Brain-controlled Robots
New MATLAB framework makes machine learning easy and accessible for Engineers
Consider Machine Learning When

Solution is too complex for hand written rules or equations
- Speech Recognition
- Object Recognition
- Engine Health Monitoring

Because algorithms can
learn complex non-linear relationships

Solution needs to adapt with changing data
- Weather Forecasting
- Energy Load Forecasting
- Stock Market Prediction

update as more data becomes available

Solution needs to scale
- IoT Analytics
- Taxi Availability
- Airline Flight Delays

learn efficiently from very large data sets
What is Machine Learning?

Machine learning algorithms use computational methods to "learn" information directly from data without assuming a predetermined equation as a model.
Challenges

Domain Expertise

Access Data

Extract Features

Develop Models

Data Science

Share Models

Software Engineering

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Challenges from our Customers

Goal: Develop a predictive maintenance system to reduce pump equipment costs and downtime.

- Convert unreadable data into a usable format.
- Automate filtering, spectral analysis, and transform steps for multiple trucks and regions.

Goal: Develop a prototype quickly, relying on functions that have been deployed across ASML's large, diverse user base and maintained by dedicated professionals.

- Lack of experience with neural networks or machine learning.
New MATLAB framework makes machine learning easy and accessible for Engineers
MATLAB makes Machine Learning Easy and Accessible...

... with industry proven solutions

... enabling non-experts

... from idea to product

Access Data | Extract Features | Develop Models | Integrate

Big Data | Visuals | APPs | Enterprise
Using Machine Learning
to build and deploy a predictive maintenance system

Pump logs
of temperature, pressure
& other data

Predictive Model
deployed to drill site

Analytics and
Machine Learning
plus signal processing,
neural networks & more

1TB

Maintenance
Needed
Catchup of moving object
Our Customers Achievements

“MATLAB gave us the ability to convert previously unreadable data into a usable format; automate filtering, spectral analysis, and transform steps for multiple trucks and regions; and ultimately, apply machine learning techniques in real time to predict the ideal time to perform maintenance.”

Gulshan Singh
Baker Hughes

“As a process engineer I had no experience with neural networks or machine learning. I worked through the MATLAB examples to find the best machine learning functions for generating virtual metrology. I couldn’t have done this in C or Python—it would’ve taken too long to find, validate, and integrate the right packages.”

Emil Schmitt-Weaver
ASML
Summary of Results

• **Savings** of more than $10 million projected
• Development **time reduced** tenfold
• Multiple types of data **easily accessed**

• Industry **leadership** established
• Potential manufacturing **improvements** identified
• Maintenance overhead **minimized**
Artificial Intelligence, Machine Learning and Deep Learning

Timeline

1950s
1980s
Today

Artificial Intelligence
- Reasoning
- Perception
- Knowledge Representation
- Machine Translation
- Computer Board Games
- Interactive Programs
- Expert Systems

Machine Learning
- Weather Forecasting
- Spam Detection
- Sentiment Analysis
- Recommender Systems
- Fraud Detection
- Bioinformatics
- Medical Diagnosis
- Algorithmic Trading
- Health Monitoring
- Sentiment Analysis

Deep Learning
- Automated Driving
- Object Recognition
- Robotics
- Speech Recognition

Application Breadth

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What is Deep Learning?

Deep learning is a type of **machine learning** that learns tasks *directly* from data.
Why is Deep Learning So Popular Now?

Source: ILSVRC Top-5 Error on ImageNet
Deep Learning Enablers

Acceleration with GPUs

Massive sets of labeled data

Availability of state of the art models from experts
MATLAB makes Deep Learning **Easy and Accessible**

- Handle large images sets
- Accelerate with GPUs
- Visualize and debug networks
- Access pre-trained models
Making Deep Learning easy to use is Changing the World
Training & Consulting

Data processing
Machine Learning
Computer Vision

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MATLAB®

Data Analytics
- Data Processing and Visualization
- Statistics
- Machine Learning
- Optimization Techniques
- Parallel Computing

Application-Specific
- Control System Design
- Signal Processing
- Communication Systems
- LTE Systems

Computational Finance
- Risk Management
- Time-Series Modelling

Signal Processing
- Using MATLAB
- Using Simulink

Image and Video Processing
- Image Processing
- Computer Vision

Application Development
- Programming Techniques
- Building Interactive Applications
- Object-Oriented Programming

Model-Based Design
- Implementing MBD Workflow
- Model Management and Architecture
- Verification and Validation

Model-Driven Design
- Rapid Prototyping and HIL-Simulation
- Embedded Systems
- FPGA Design
- Generating HDL Code
- Xilinx Zynq SoCs
- AUTOSAR

Code Generation
- Integrating C and MATLAB

Simulink
- General Simulink
- Simulink Multibody
- Simulink Drivelime
- Simulink Fluids
- Simulink Power Systems

Polyspace
- Polyspace Code Prover

https://nl.mathworks.com/services/training.html

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