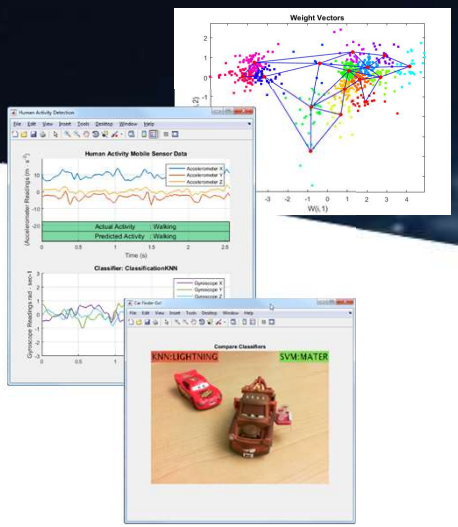
ASCENDAS SYSTEMS

Machine Learning & Deep Learning with MATLAB



Phitcha Phitchayanon

Applications Engineer

phitcha.phitchayanon@techsource-asia.com

Supported by

MathWorks®

Southeast Asia's sole distributor of

MATLAB® & SIMULINK®

Agenda

Part I: Introduction to Machine Learning

- Overview of Machine Learning
- Machine Learning Algorithms
- Demo: Detecting Human Activity

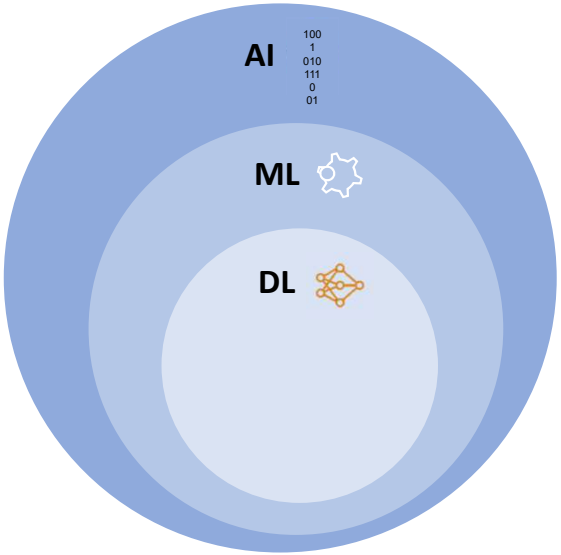
Part II: Introduction to Deep Learning

- Why Deep Learning
- Deep Learning vs Machine Learning
- Demo: Object classification with ALEXNET

Key takeaways

Q&A

Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL)



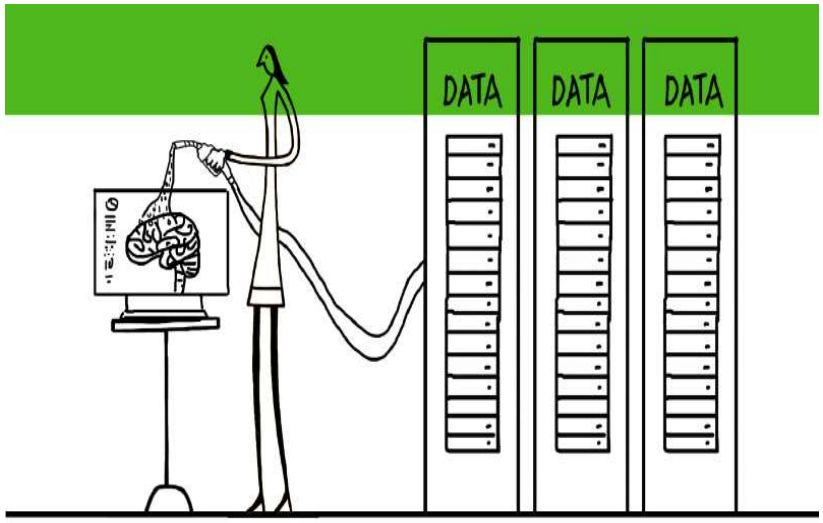
The **simulated intelligence** that tries to mimic human actions or decision making.

The use of **statistical methods** that enables computer to learn from data without explicitly programmed to do so.

A subfield of machine learning that uses **multi-layer neural networks** in the architecture

Machine Learning

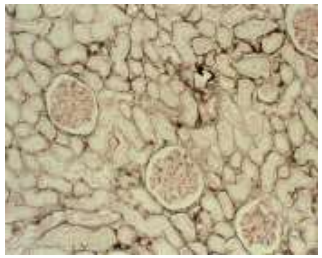
Most common tool for Data analytics modelling

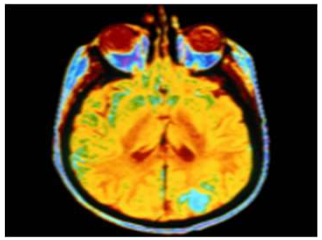


Use features in the data and to create a predictive model

Used Across Many Application Areas

Biology



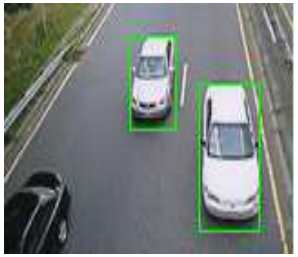


Tumor Detection, Drug Discovery

Agriculture

Predictive Maintenance & Forecasting

Image & Video Processing



Pattern Recognition

Energy

Load, Price Forecasting, Trading

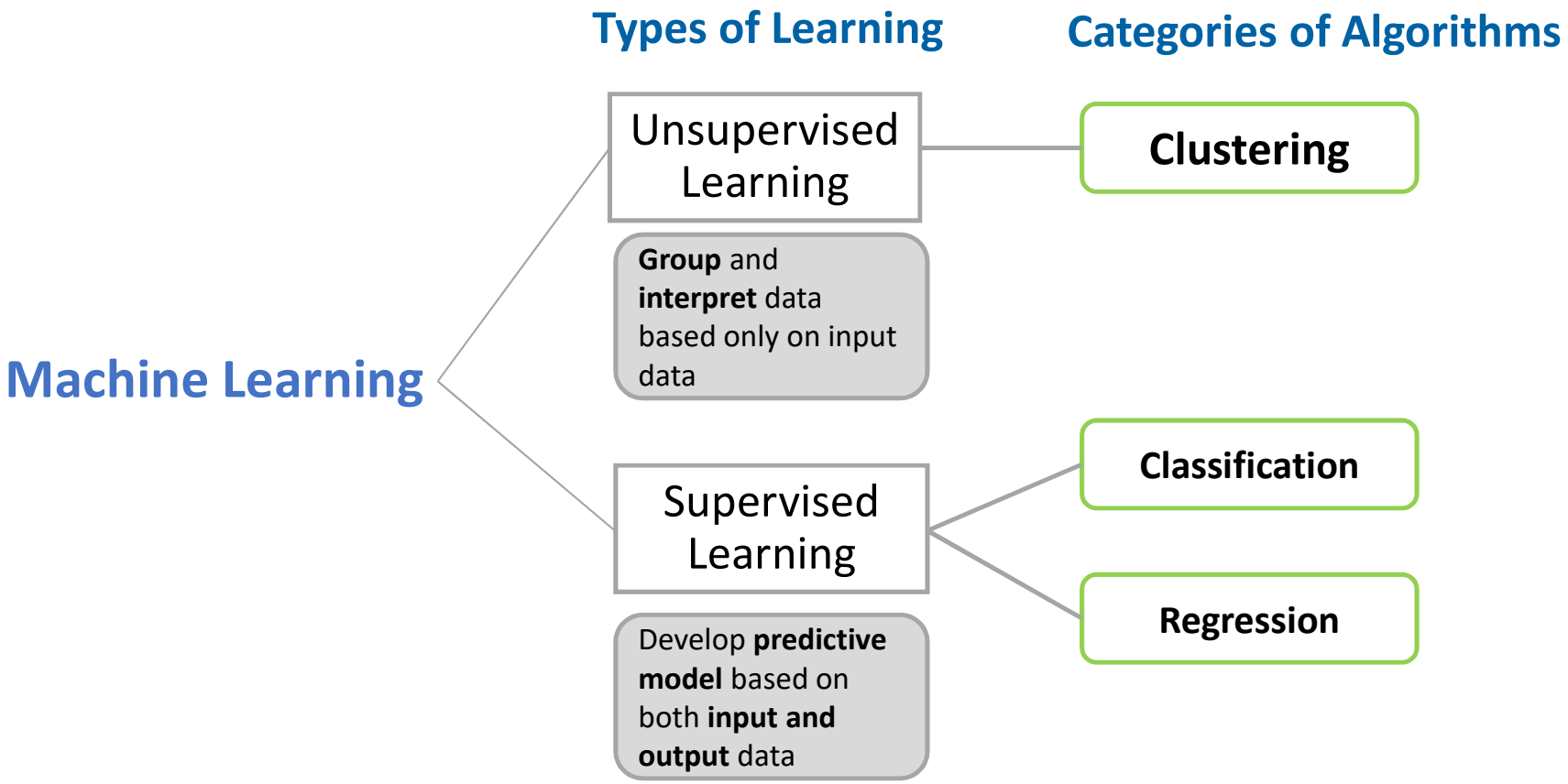
Motivation for Machine Learning

- Do you want to create a model of a system?
  - Understand dynamics
  - Predict Outputs

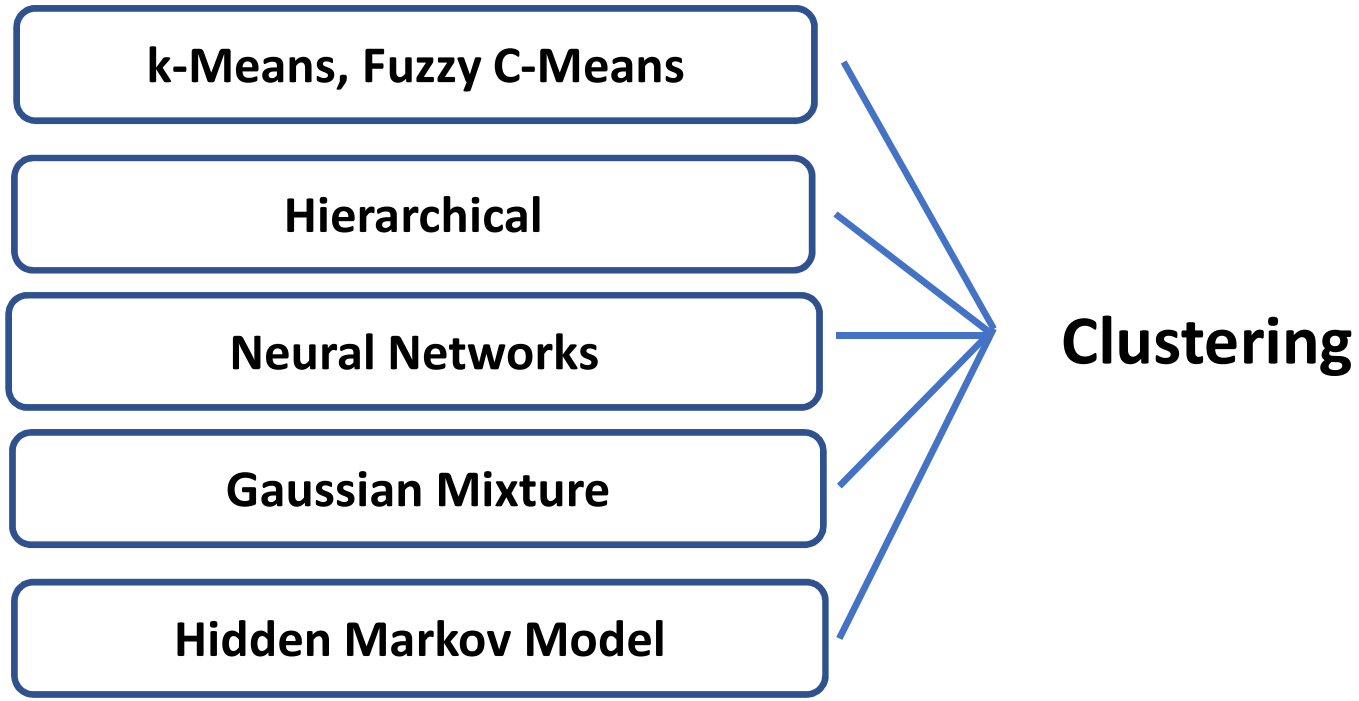
- How do you create model?
  - Develop an equation
    - Takes time to develop, sometimes even years
    - Unknown if there is actually an equation at all

- Another option, Machine Learning

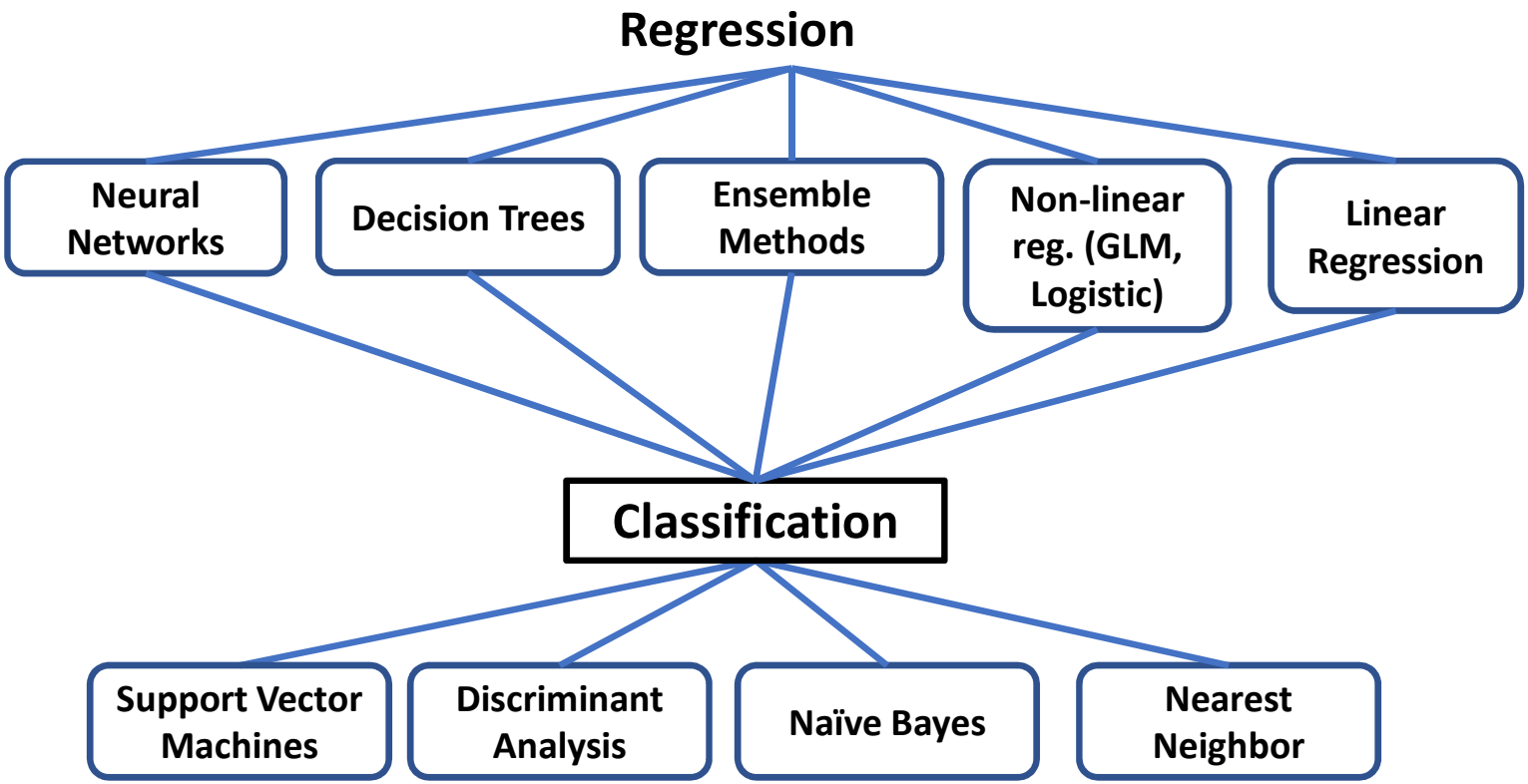
Overview – Machine Learning



Unsupervised Learning

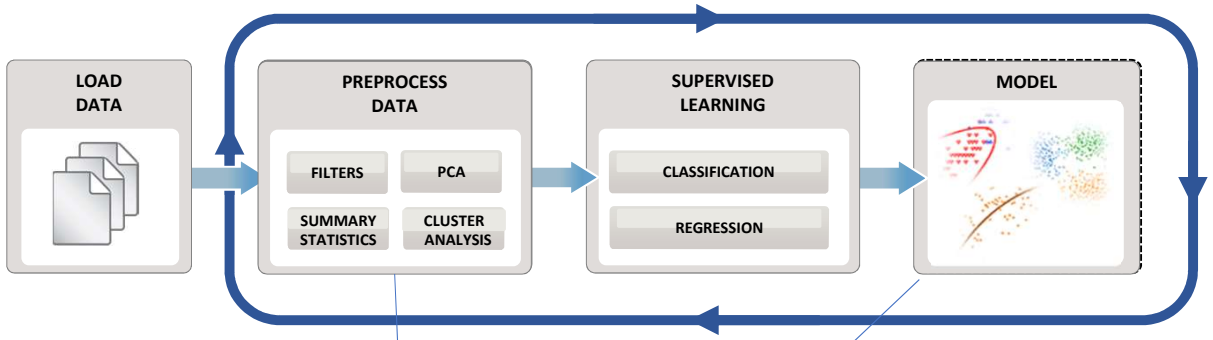


Supervised Learning

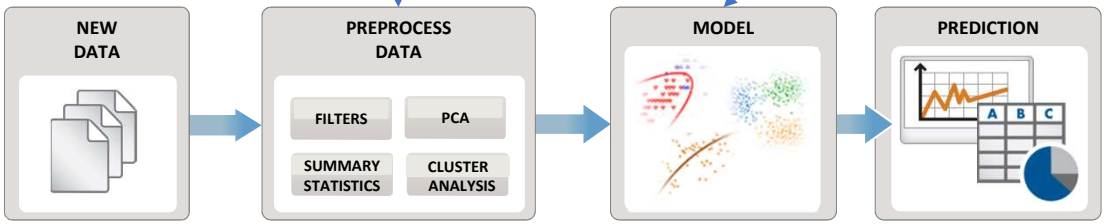


Supervised Learning Workflow

Train: Iterate till you find the best model



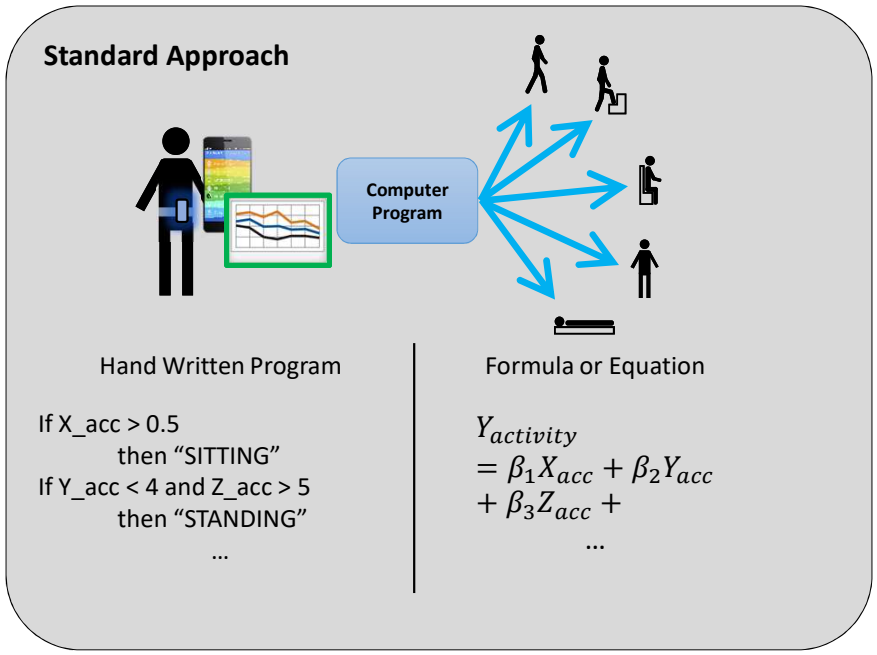
Predict: Integrate trained models into applications

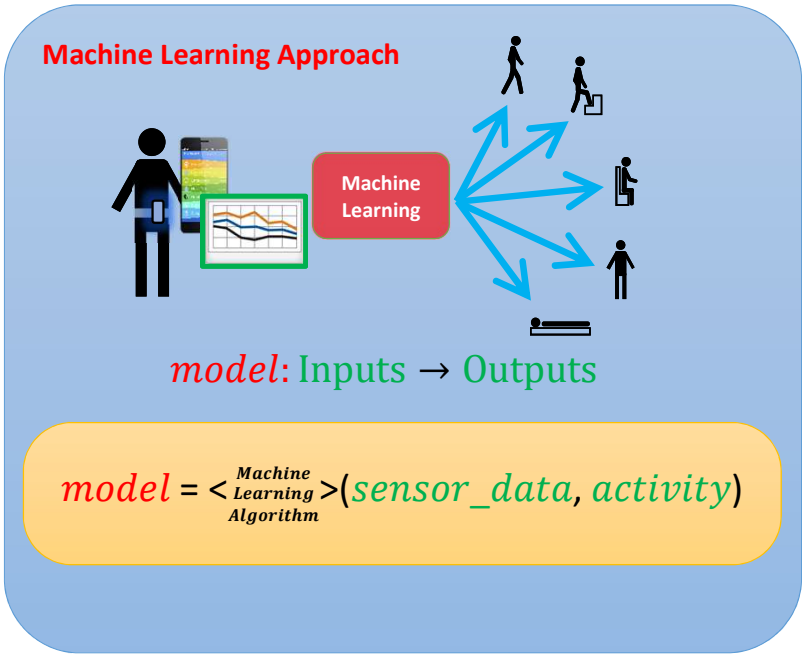


Machine Learning

Machine learning uses **data** and produces a **program** to perform a **task**

Task: Human Activity Detection





Demo 1: Human Activity Learning Using Mobile Phone Data

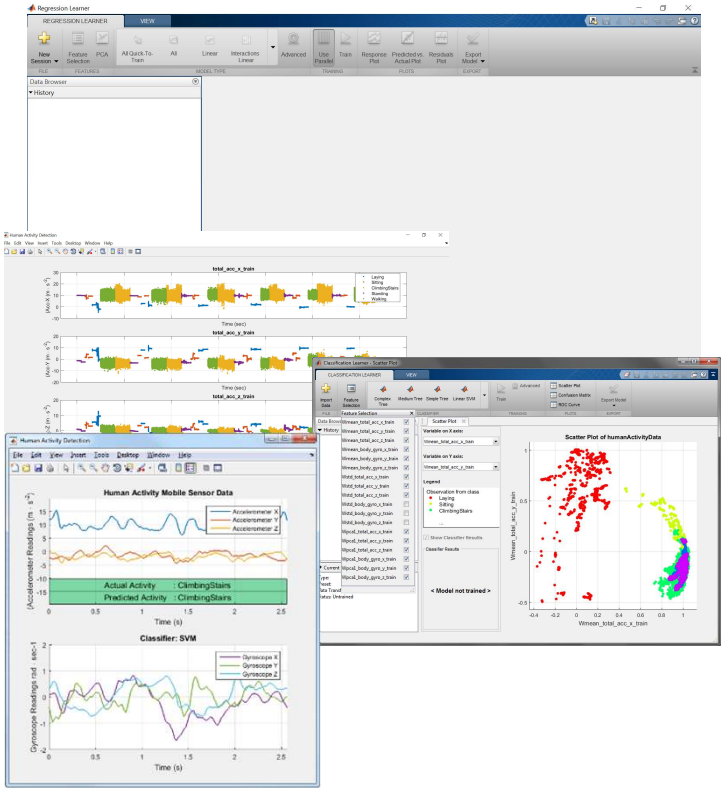
Objective: Train a classifier to classify human activity from sensor data

Data:

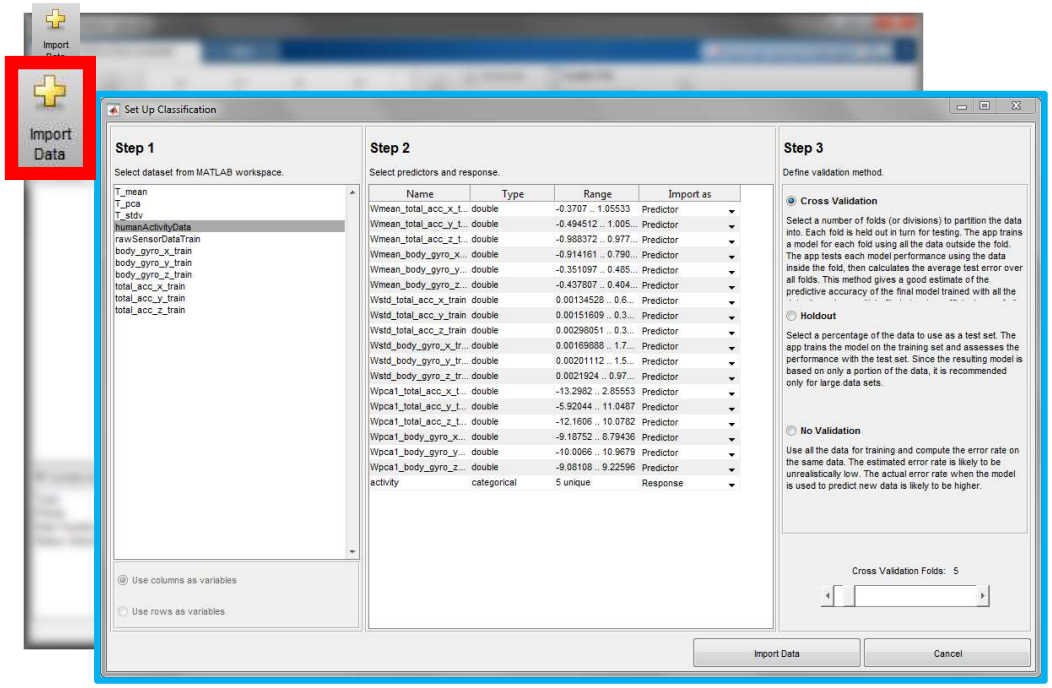
Predictors	3-AxialAccelerometer and Gyroscope 
Response	Activity: 

Approach:

- Extract features from raw sensor signals
- Train and compare classifiers
- Test results on new sensor data



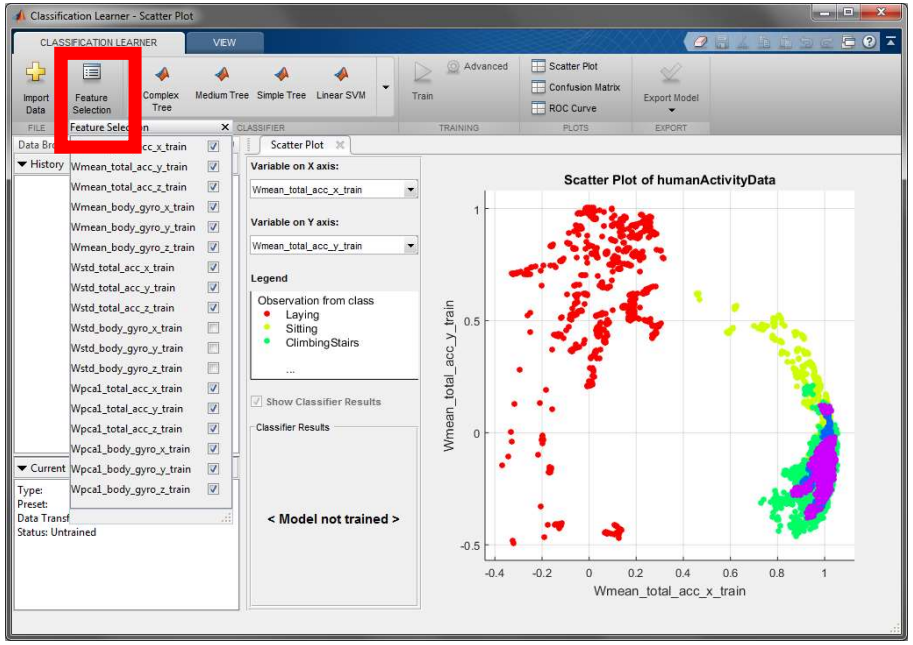
Train a Model with the Classification Learner App



Classification Learner App with data: Step 1

1. Data import and Cross-validation setup

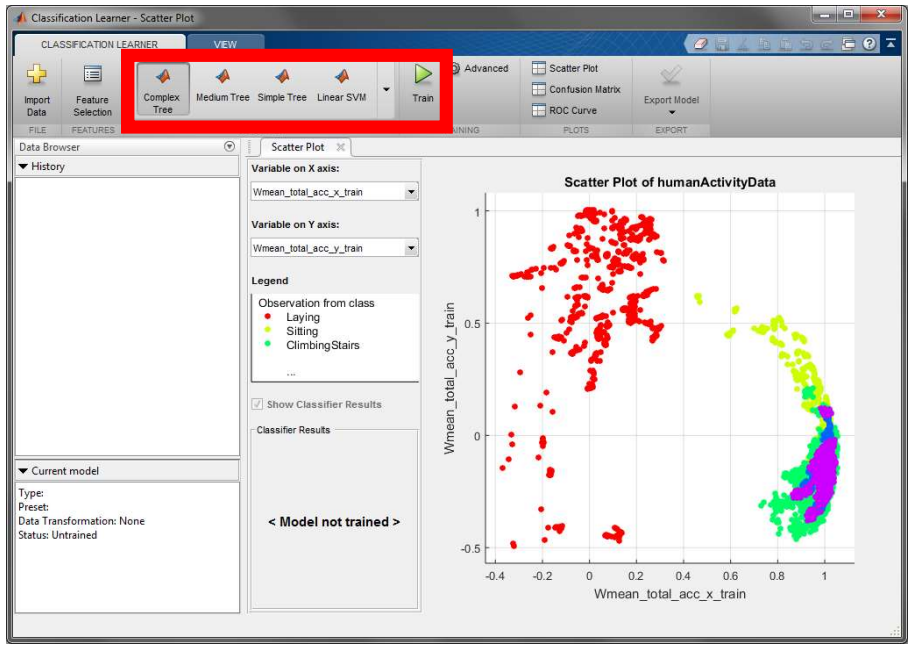
Train a Model with Classification Learner App



Classification Learner App with data: Step 2

1. Data import and Cross-validation setup
2. Data exploration and feature selection

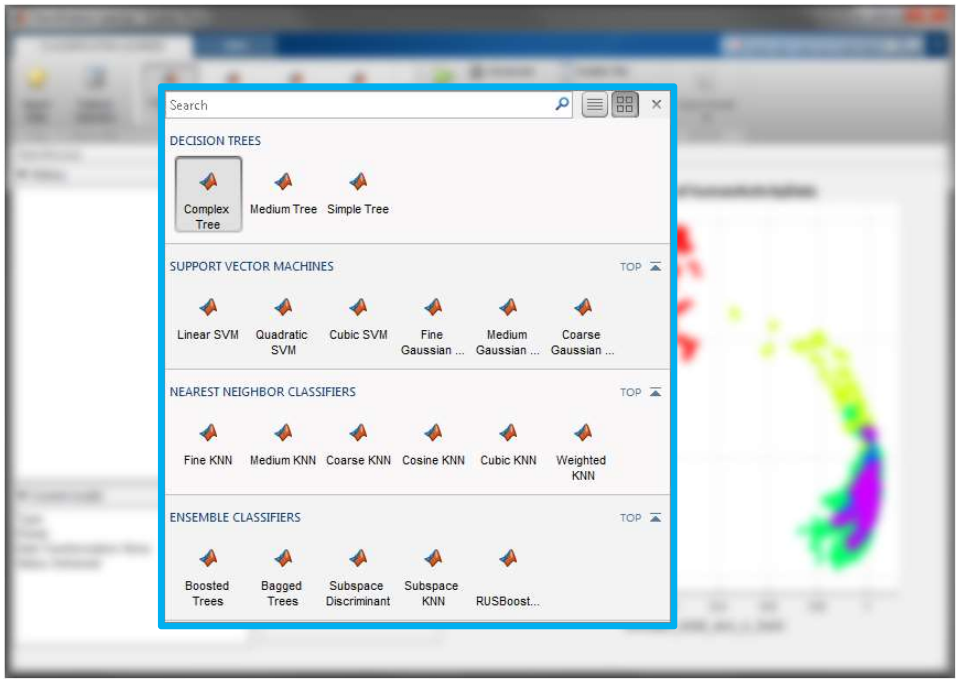
Train a Model with the Classification Learner App



Classification Learner App with data: Step 3

1. Data import and Cross-validation setup
2. Data exploration and feature selection
3. Train multiple models

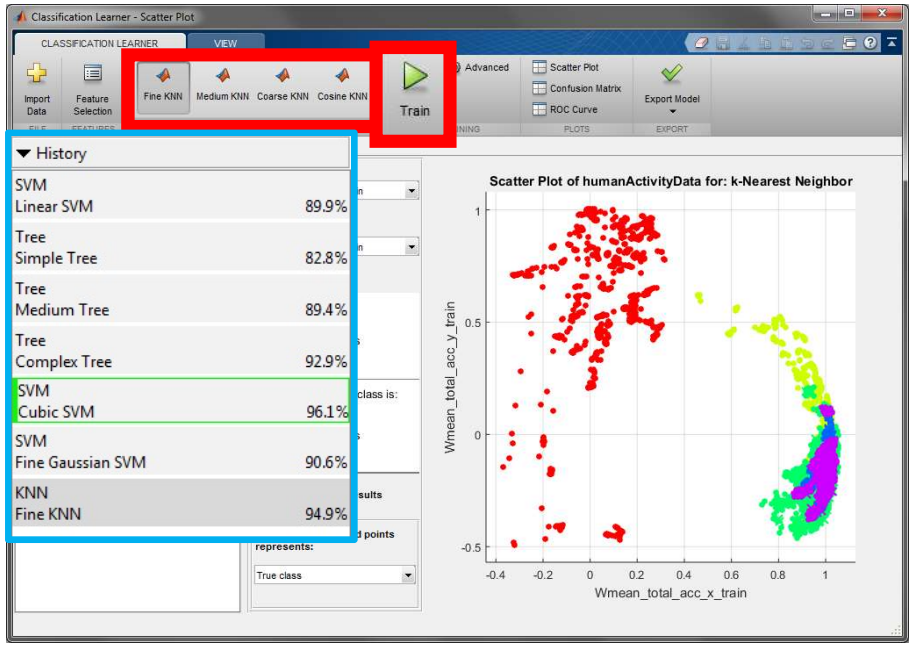
Train a Model with Classification Learner App



Classification Learner App with data: Step 3 cont'd

1. Data import and Cross-validation setup
2. Data exploration and feature selection
3. Train multiple models

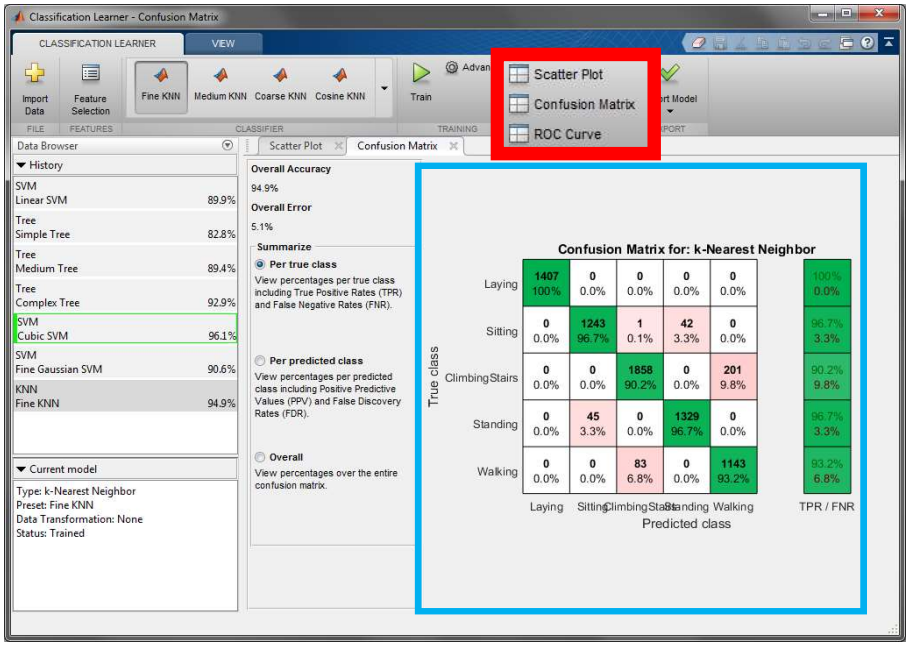
Train a Model with the Classification Learner App



Classification Learner App with data: Step 3 cont'd

1. Data import and Cross-validation setup
2. Data exploration and feature selection
3. Train multiple models

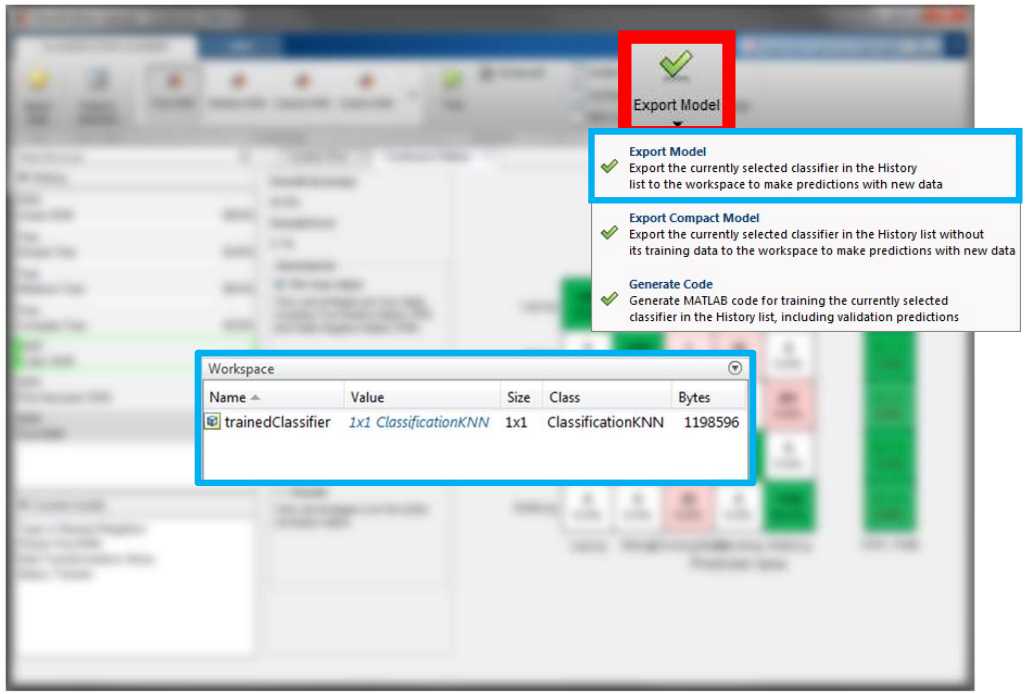
Train a Model with the Classification Learner App



Classification Learner App with data: Step 4

1. Data import and Cross-validation setup
2. Data exploration and feature selection
3. Train multiple models
4. Model comparison and assessment

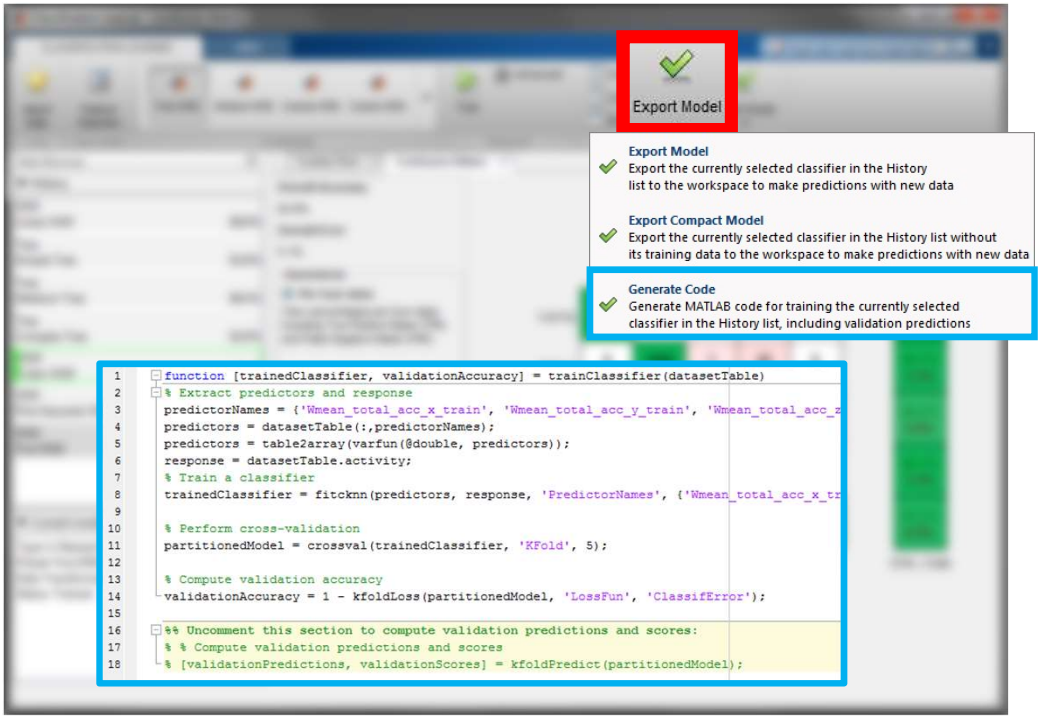
Train a Model with Classification Learner App



Classification Learner App with data: Step 5

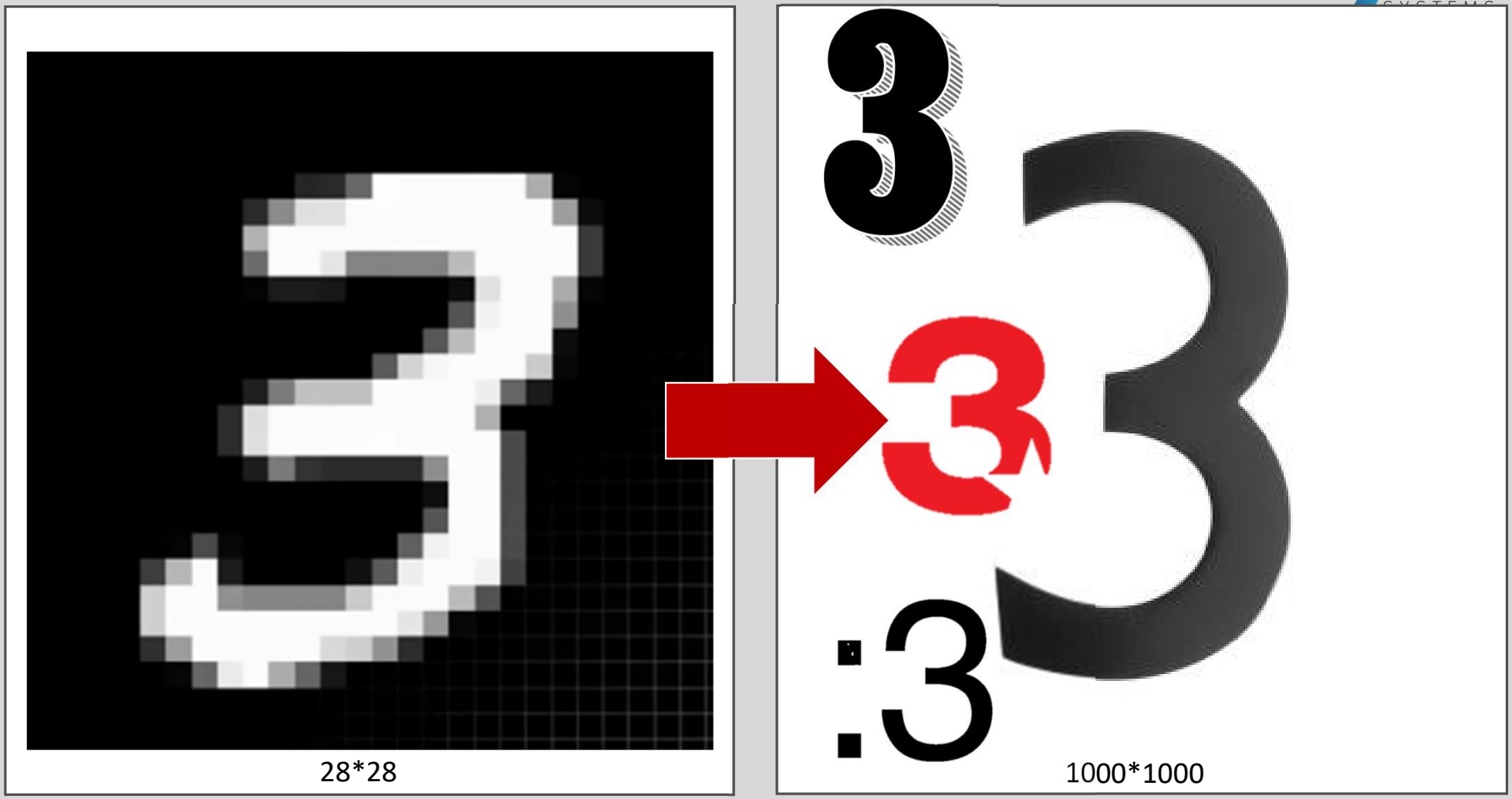
1. Data import and Cross-validation setup
2. Data exploration and feature selection
3. Train multiple models
4. Model comparison and assessment
5. Share model

Train a Model with the classification Learner App



Classification Learner App with data: Step 5 Cont'd

1. Data import and Cross-validation setup
2. Data exploration and feature selection
3. Train multiple models
4. Model comparison and assessment
5. Share model or automate process


28*28
1000*1000

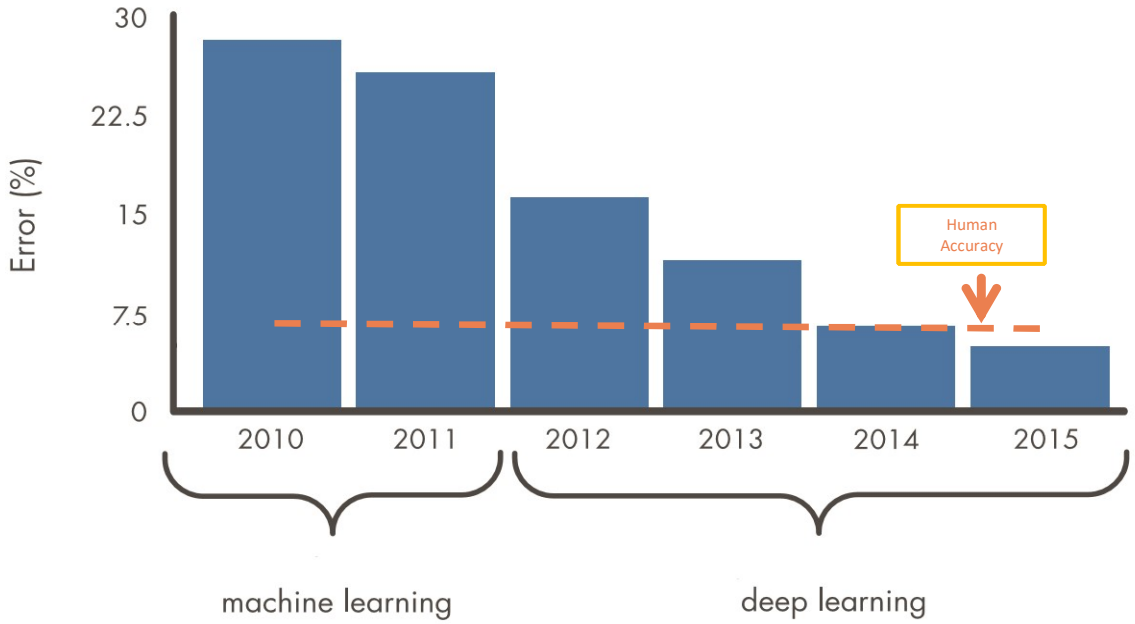
Deep Learning

Deep Learning

Definition: Deep learning is a **machine learning** technique that learns **features and tasks** directly from data.

Data can be **images, text or sound.**

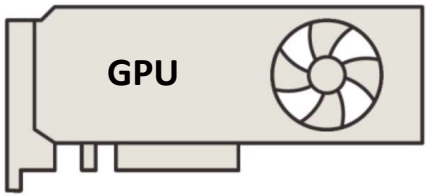
Why is Deep Learning So Popular Now?

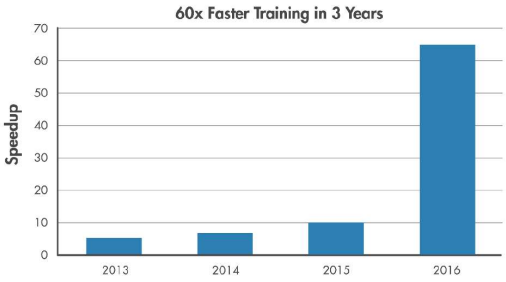


Source: ILSVRC Top-5 Error on ImageNet

Factors promoting Deep Learning

High-Performance Computing





Big Data

AlexNet PRETRAINED MODEL

VGG-16 PRETRAINED MODEL

ResNet-50 PRETRAINED MODEL

ResNet-101 PRETRAINED MODEL

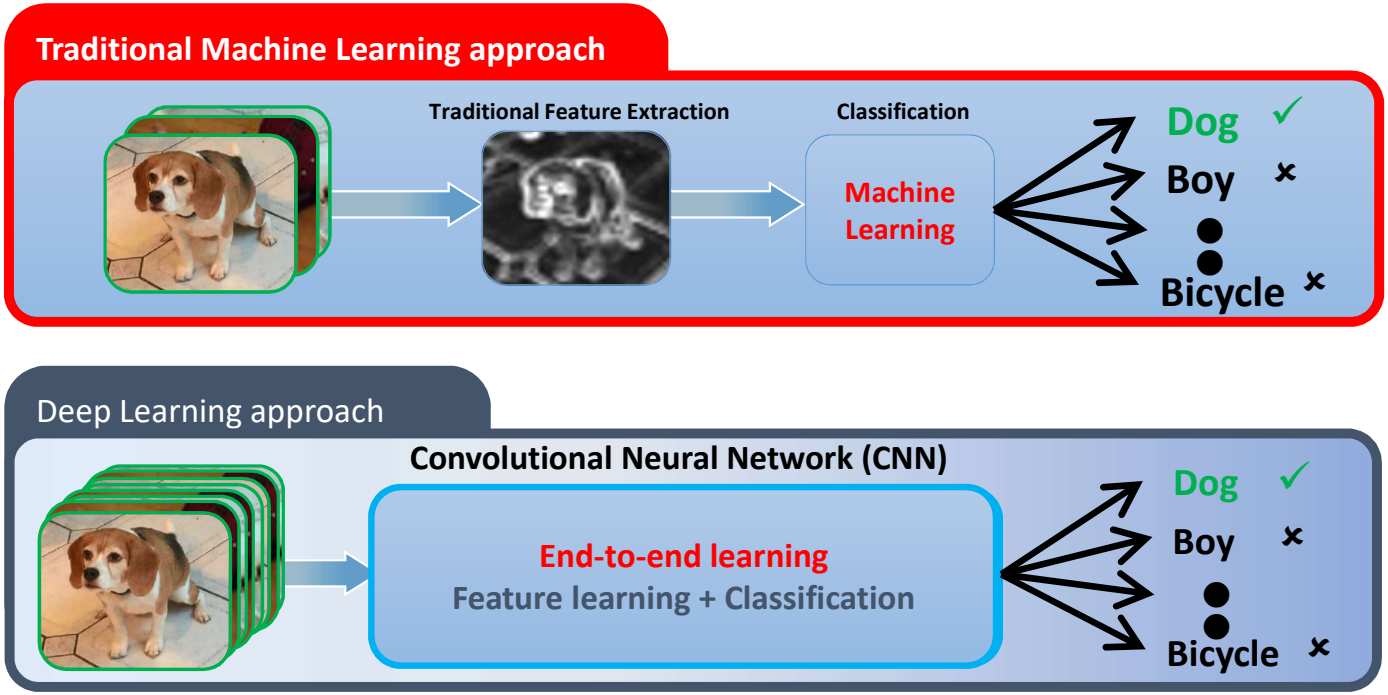
Caffe IMPORTER

GoogLeNet PRETRAINED MODEL

TensorFlow-Keras IMPORTER

Inception-v3 MODELS

Machine Learning vs Deep Learning

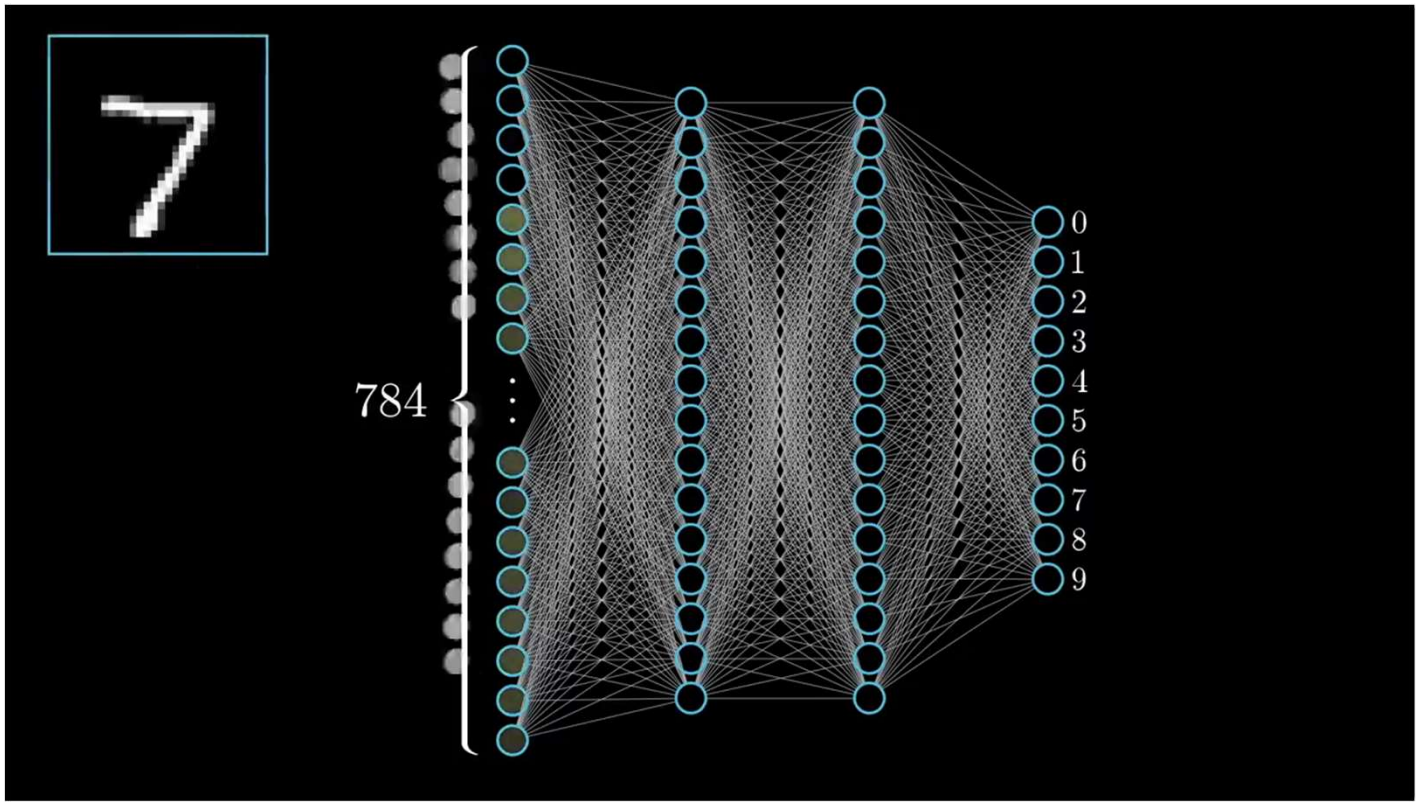


Machine Learning vs Deep Learning

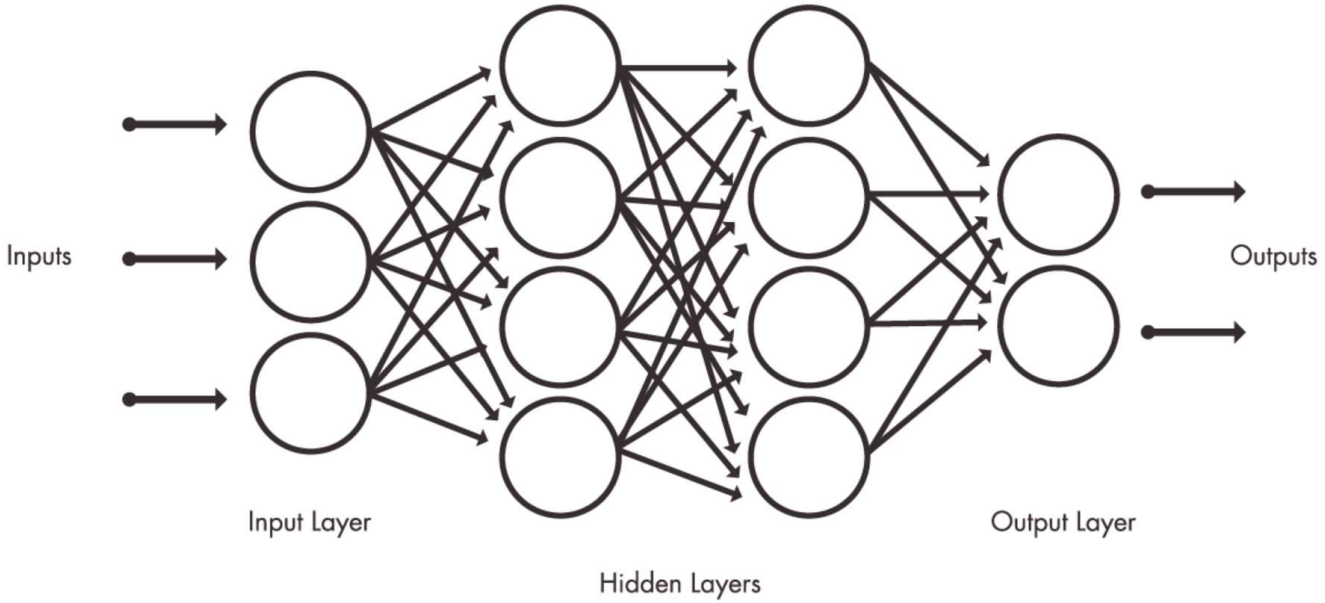
Question: Machine Learning or Deep Learning?

	Machine Learning	Deep Learning
Training dataset	Small	Large
Choose your own features	Yes	No
# of classifiers available	Many	Few
Training time	Short	Long

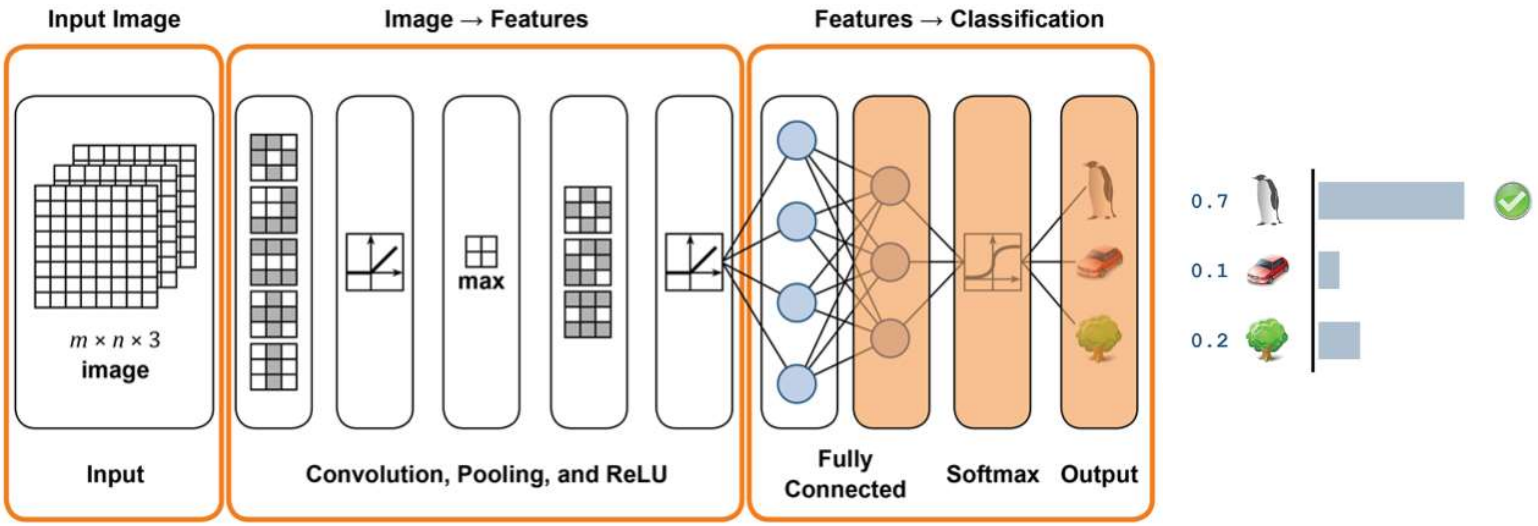
Neural Network



Multilayer Neural Network



ALEXNET

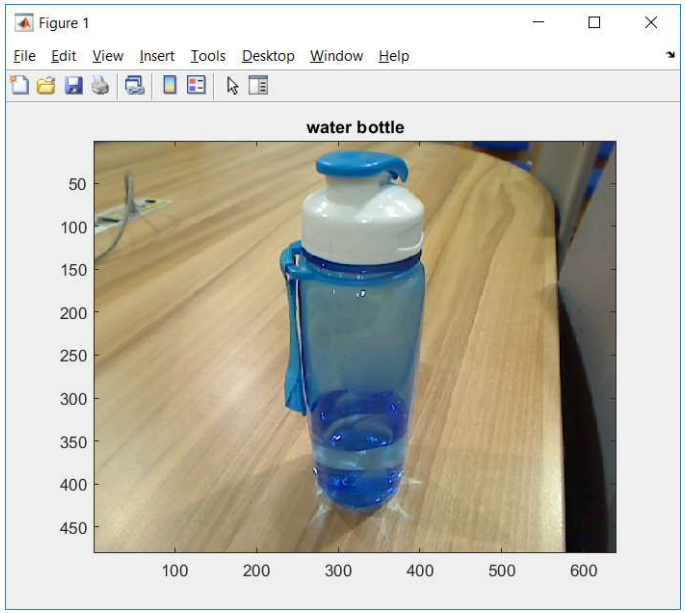

Input Image
Image → Features
Features → Classification
m × n × 3
image
max
Input
Convolution, Pooling, and ReLU
Fully Connected
Softmax
Output
0.7
0.1
0.2

Classification with 11 lines of codes

```
%% Get Webcam
webcaminfo = webcamlist;
vid = webcam(webcaminfo{2});
% preview(vid)

%% Define Alexnet
net = alexnet;

while true
    im = snapshot(vid);
    image(im)
    im = imresize(im,[227 227]);
    label = classify(net,im);
    title(string(label))
    drawnow
end
```




Q&A
When?
Why?
How?
WHAT?
WHERE?
WHEN?
HOW?
WHO?
Where?
What?

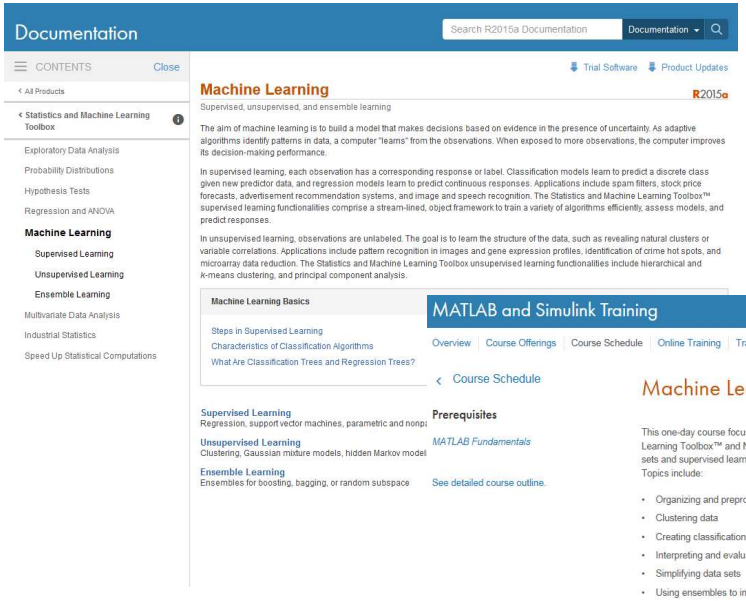
ASCENDAS SYSTEMS

MathWorks

With MATLAB and Simulink, you ARE ready for AI!

Additional Resources

Documentation



mathworks.com/machine-learning

Training

Thank you

See you next time

Supported by

MathWorks

Southeast Asia's sole distributor of

MATLAB® & SIMULINK®