

AI, Machine, Deep learning and NLP

Enterprise Investment and Risk Management

Marshall Alphonso

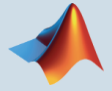
Global Lead Engineer

malphons@mathworks.com



Bloomberg

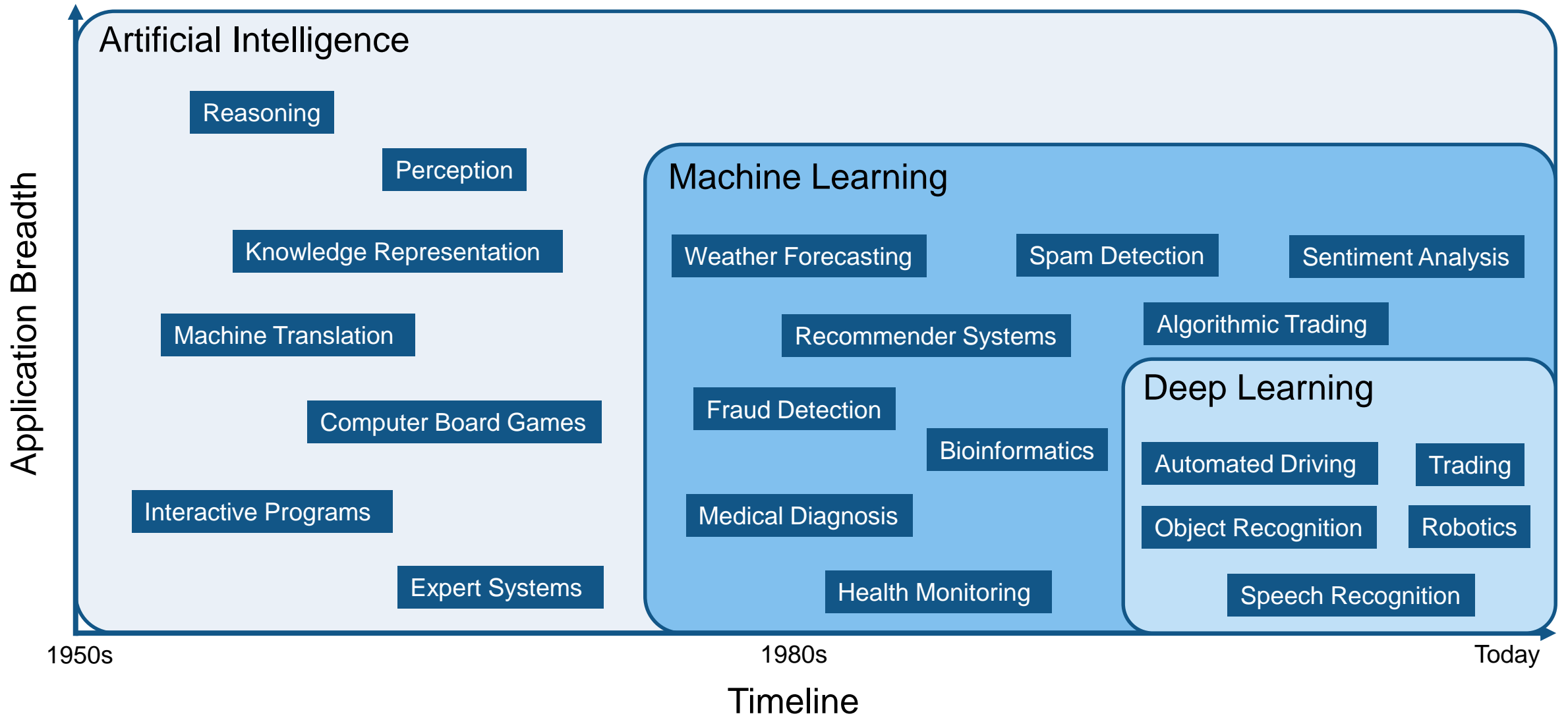
Agenda



What is AI vs. Machine Learning vs Deep? Challenges?

- **Deep Learning vs. Machine Learning**
 - **Demo:** Trading in Finance
- **General deep learning considerations**
 - **Demo:** Neural Network architectures
- **Deep learning – Diving into the details**
 - **Demo:** Classification using deep learning
 - **Demo:** Regression (Time Series modeling) using deep learning
 - **Demo:** Natural language processing
- **The Future:** Reinforcement Learning

AI, Machine Learning and Deep Learning



Deep learning challenges

Data challenges

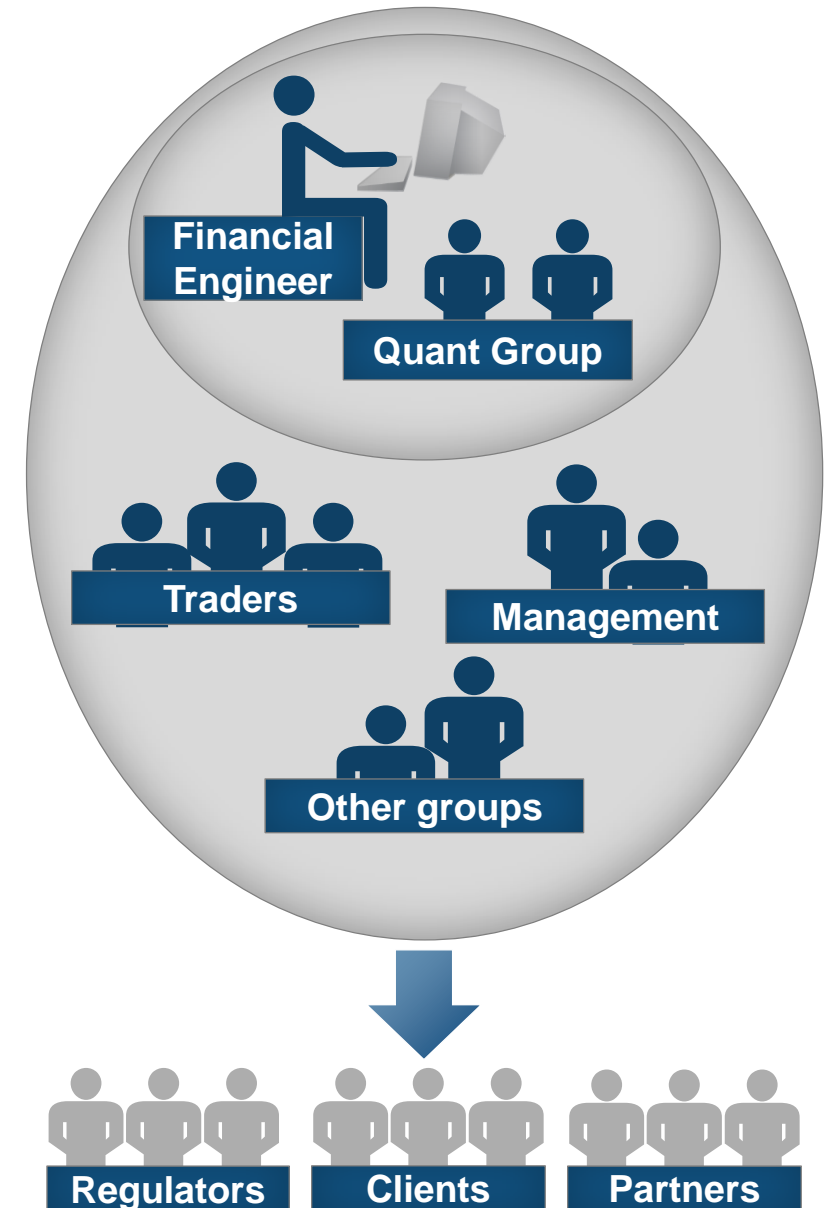
- Volume of data is growing
- Velocity of data is accelerating
- Variety of data is dynamic
- Data cleaning is time consuming

Modeling challenges

- Data driven models
- No “one size fits” all solution
- Machine learning modeling is iterative

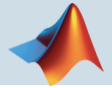
Production challenges

- Scalability – leveraging IT resources
- Flexibility – interfacing with systems



Agenda

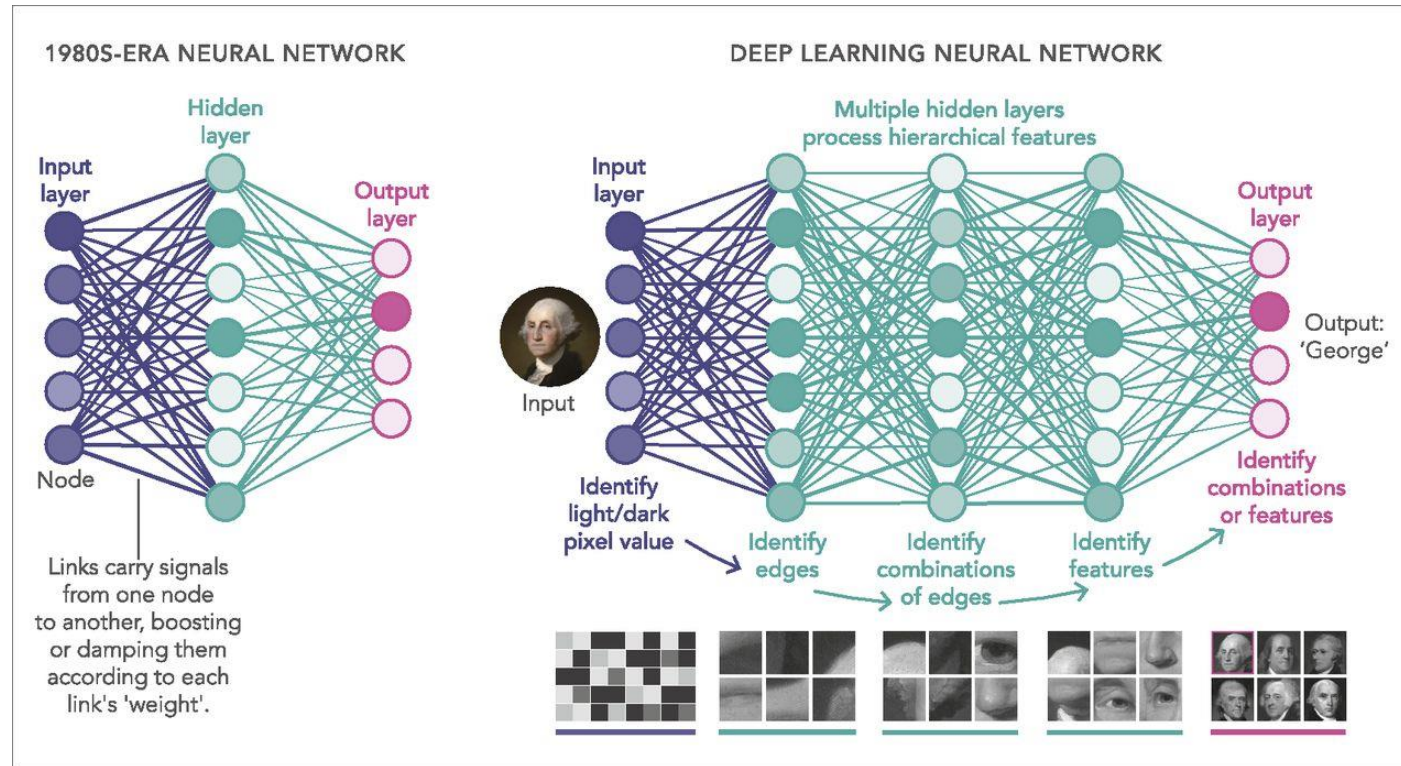
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Deep Learning vs. Machine Learning

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What is Deep Learning?

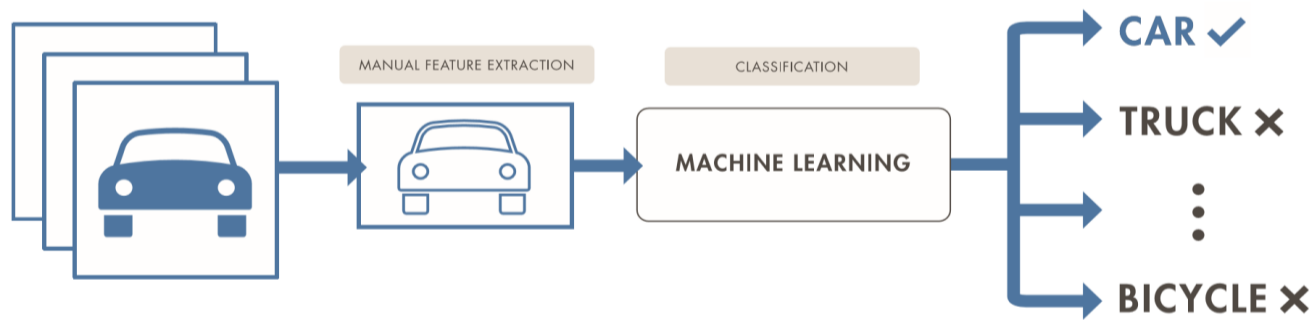


The term “deep” refers to the number of layers in the network—the more layers, the deeper the network.

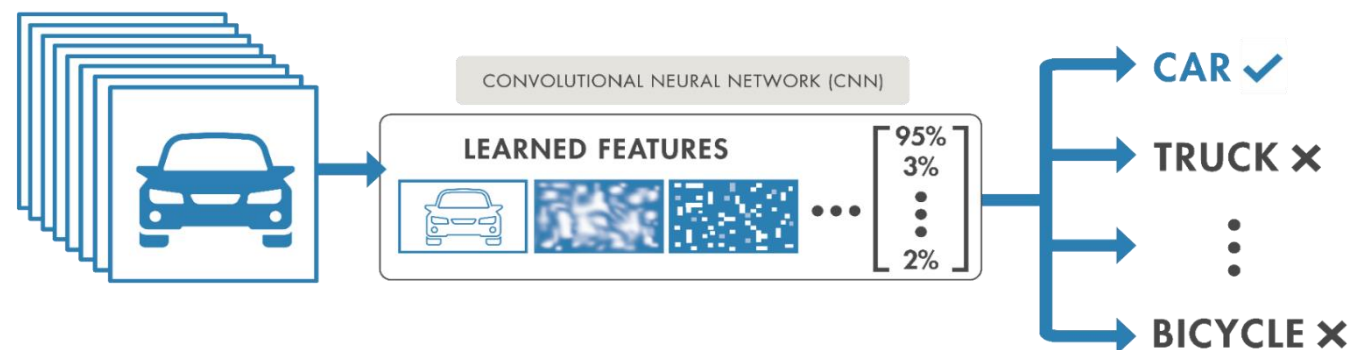
Machine Learning vs Deep Learning

Deep learning performs **end-to-end learning** by learning **features, representations and tasks** directly from **images, text, and signals**

Machine Learning

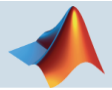


Deep Learning



Agenda

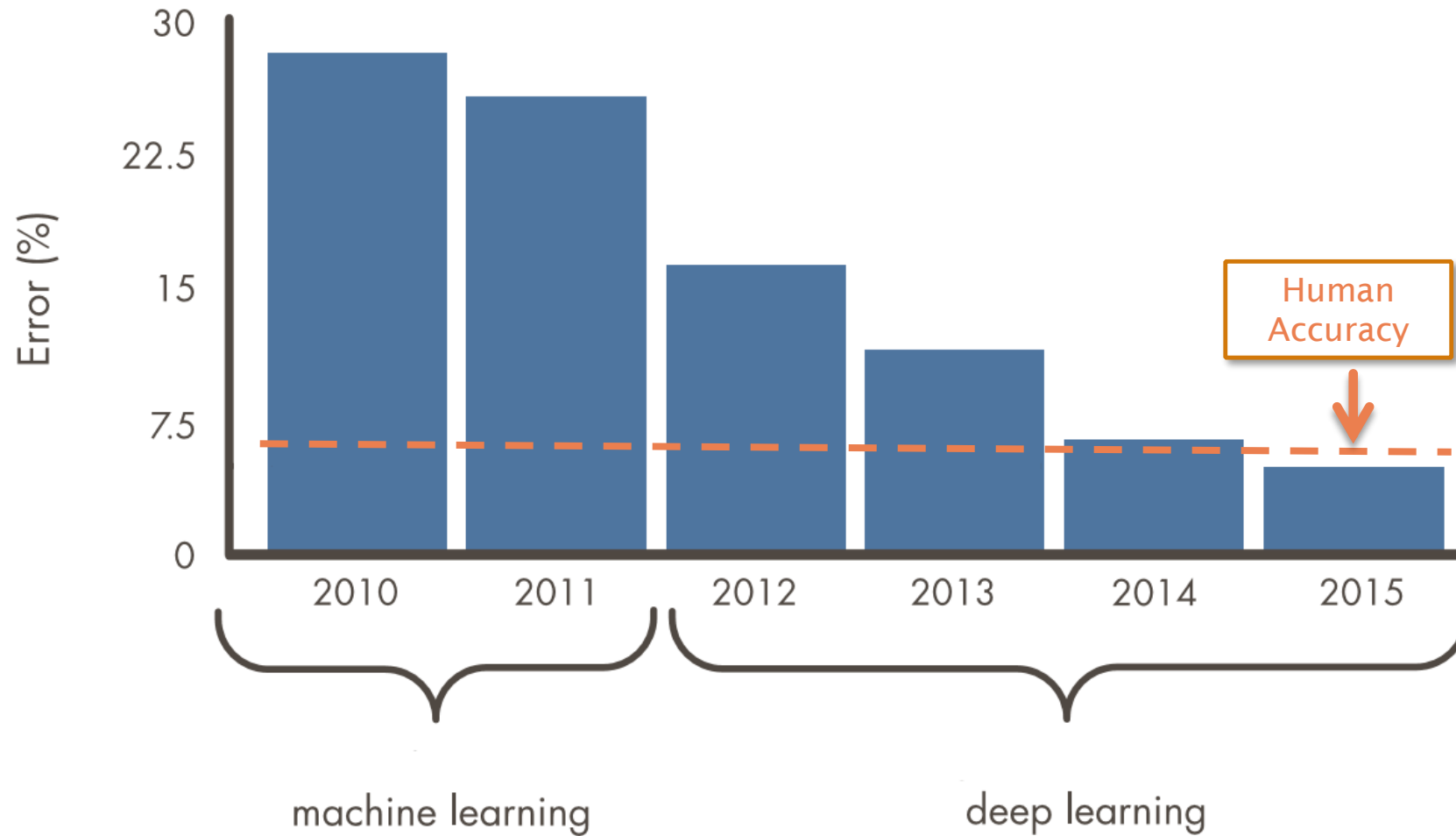
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General deep learning considerations

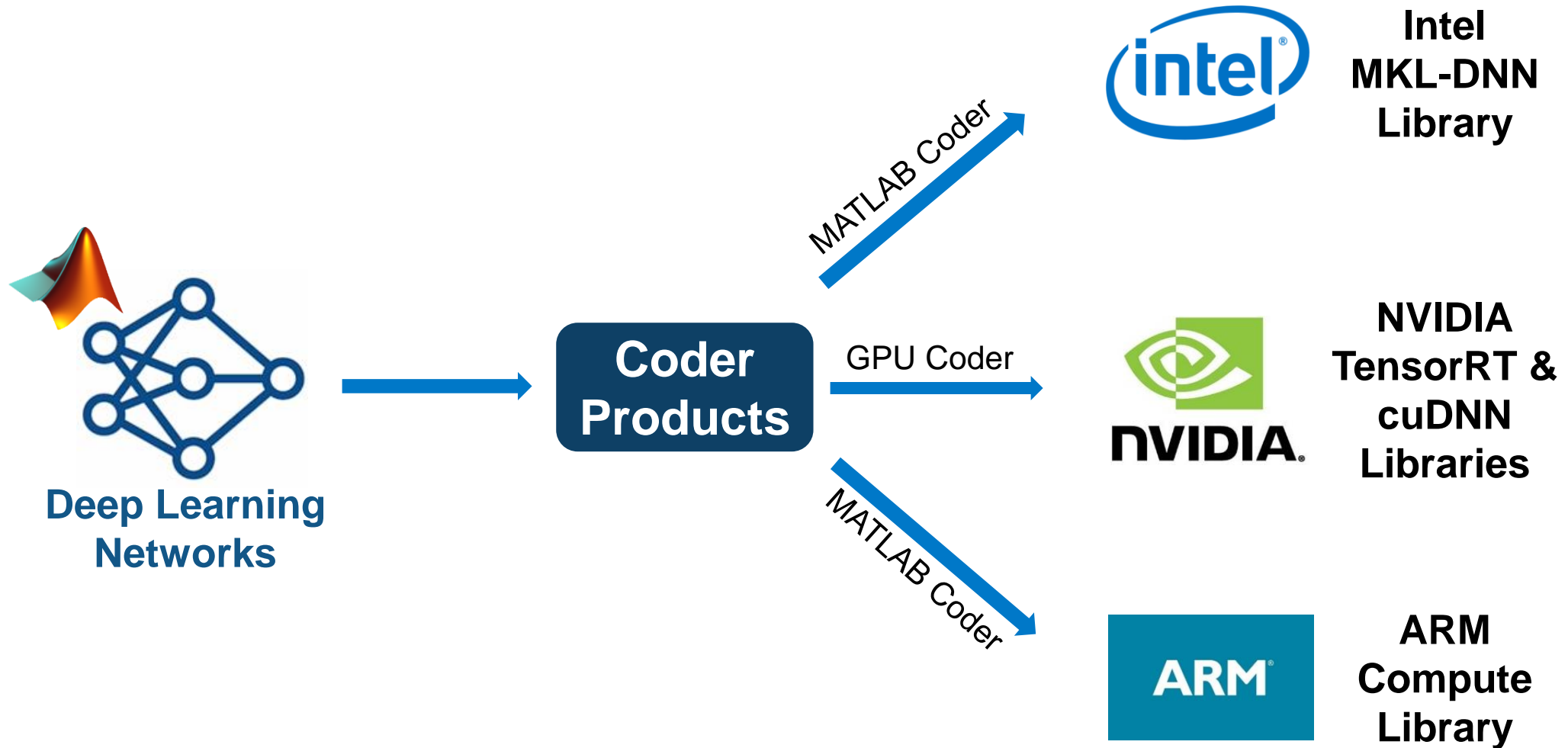
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Why is Deep Learning So Popular Now?



Source: ILSVRC Top-5 Error on ImageNet

Deploying Deep Learning Models for Inference

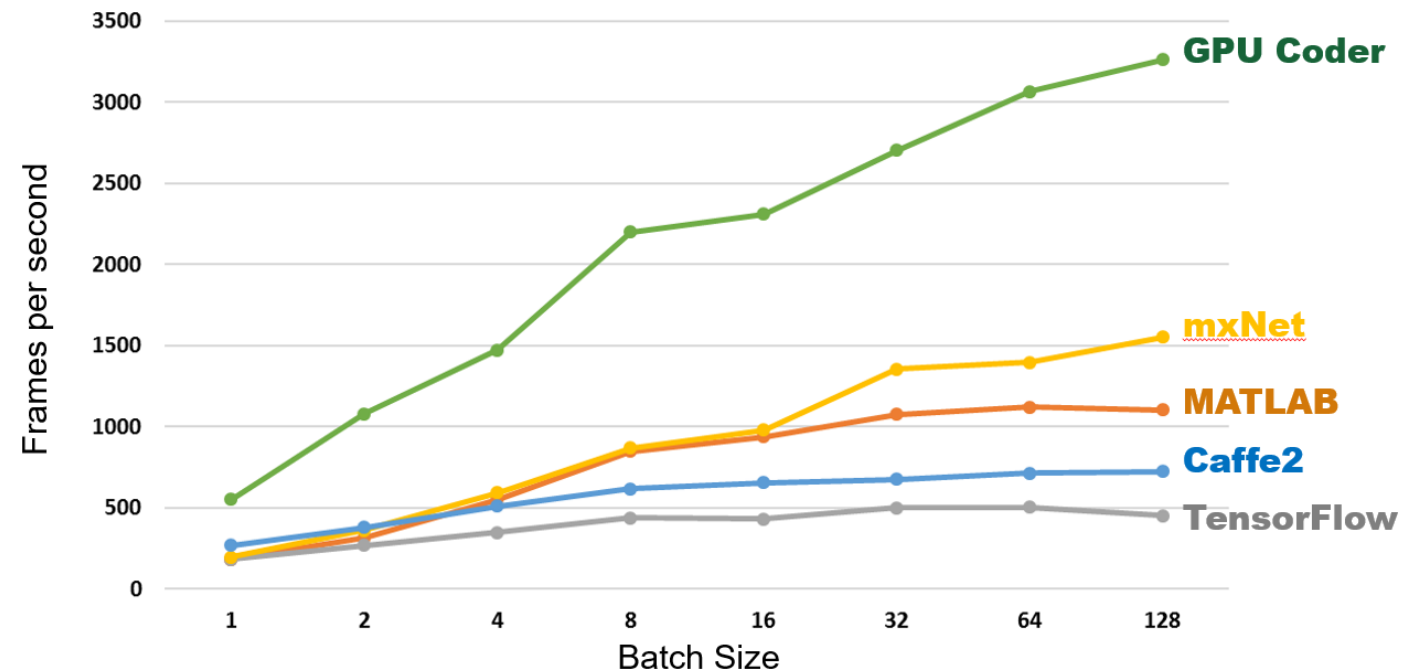


New Product: GPU Coder

R2017b

Automatically generate CUDA code from MATLAB

- Support for deep learning networks in Neural Network Toolbox
- Generate MEX functions for acceleration and verification
- Generated code can integrate with external CUDA code
- Deploy deep learning networks on embedded devices like the NVIDIA Tegra / Jetson

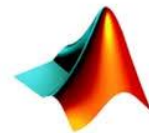


CPU: Intel(R) Xeon(R) CPU E5-1650 v3 @ 3.50GHz

GPU: Pascal TitanXP

MATLAB Differentiators for AI / Deep Learning

- **MATLAB**
 - makes it easy to learn and use deep learning techniques
 - provides complete workflow from research to prototype to production (enterprise or embedded systems)
- **It enables analysts to**
 - **Access pretrained models** from Caffe and TensorFlow-Keras
 - **Automate ground-truth labeling** with Apps
 - **Visualize** intermediate results and **debug** deep learning models
 - **Accelerate model training** using NVidia GPUs, Cloud and Clusters
 - **Automatically convert** deep learning models to CUDA or C code for cloud or embedded deployment



MATLAB®

Pretrained Models

from Deep Learning Frameworks

Inception-v3
Pretrained Model

VGG-16 VGG-19
PRETRAINED MODEL PRETRAINED MODEL

ResNet-50 ResNet-101
PRETRAINED MODEL PRETRAINED MODEL

GoogLeNet AlexNet
PRETRAINED MODEL PRETRAINED MODEL



Caffe

Caffe Model Zoo

Training & Inference

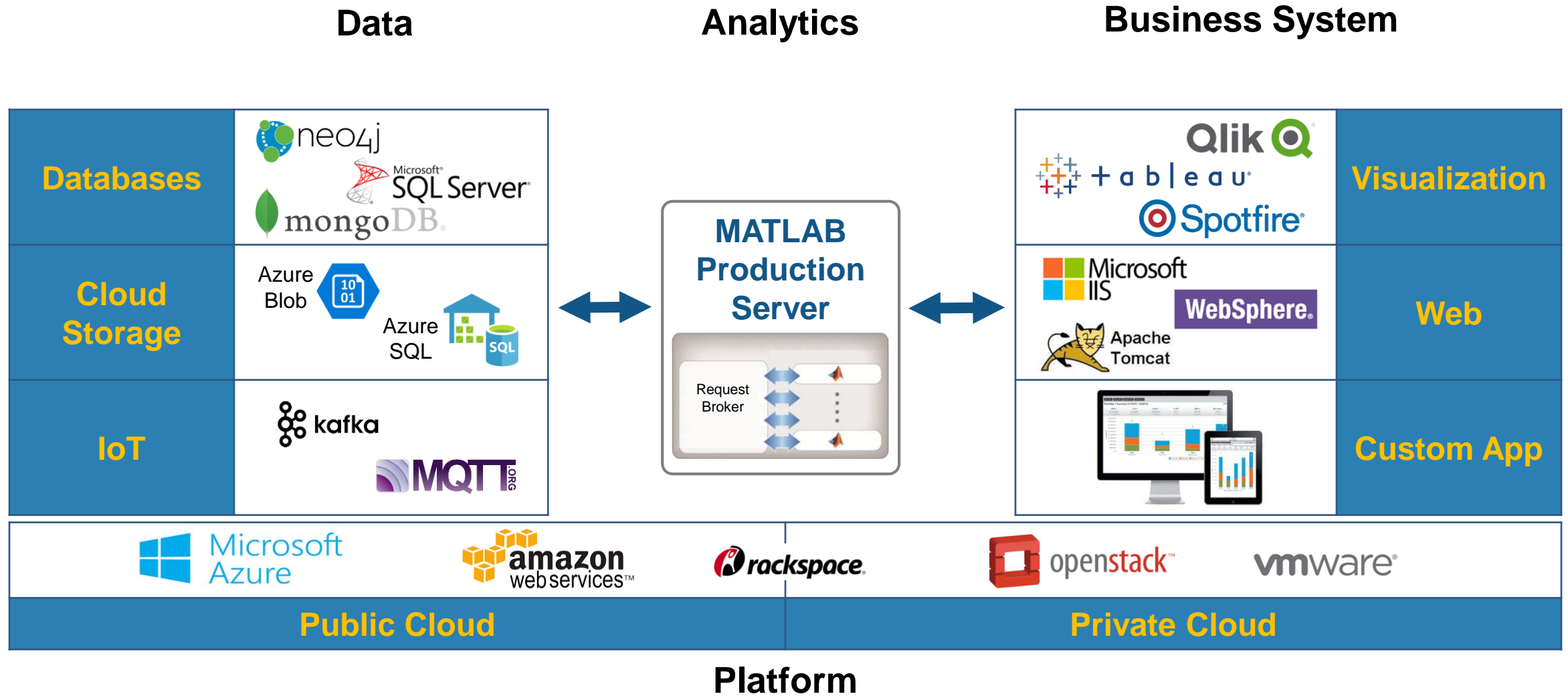


NVIDIA
CUDA




Technology Stack for Enterprise Integration

Many possible solutions. Reference architectures and consulting services available

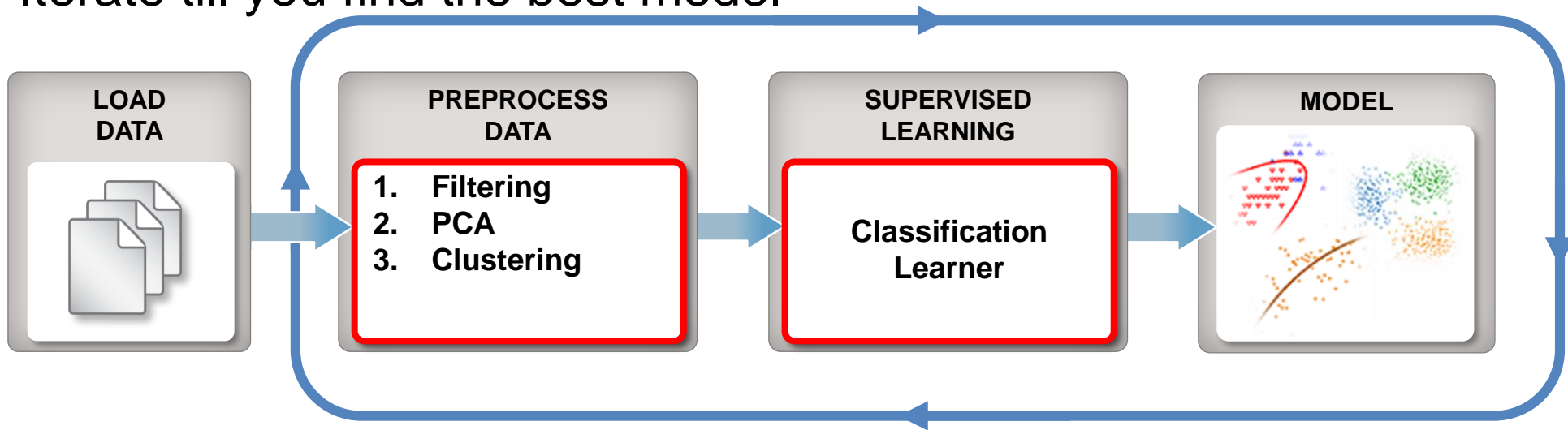


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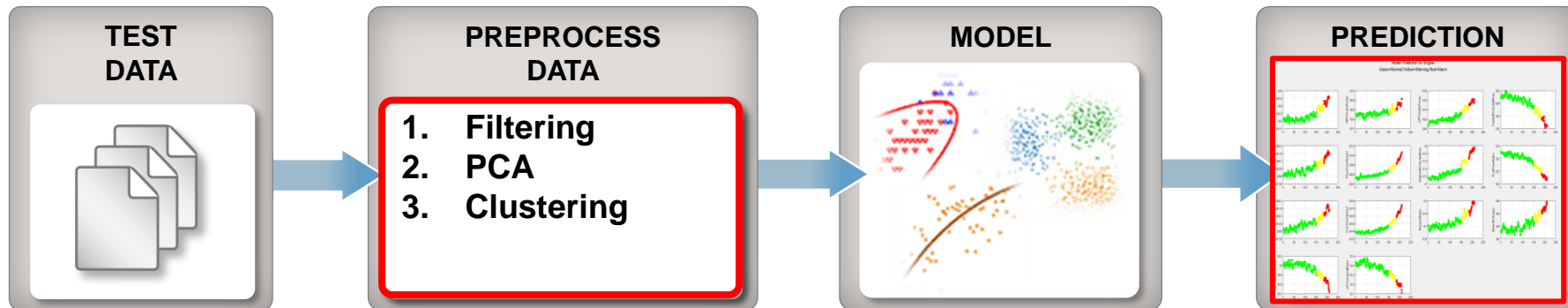
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Machine Learning Workflow

Train: Iterate till you find the best model



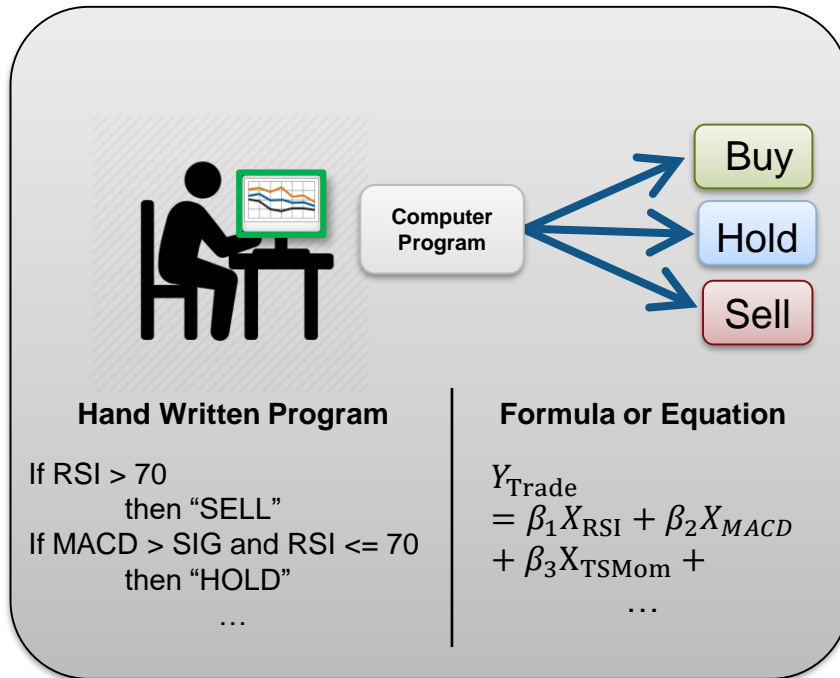
Predict: Integrate trained models into applications



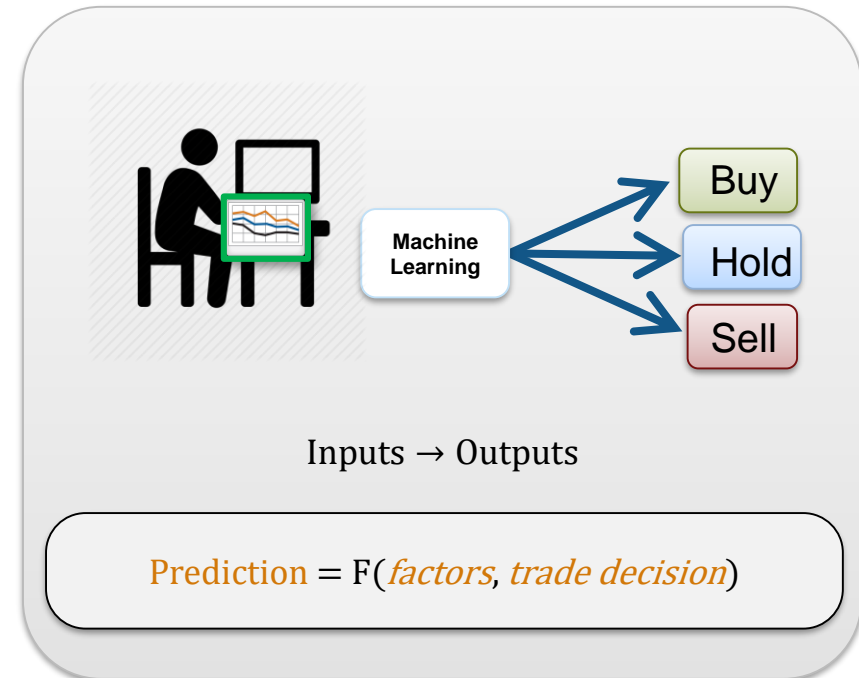
Demo: Trading strategy

“[Machine Learning] gives computers the ability to learn without being explicitly programmed”
Arthur Samuel, 1959

Standard Approach

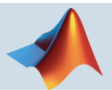


Machine Learning Approach



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The Future: Reinforcement Learning

Reinforcement learning is available too!

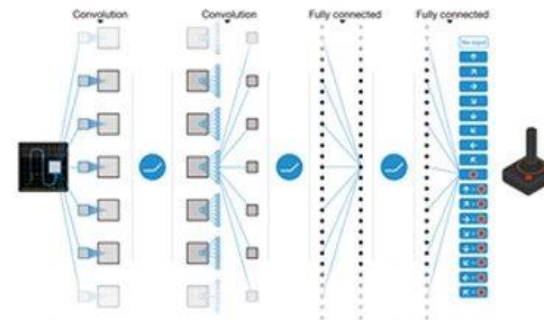
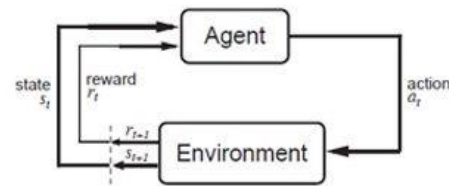
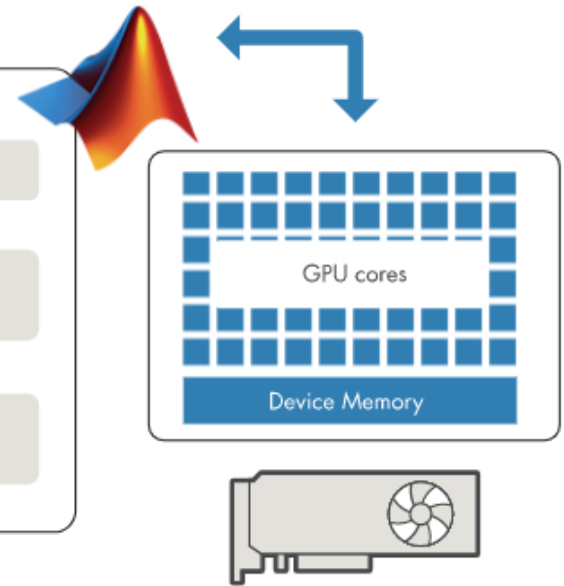


```

Set options for training
opts = trainingOptions('sgdm');

Train the network
net = trainNetwork ...
(XTrain, TTrain, layers, opts);

Make predictions
trainFeatures = ...
activations(net, XTrain, 6);
    
```



Machine learning challenges

Data challenges

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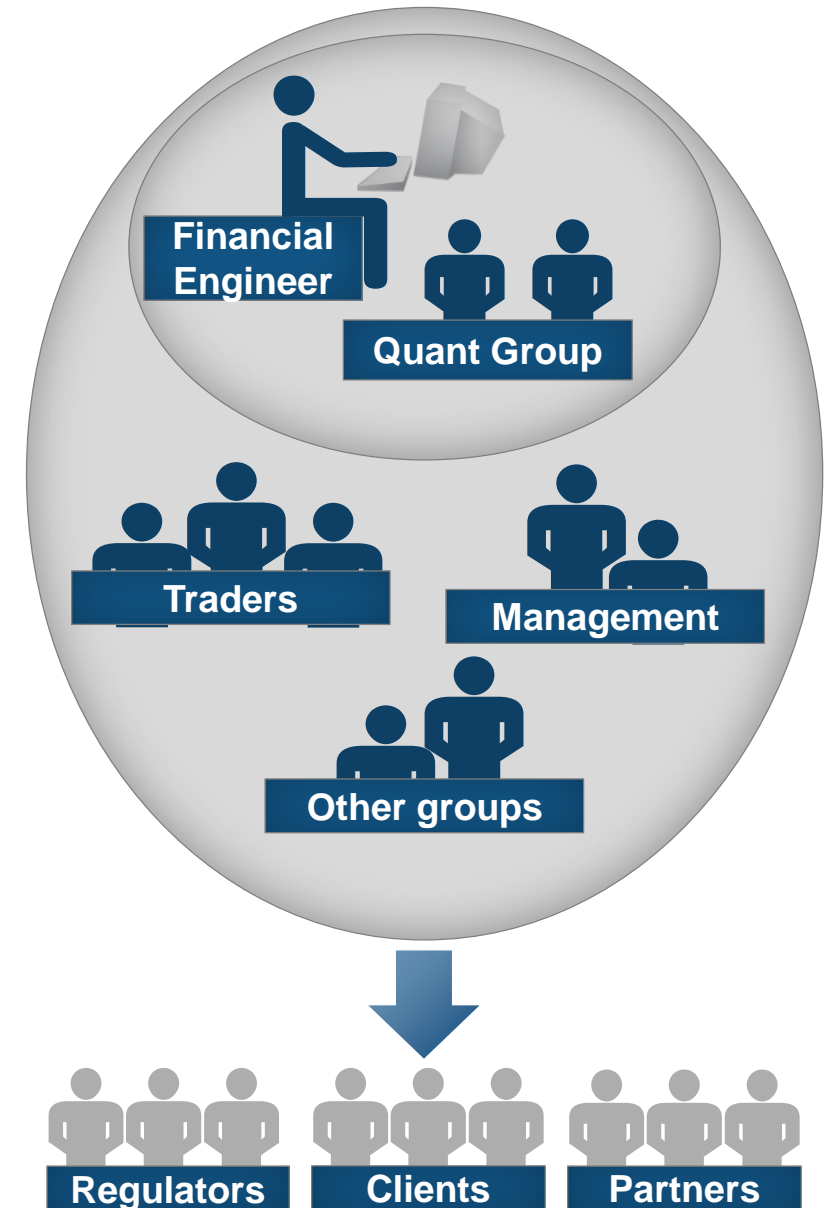
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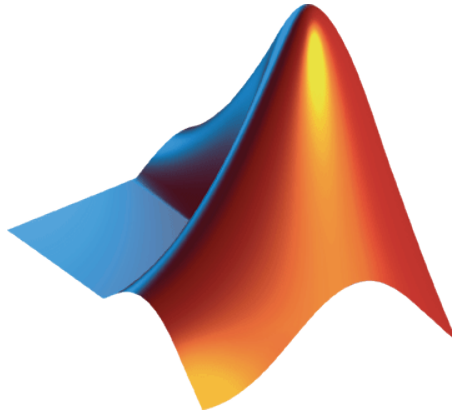


Production challenges

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Aberdeen Asset Management Implements Machine Learning–Based Portfolio Allocation Models in the Cloud

Challenge

Improve asset allocation strategies by creating model portfolios with machine learning techniques

Solution

Use MATLAB to develop classification tree, neural network, and support vector machine models, and use MATLAB Distributed Computing Server to run the models in the cloud

Results

- Portfolio performance goals supported
- Processing times cut from 24 hours to 3
- Multiple types of data easily accessed

[Link to user story](#)



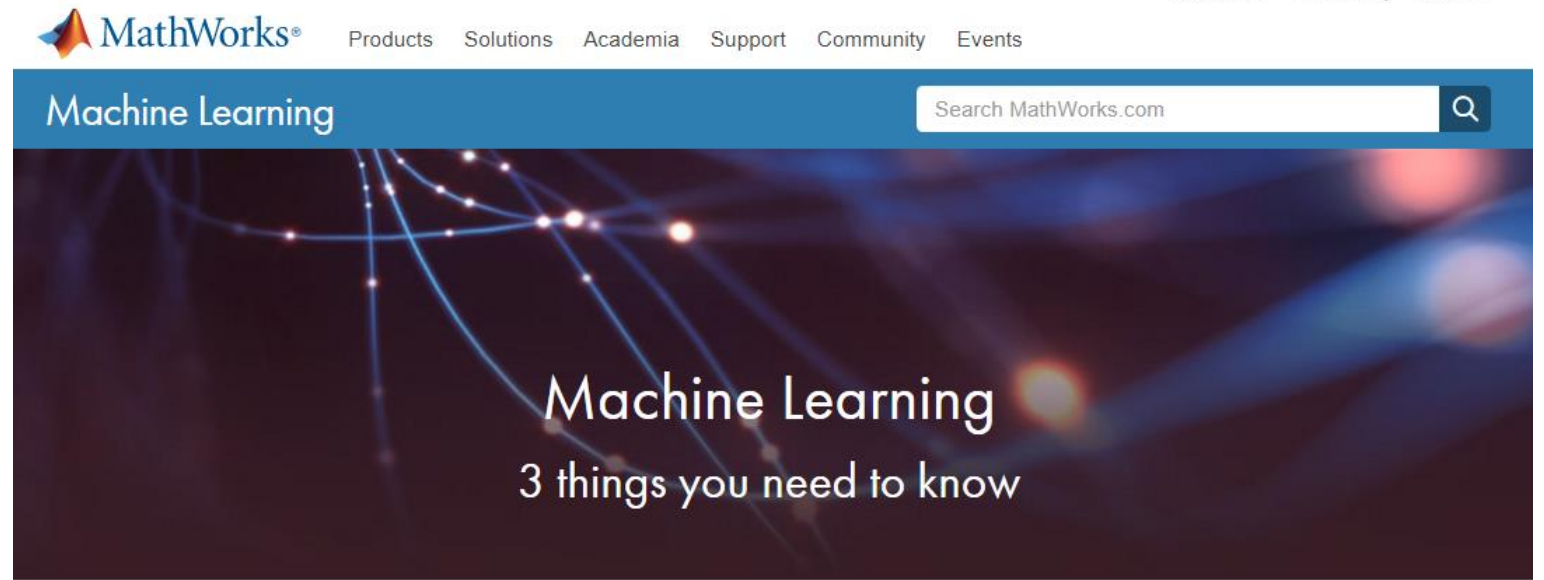
Interns using MATLAB at Aberdeen Asset Management.

“The widespread use of MATLAB in the finance community is a real advantage. Many university students learn MATLAB and can contribute right away when they join our team during internship programs. In addition, the strong MATLAB libraries developed by academic researchers help us explore all the possibilities of this programming language.”

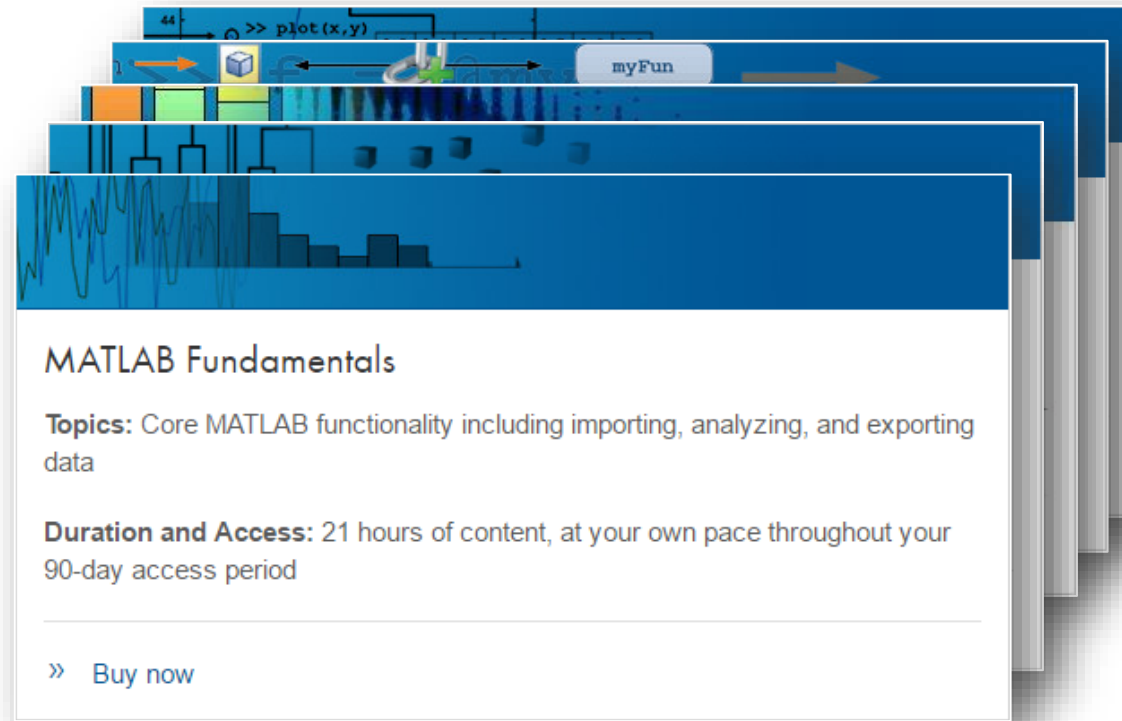
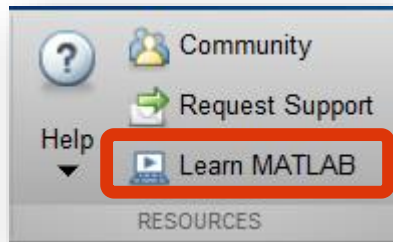
Emilio Llorente-Cano
Aberdeen Asset Management

Additional Resources

- Machine learning
 - <https://www.mathworks.com/discovery/machine-learning.html>
- Predictive analytics
 - <https://www.mathworks.com/discovery/predictive-analytics.html>



Get Training

A stack of three overlapping cards for the 'MATLAB Fundamentals' course. The top card shows the course title, topics, duration, and a 'Buy now' button. The background of the cards features MATLAB-related graphics, including a code editor window with the command 'plot(x,y)', a 3D plot, and a bar chart.

 **GARP**
CPE Approved
Provider

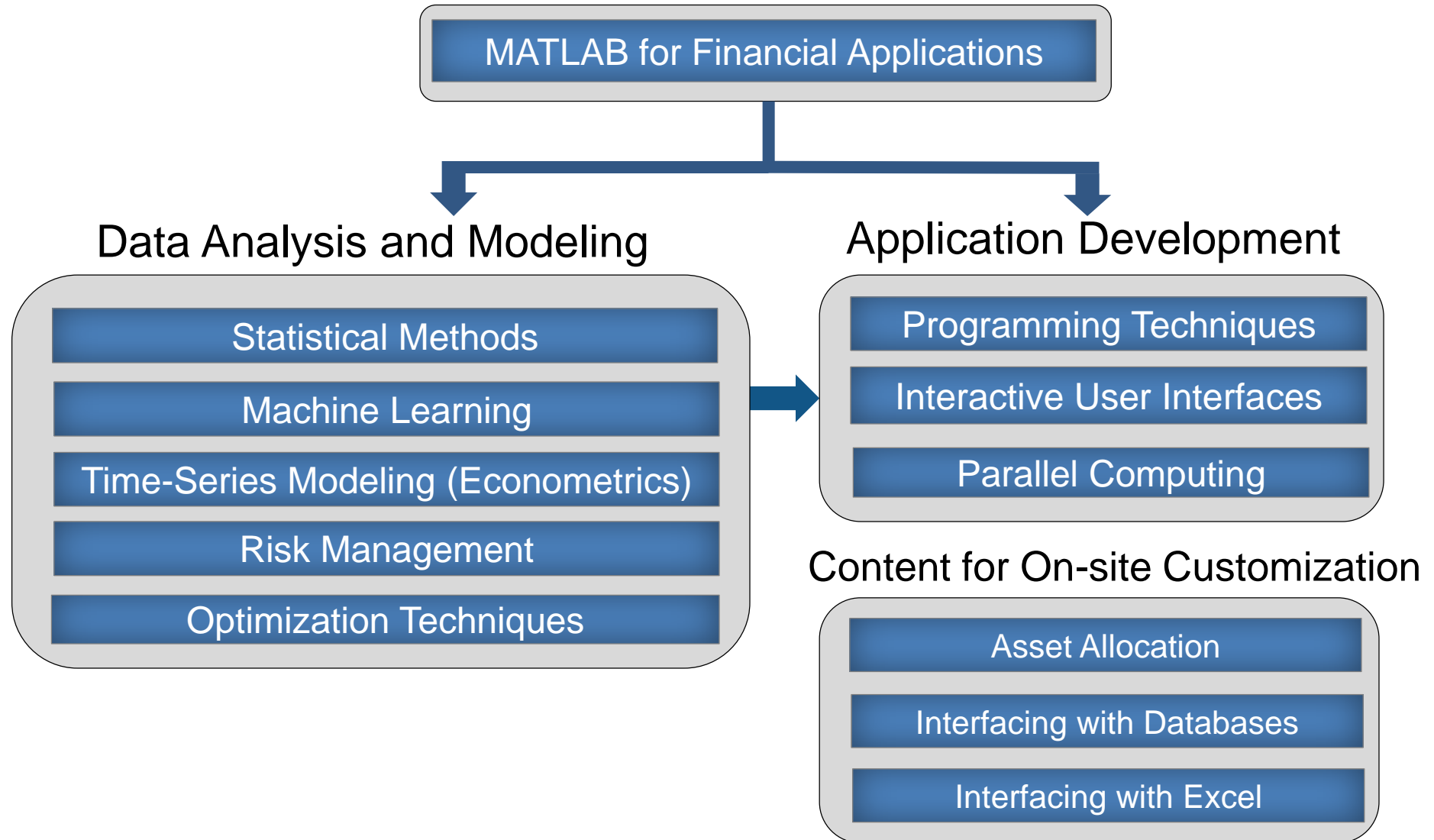
Accelerate your learning curve:

- Customized curriculum
- Learn best practices
- Practice on real-world examples

Options to fit your needs:

- Self-paced (online)
- Instructor led (online and in-person)
- Customized curriculum (on-site)

Training Roadmap



Consulting Services

Accelerating return on investment

A global team of experts supporting every stage of tool and process integration

