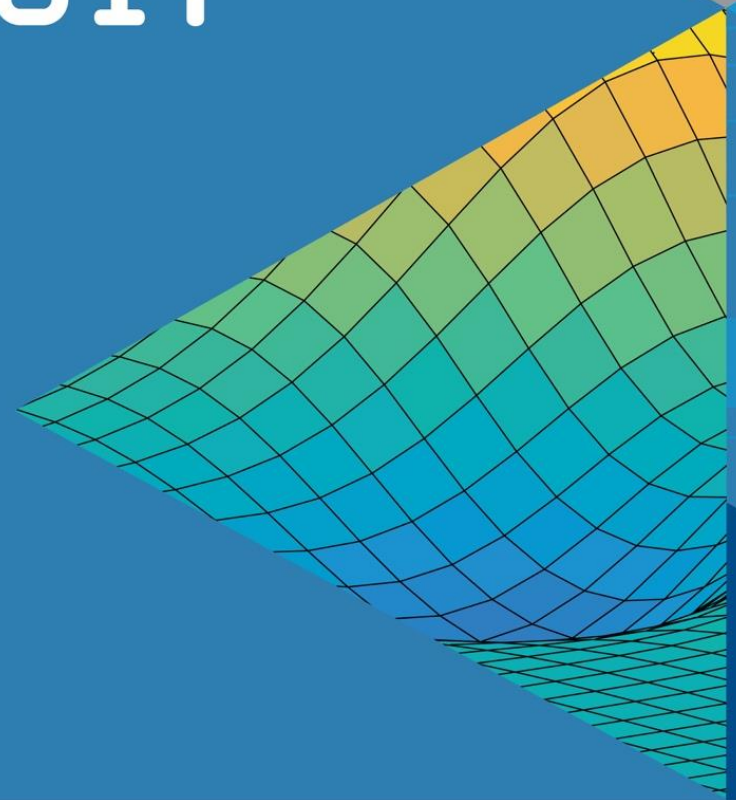
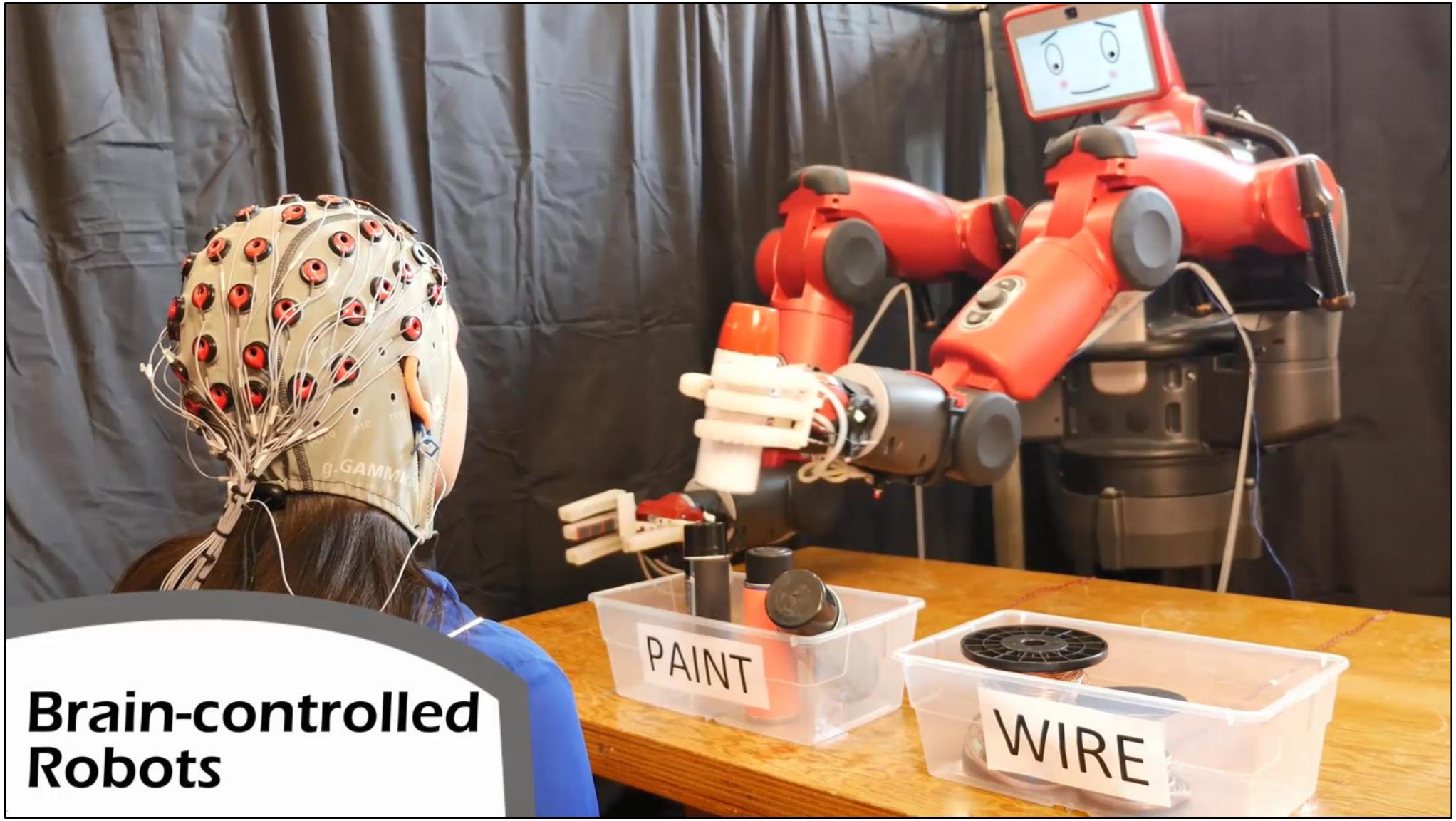
MATLAB EXPO 2017

Machine Learning Simplified



Paola Jaramillo



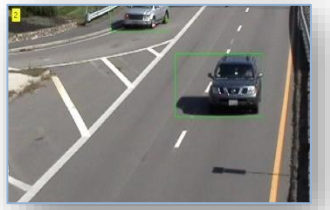
[Brain-Controlled Robots]

New MATLAB framework makes machine learning easy and accessible for Engineers

Consider Machine Learning When

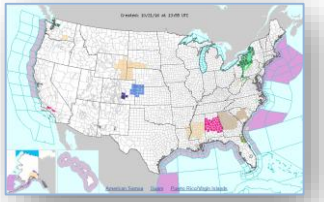
Solution is too complex for hand written rules or equations

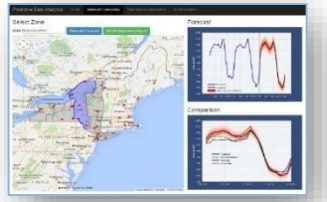
Speech Recognition


Object Recognition

Engine Health Monitoring

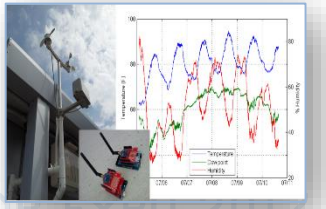
Solution needs to adapt with changing data


Weather Forecasting

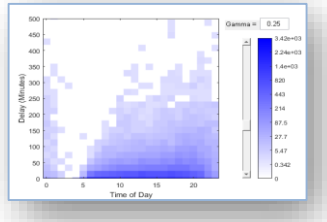

Energy Load Forecasting

Stock Market Prediction

Solution needs to scale


IoT Analytics

Taxi Availability


Airline Flight Delays

Because algorithms can

learn complex non-linear relationships

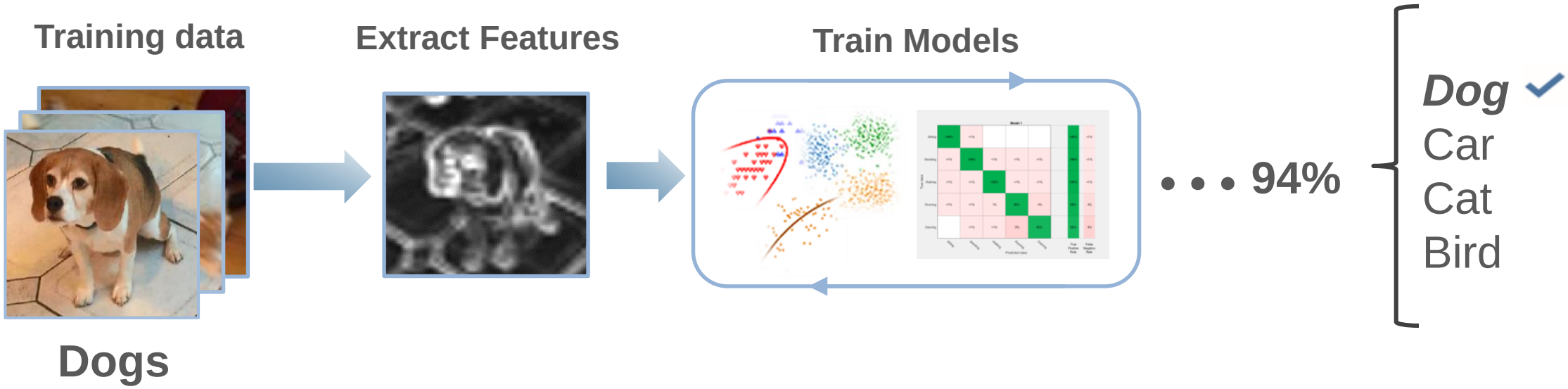
update as more data becomes available

learn efficiently from very large data sets

MATLAB EXPO 2017

What is Machine Learning?

Machine learning algorithms use computational methods to **“learn”** information *directly* from data without assuming a predetermined equation as a model

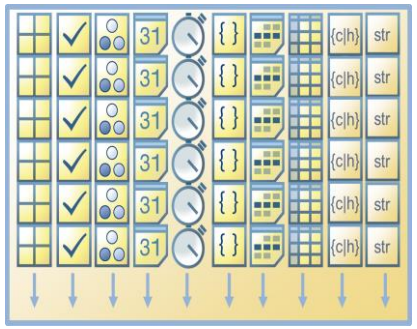


Challenges

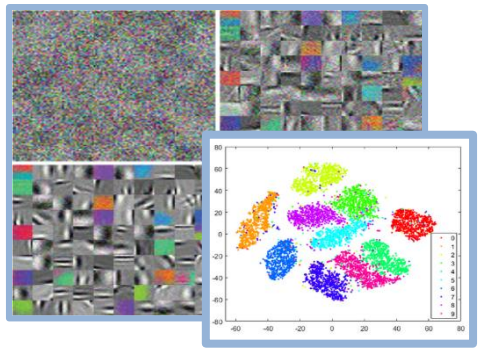
Domain-Expertise

Data-Science

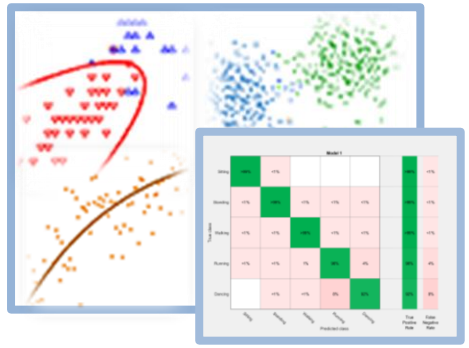
Software Engineering



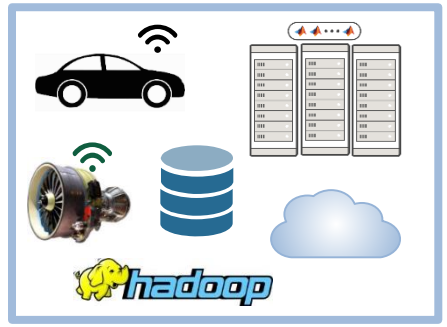
Access Data



Extract Features



Develop Models



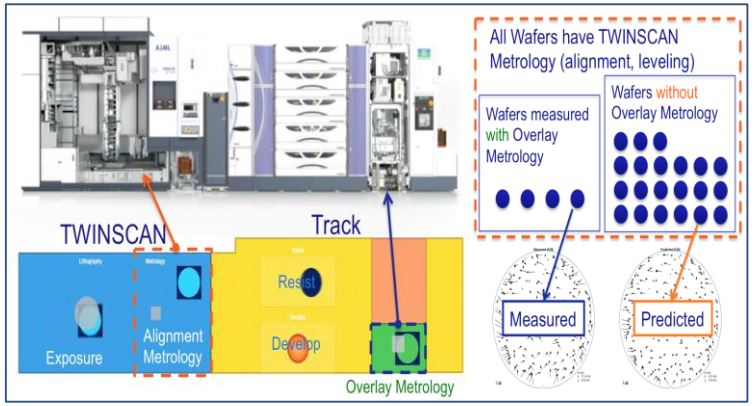
Share Models

Challenges from our Customers

BAKER HUGHES

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.



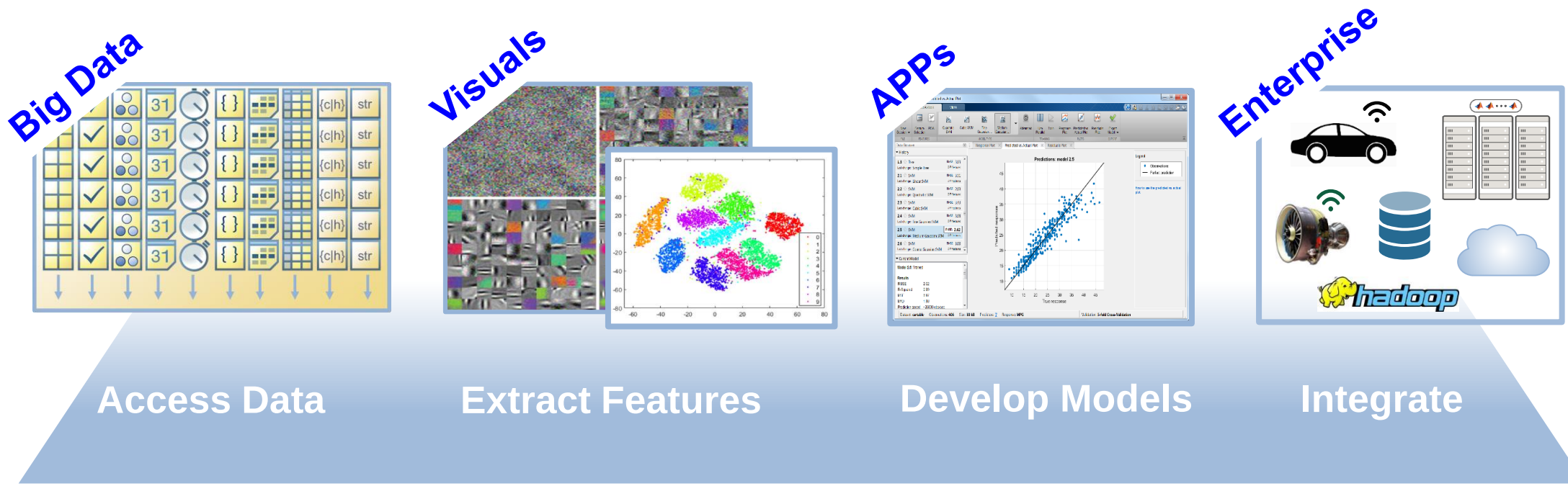
ASML

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…



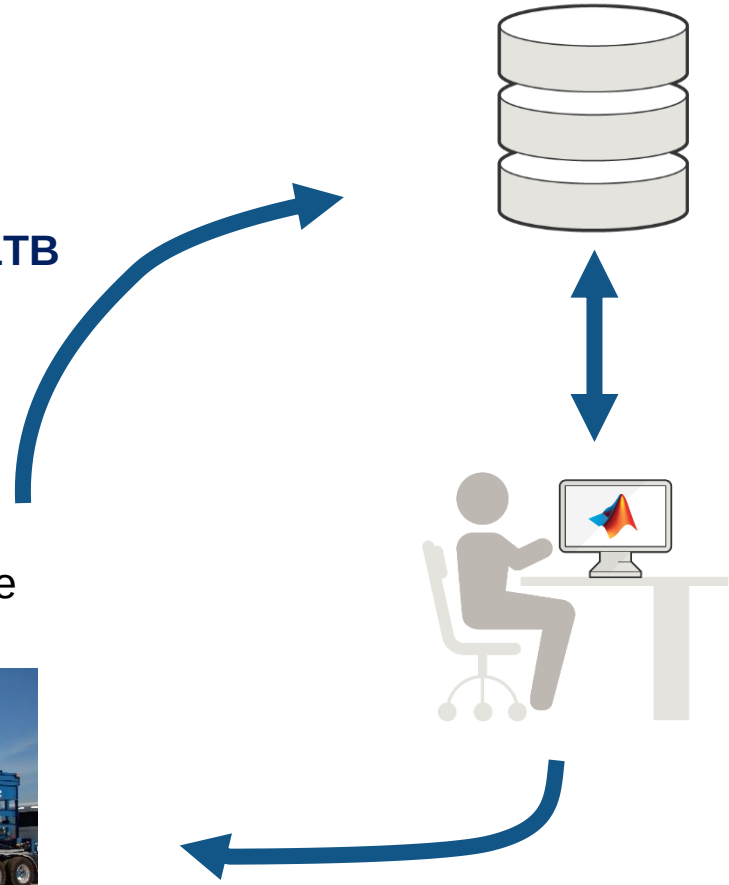
… with **industry proven** solutions

… enabling **non-experts**

… from **idea to product**

Using Machine Learning
to build and deploy a predictive maintenance system

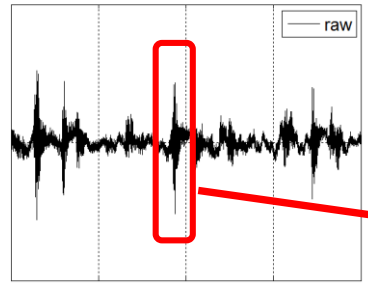
BAKER HUGHES

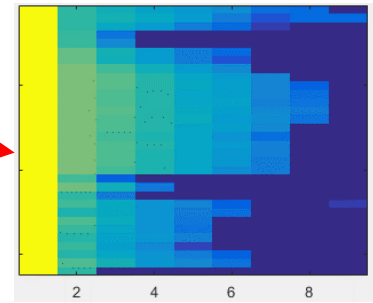


Pump logs
of temperature, pressure & other data

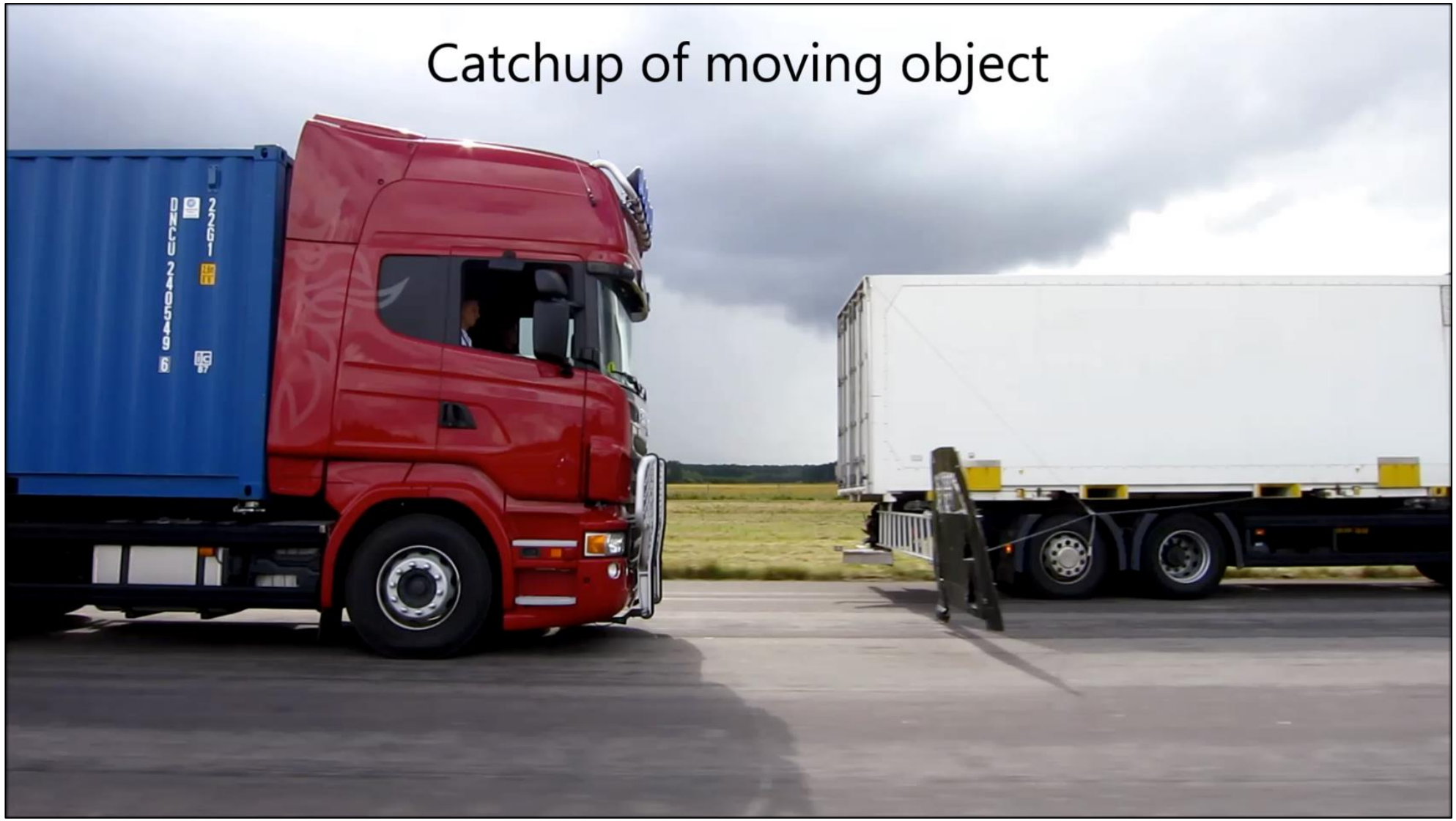
Predictive Model
deployed to drill site

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





Maintenance Needed

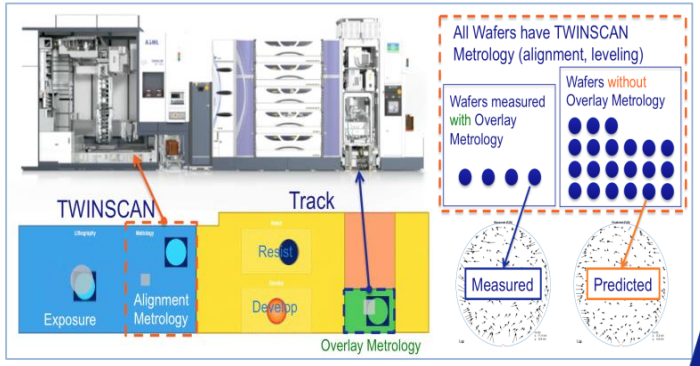


Autonomous Braking System, Scania

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



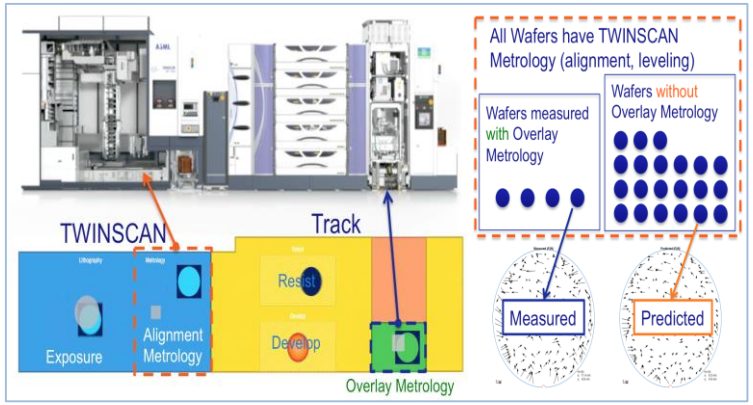
"As a process engineer I had no experience with neural networks or machine learning. I worked through the MATLAB examples to find the best machine learning functions for generating virtual metrology. **I couldn't have done this in C or Python—it would've taken too long to find, validate, and integrate**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

Emil Schmitt-Weaver
ASML

Summary of Results

BAKER HUGHES

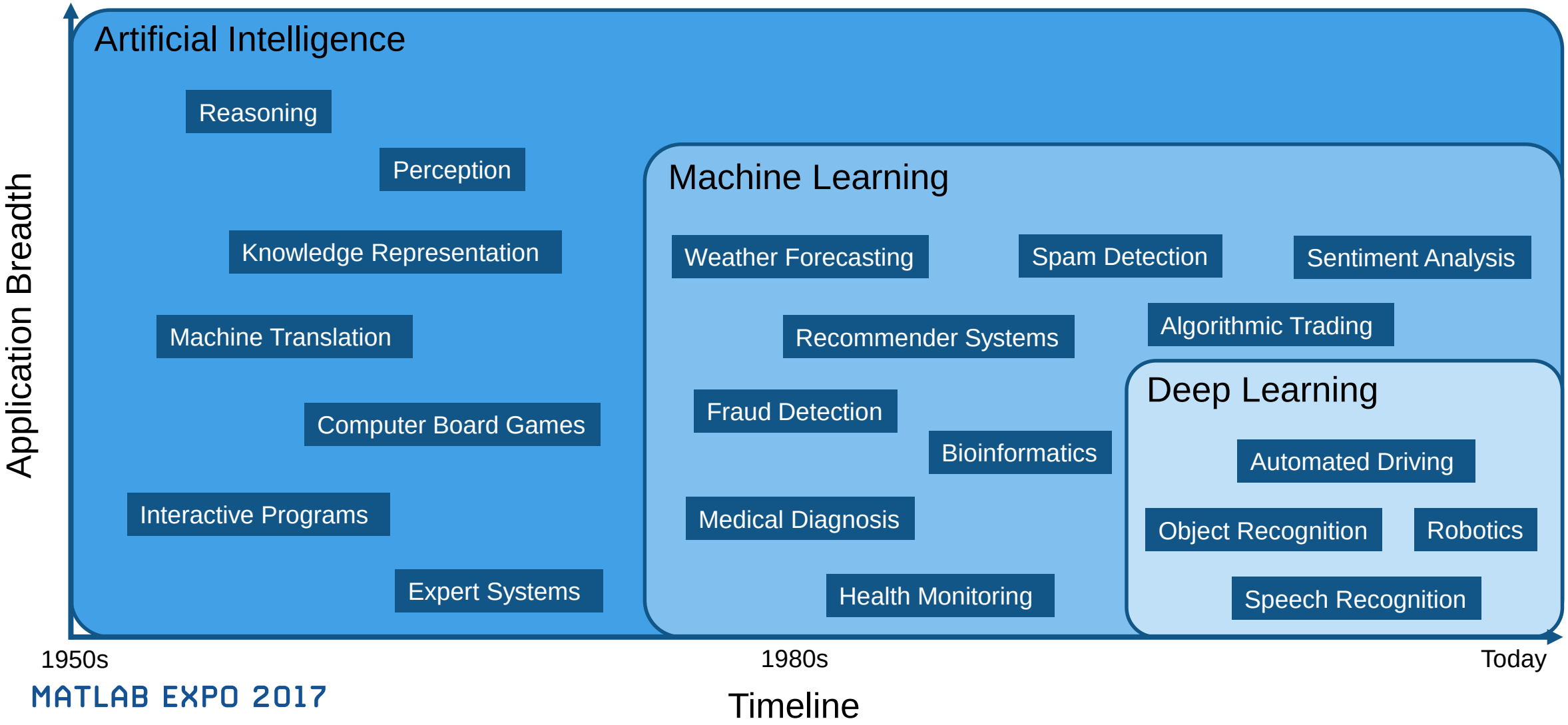
- **Savings** of more than $10 million projected
- Development **time reduced** tenfold
- Multiple types of data **easily accessed**



ASML

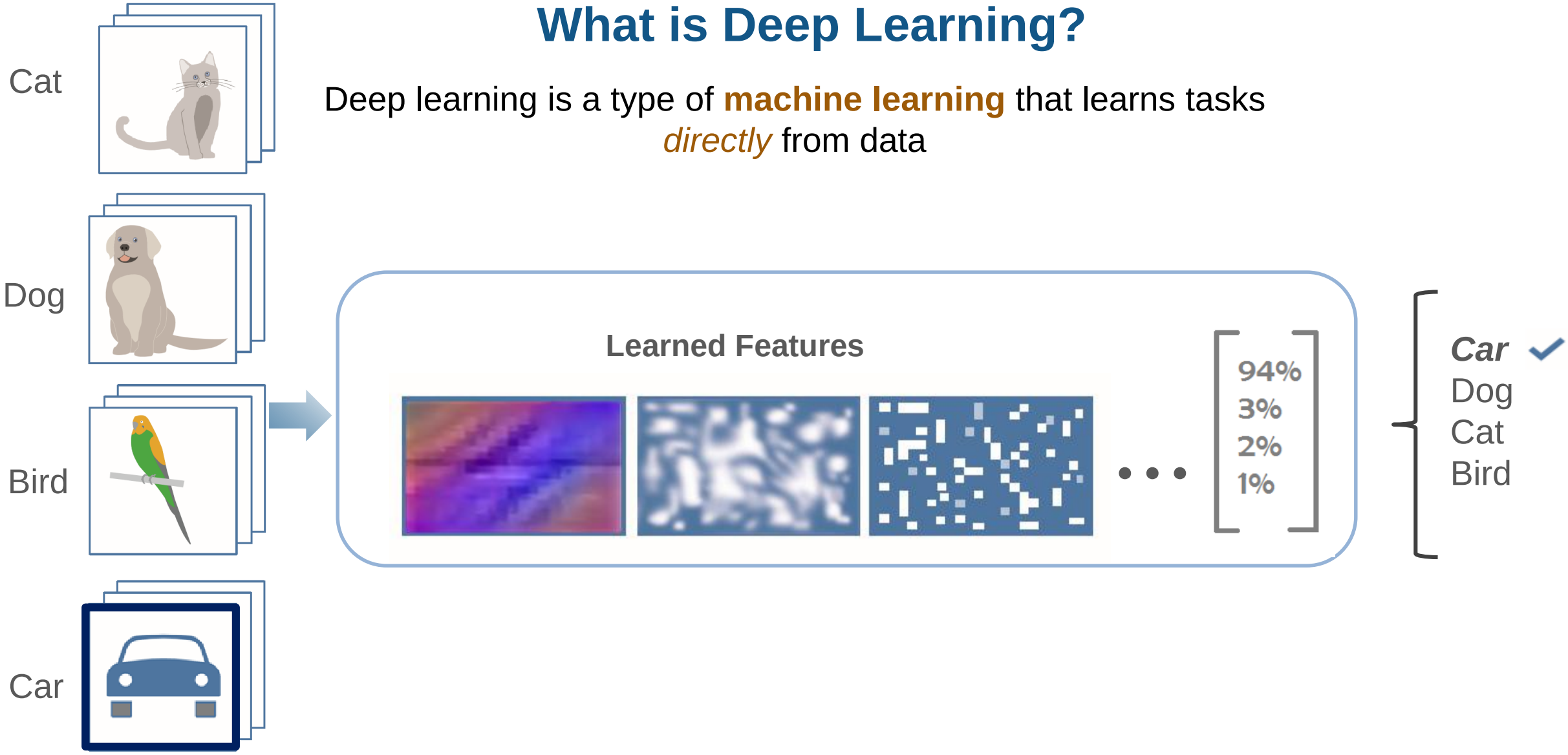
- Industry **leadership** established
- Potential manufacturing **improvements** identified
- Maintenance overhead **minimized**

Artificial Intelligence, Machine Learning and Deep Learning

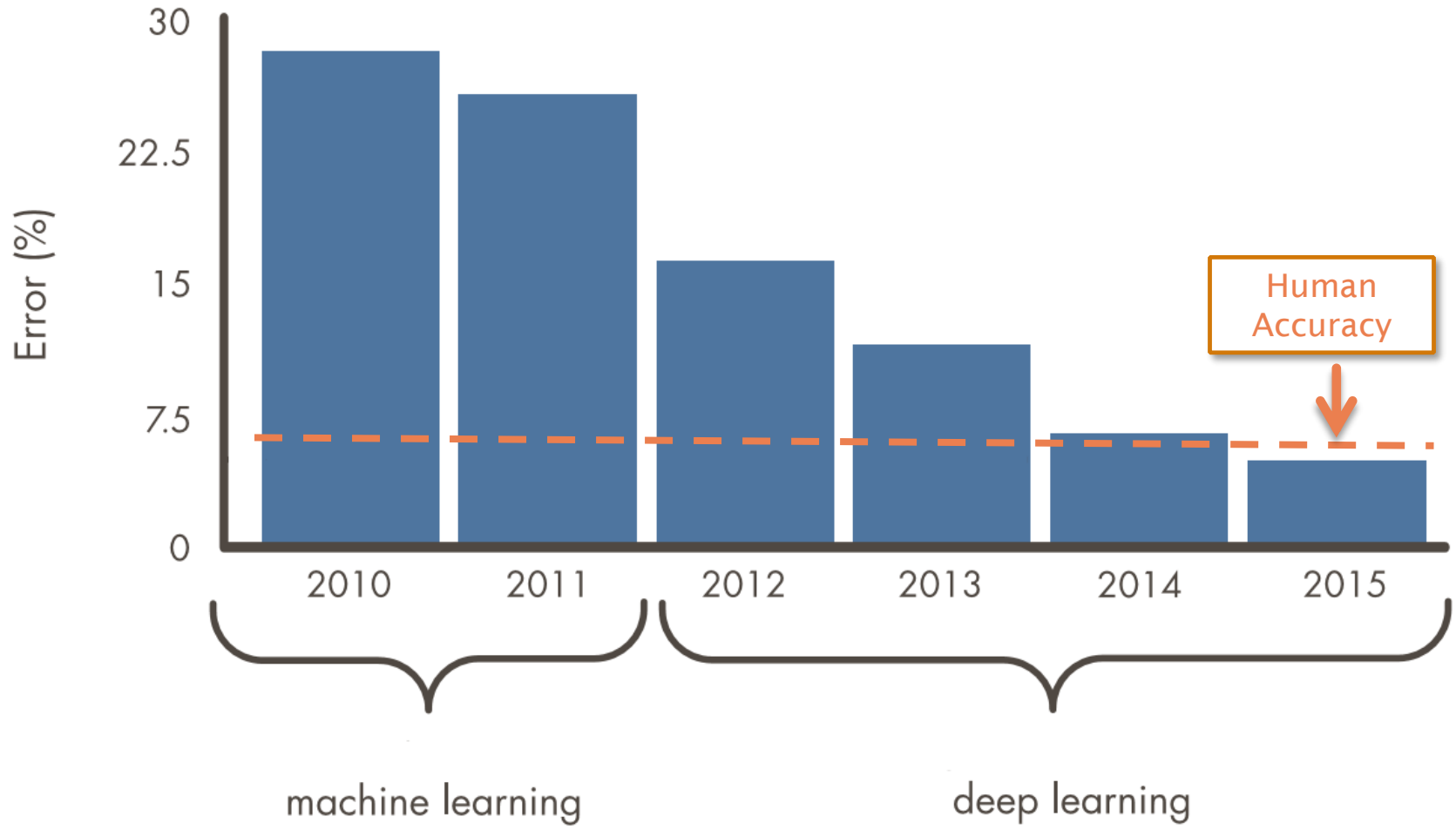


What is Deep Learning?

Deep learning is a type of **machine learning** that learns tasks *directly* from data



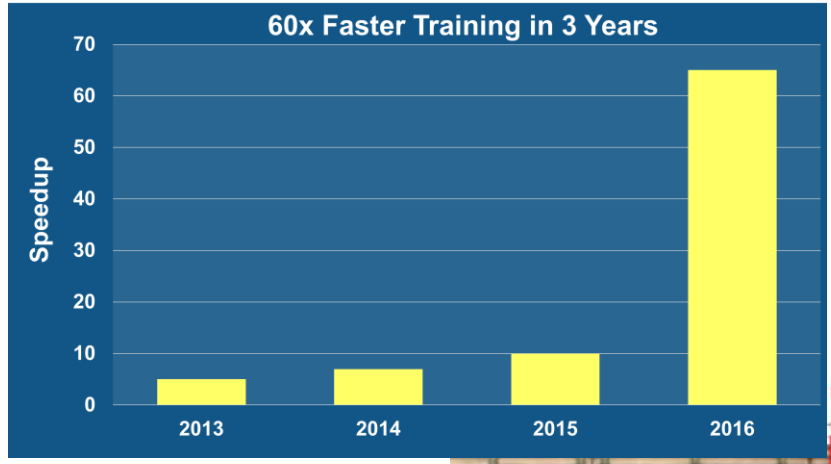
Why is Deep Learning So Popular Now?



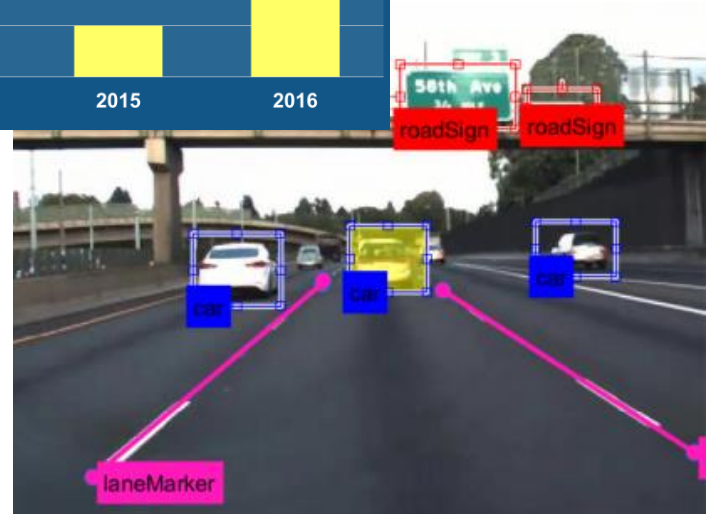
Source: ILSVRC Top-5 Error on ImageNet

Deep Learning Enablers

Acceleration with GPUs



Massive sets of labeled data



Availability of state of the art models from experts

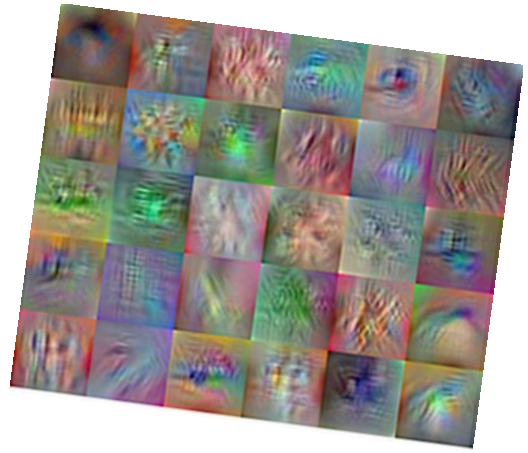
AlexNet
PRETRAINED MODEL

VGG-16
PRETRAINED MODEL

Caffe
MODELS

MATLAB makes Deep Learning Easy and Accessible

- Handle large images sets
- Accelerate with GPUs
- Visualize and debug networks
- Access pre-trained models



AlexNet
PRETRAINED MODEL

VGG-16
PRETRAINED MODEL

Caffe
MODELS

Making Deep Learning easy to use is Changing the World

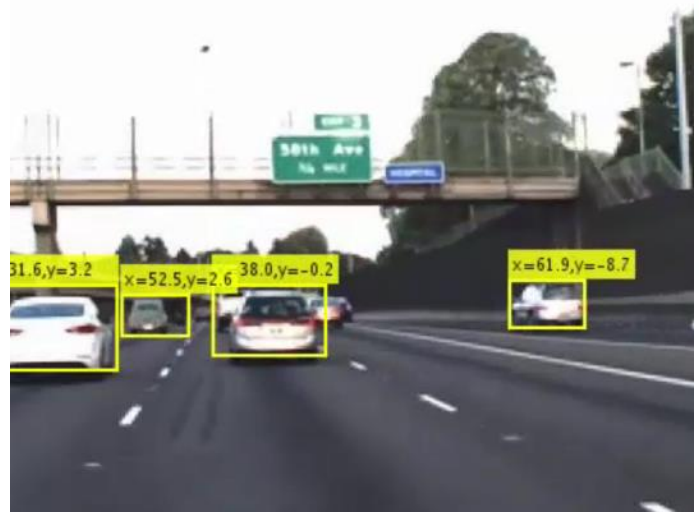
```
ple\CameraAndNetwork.m
clear

camera = webcam; % Connect to the camera
nnet = alexnet;  % Load the neural net

while true
    picture = camera.snapshot;                % Take a picture
    picture = imresize(picture,[227,227]);    % Resize the picture

    label = classify(nnet, picture);          % Classify the pictur

    image(picture);       % Show the picture
    title(char(label)); % Show the label
    drawnow;
end
```



Train a Deep Learning Vehicle Detector

Train a vision-based vehicle detector using deep learning.

Training & Consulting

Data processing

Machine Learning

Computer Vision

MATLAB®

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

Application Development
Programming Techniques
Building Interactive Applications
Object-Oriented Programming

Code Generation
MATLAB Coder
Interfacing with C-code

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

SIMULINK®

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

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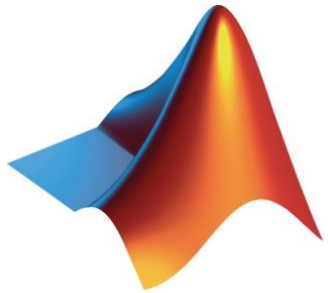
Rapid Prototyping and HIL-Simulation
Embedded Systems
FPGA Design
Generating HDL Code
Xilinx Zynq SoCs
AUTOSAR

Code Integration
Integrating C and MATLAB

Polyspace©
Polyspace Code Prover™

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



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