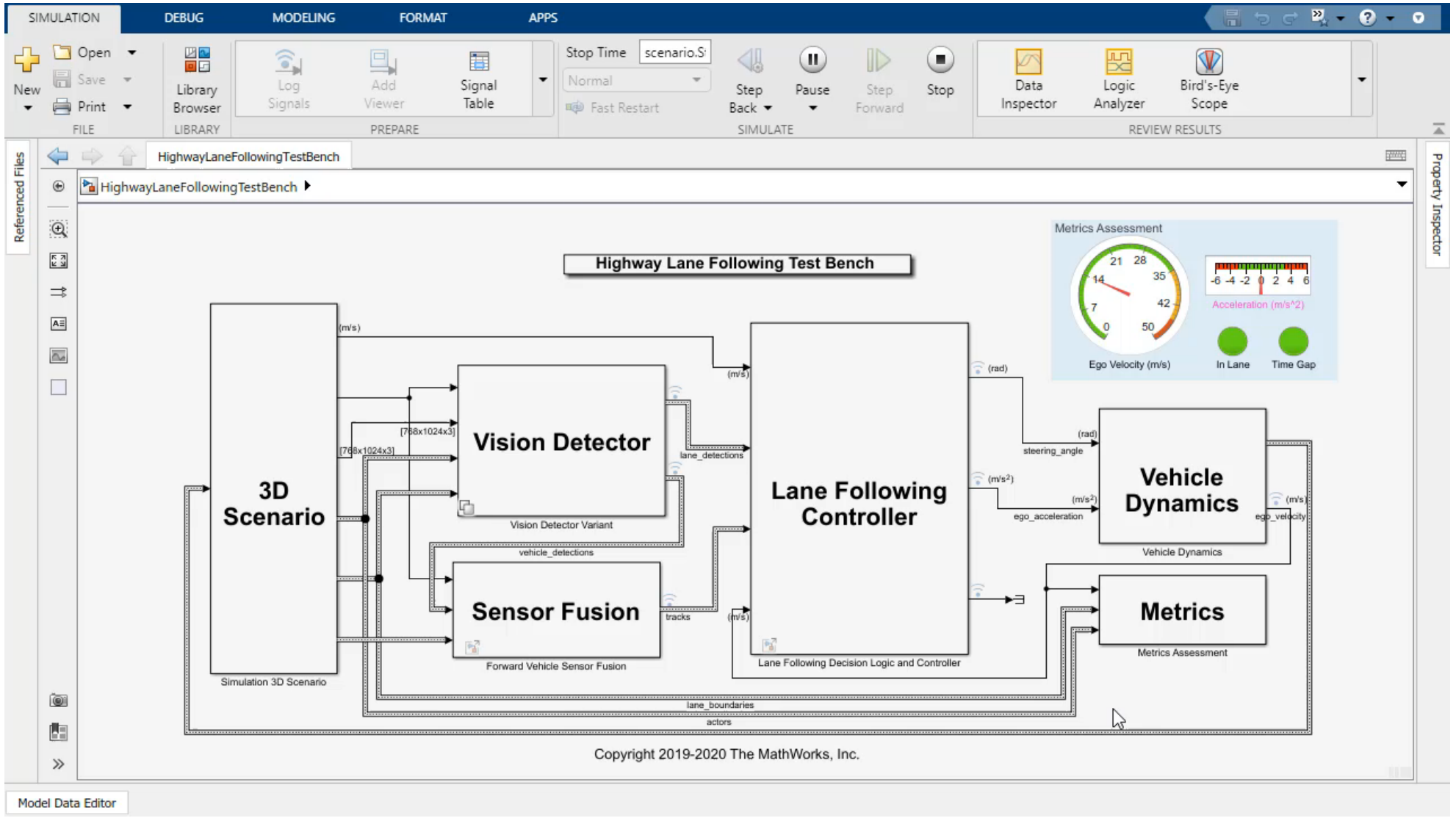
MATLAB interoperates with other AI frameworks

1. Data Preparation
2. AI Modeling
3. Simulation and test
4. Deployment



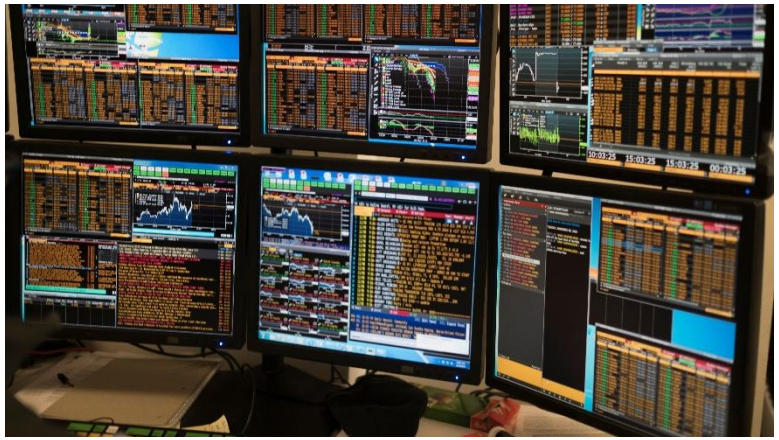
Complex, AI-driven systems require integration and simulation

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



AI Models need to be deployed anywhere…

1. Data Preparation
2. AI Modeling
3. Simulation and test
4. Deployment



Now that we covered the process, how can we familiarize our students and engineers with these concepts?

Course material

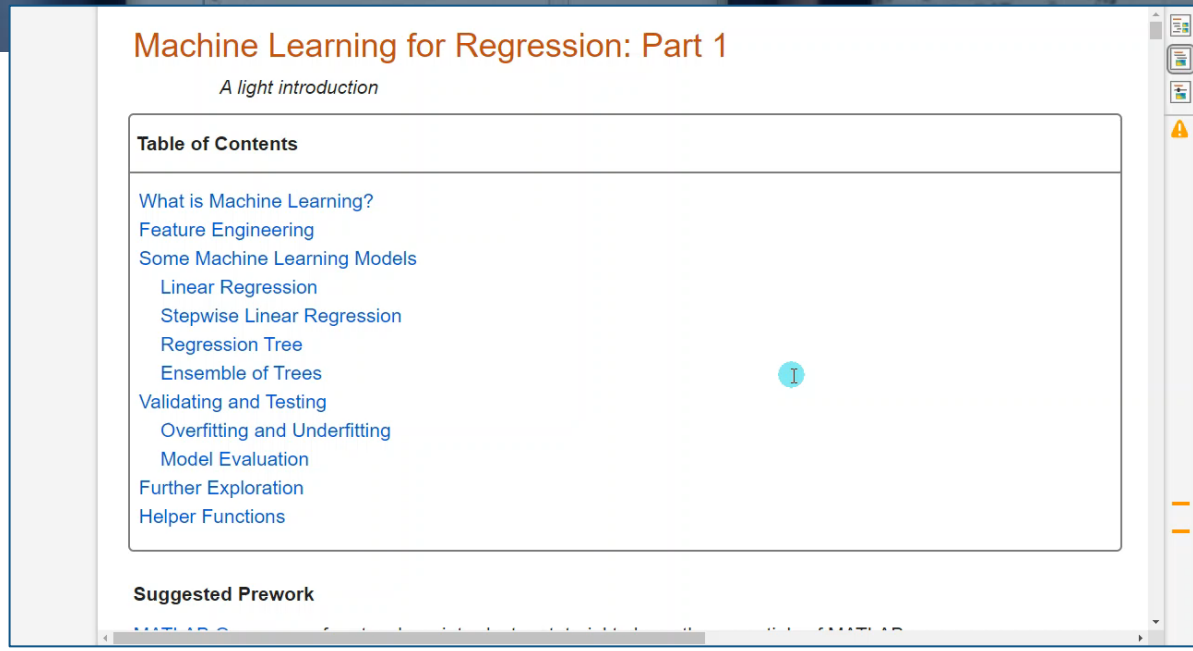
Self-paced learning

Projects

Books and Courseware in Artificial Intelligence

https://www.mathworks.com/academia/books.html

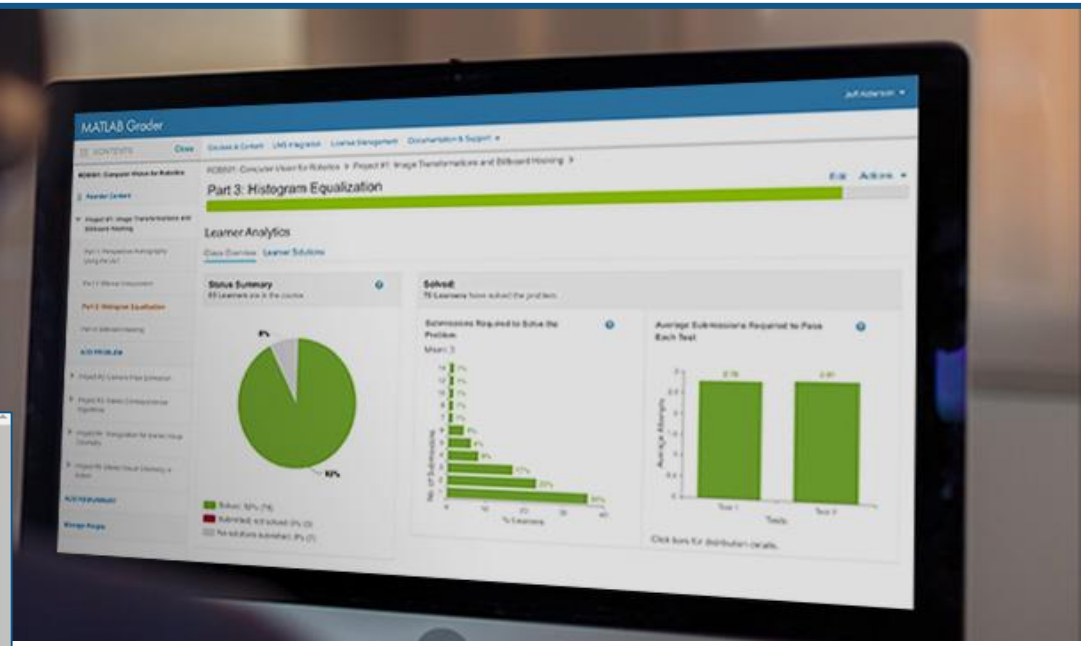
MATLAB Live Editor

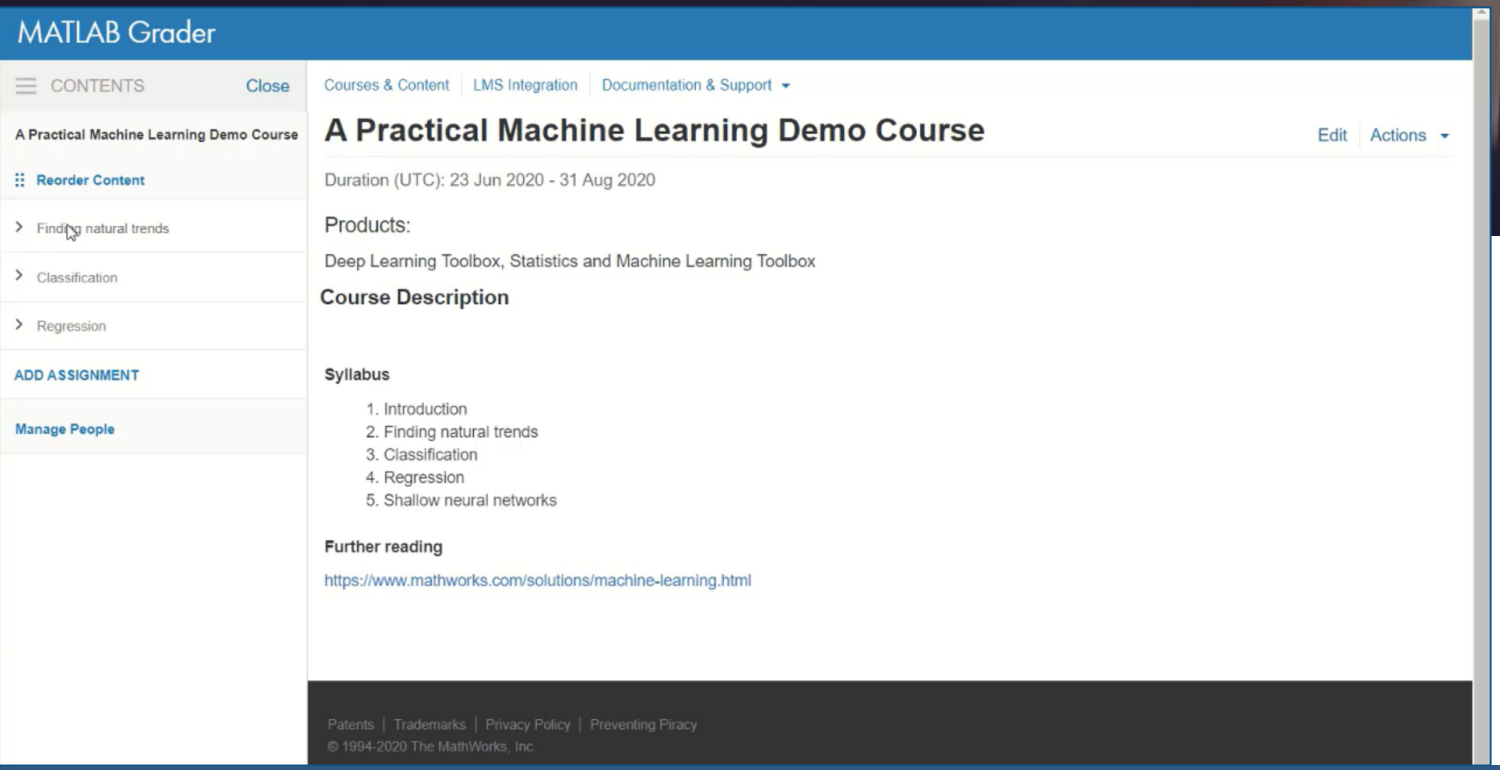


- Create **engaging lectures**
- **Share** live scripts directly with colleagues or students
- Work in a **single environment** to eliminate context switching

https://github.com/MathWorks-Teaching-Resources/Machine-Learning-for-Regression

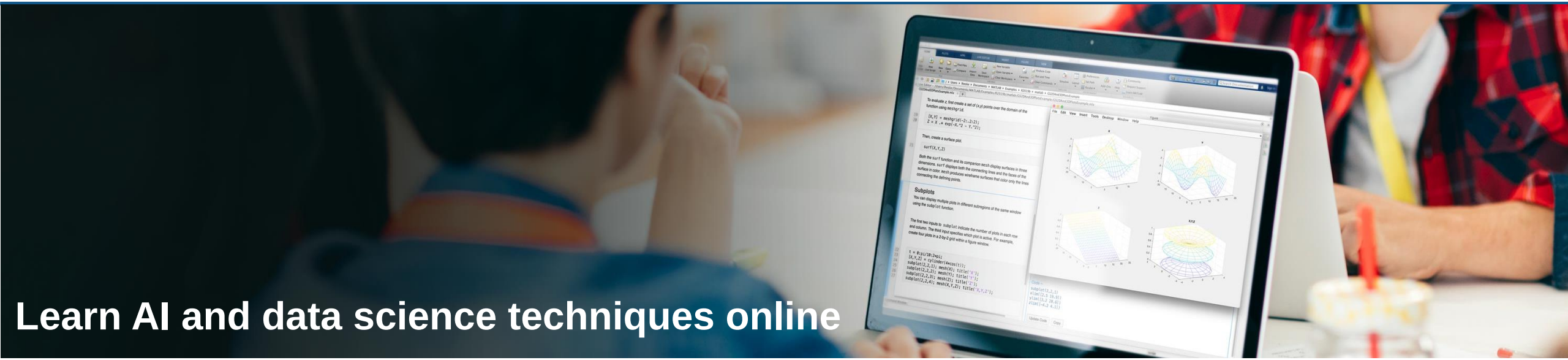
MATLAB Grader





- Create interactive course assignments
- Automatically grade student work and provide feedback
- Run your assignments in any learning environment

https://www.mathworks.com/products/matlab-grader.html

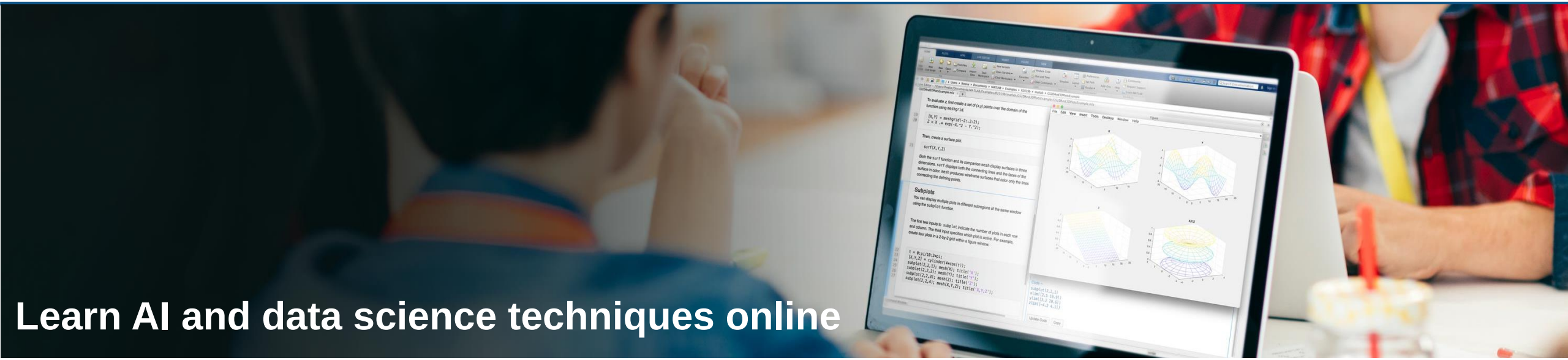


Learn AI and data science techniques online

Machine Learning Onramp

Deep Learning Onramp

Reinforcement Learning Onramp



coursera

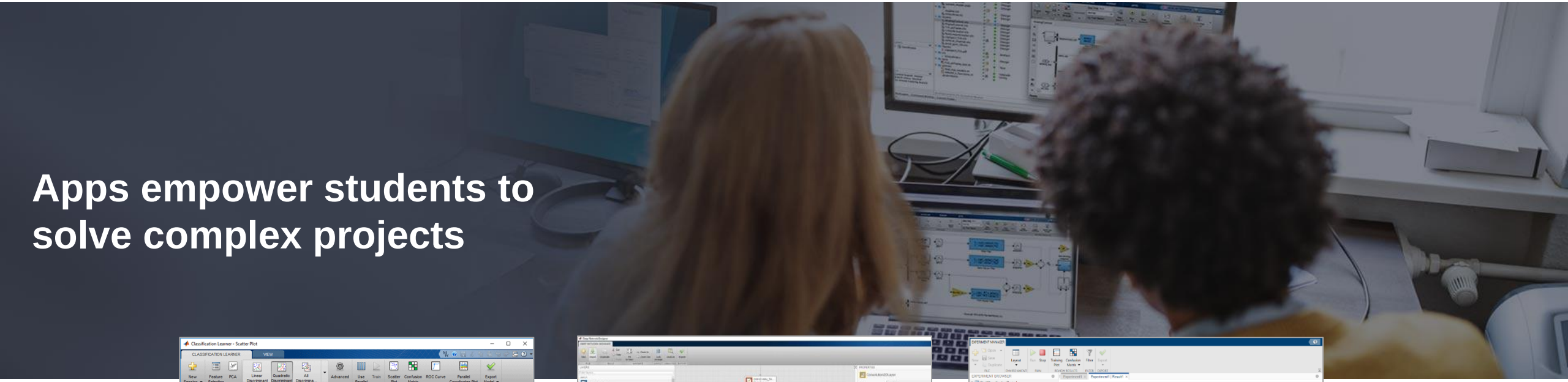
Practical Data Science with MATLAB Specialization

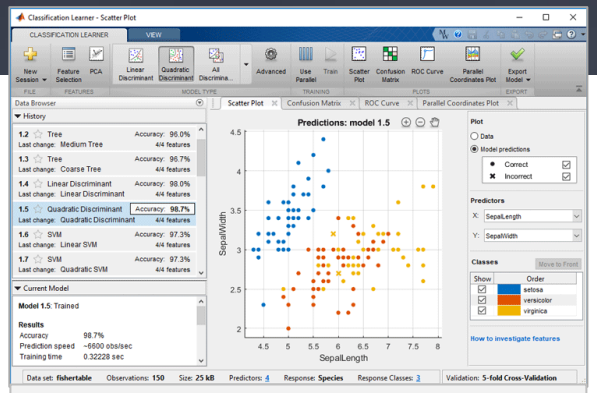
Offered By

MathWorks®

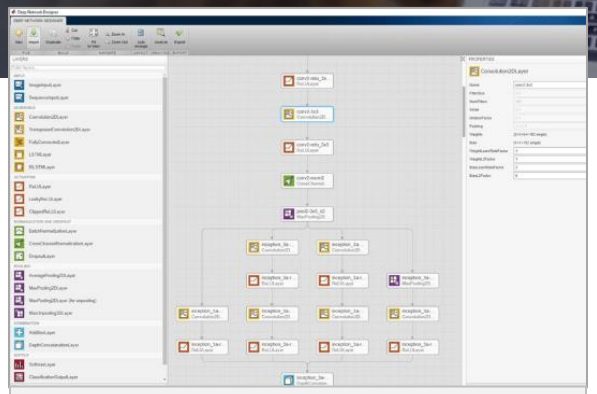
https://www.coursera.org/specializations/practical-data-science-matlab

Apps empower students to solve complex projects

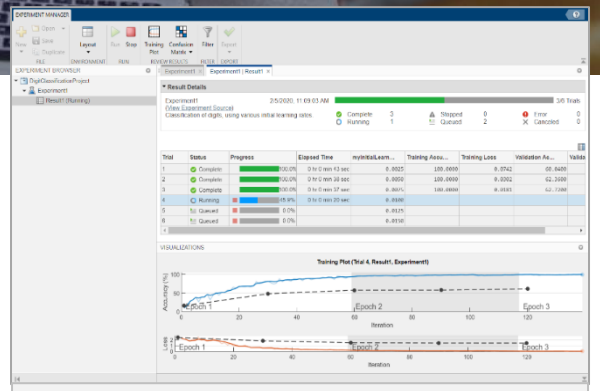




Classification Learner try different classifiers and find the best fit for data sets.



Deep Network Designer build, visualize, and edit deep learning networks.



Experiment Manager run deep learning experiments to train networks and compare results.

https://www.mathworks.com/discovery/matlab-apps.html

Build AI-enabled systems

- Treat engineering students like engineers with real projects
- Easy-to-learn syntax and block diagrams
- Increase student interest and improve learning

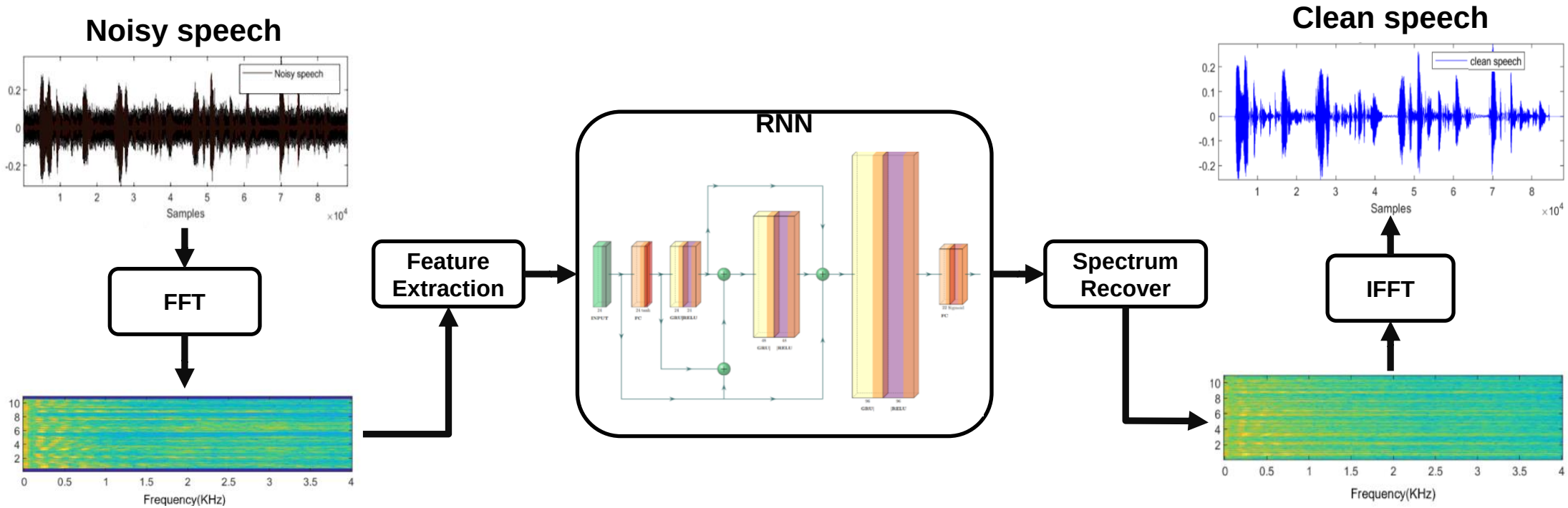
https://www.mathworks.com/hardware-support/home.html

MATHWORKS EXCELLENCE IN INNOVATION

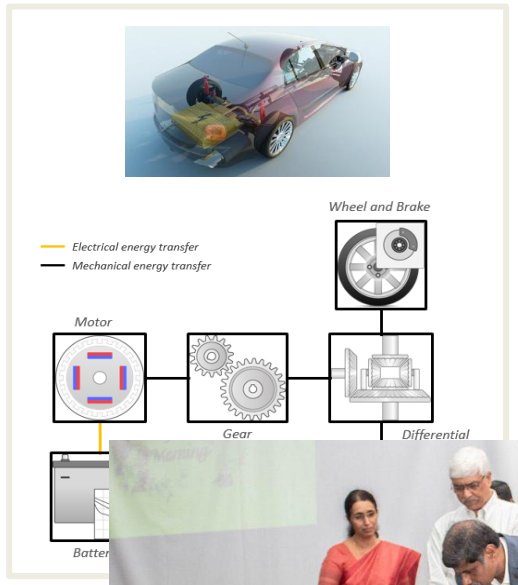
- Learn about Industry trends
- Solve a project of real industry relevance
- Contribute to the advancement of technical computing and Model-Based Design
- Gain official recognition for your problem-solving skills from technology leaders

Speech Background Noise Suppression with Deep Learning

- **Project**: Develop a deep learning neural network for audio background noise suppression
- **Student solution:** Adopt a Recurrent Neural Network following the RNNoise structure



Engineering Education, Research and Industry



Knowledge Curricula

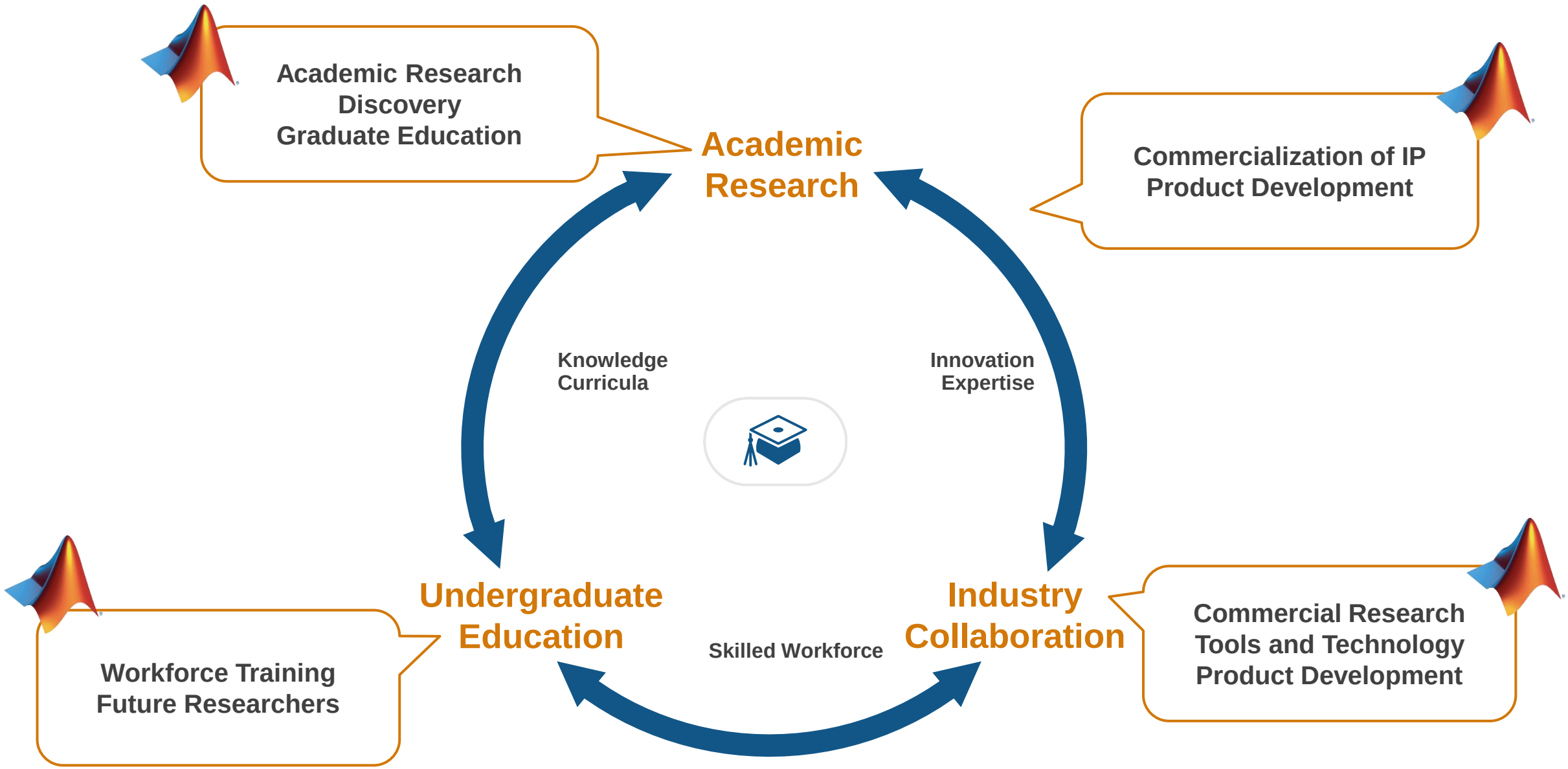
> "The EVSE course I took in my final year of BTech was a turning point in my understanding of the world of engineering."

—Hari Bhaskar, Bosch Global Software Technologies and Graduate of NIT Calicut

Skilled Workforce

BOSCH

AI in Engineering Education, Research and Industry



AI in Engineering Education, Research and Industry

Aca

Gra

Workforce Tr
Future Researchers

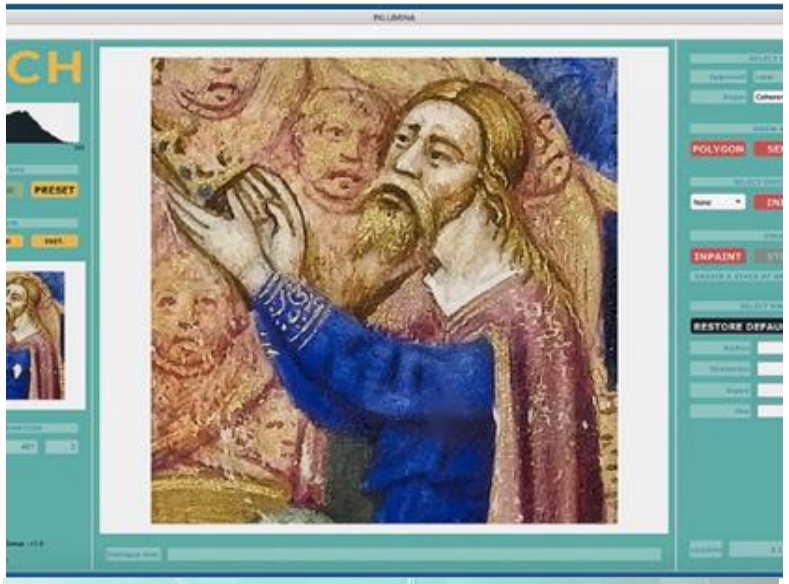
Education

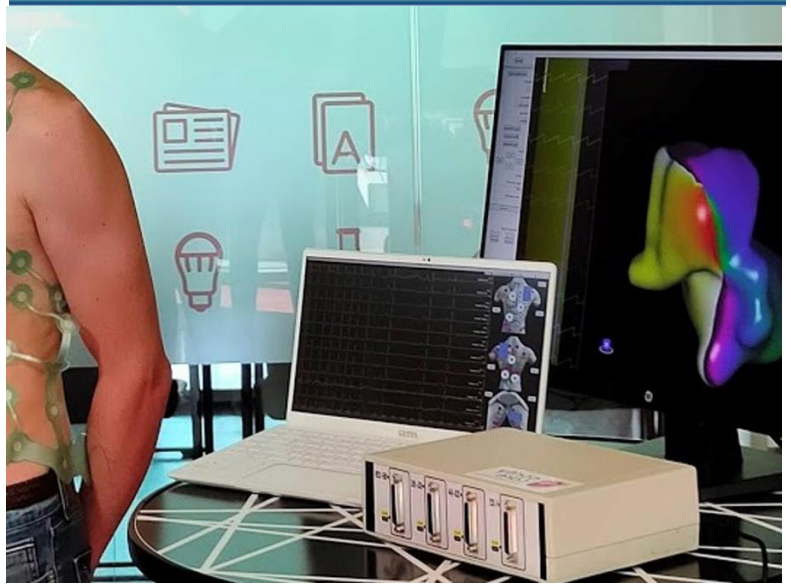
Skilled Workforce

Collaboration

Tools and Technology
Product Development

We can make a positive impact on society with AI





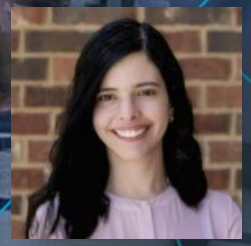
MathWorks
@MathWorks

Share the EXPO experience
#MATLABEXPO

Next Steps

1. Explore our website: mathworks.com
2. Explore Education Resources available
3. Interact with the community via MATLAB Central

Let's stay in touch!



Gaby Arellano Bello

gabyarellanobello

@GabyArellanoB

Maria E. Gavilan Alfonso

mariagavilan

@MariaEGavilanA

MATLAB EXPO

Thank you