ASCENDAS SYSTEMS

All about Ascendas Systems

Presented by…

Phitcha PHITCHAYANON

6/25/2019

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Enable organisations and businesses with the best tools, products and solutions.
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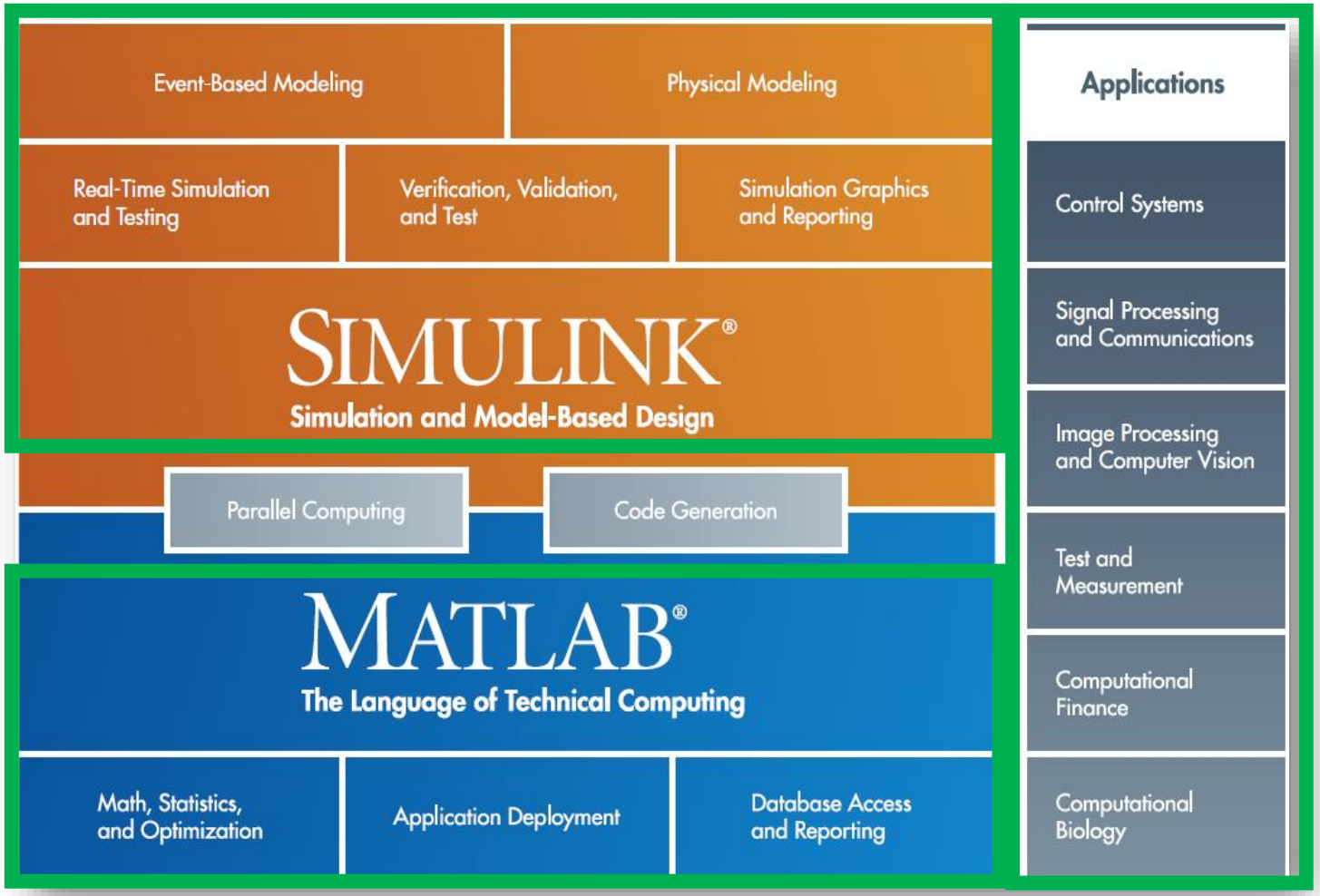
MathWorks Products



MathWorks offers nearly 100 products for technical computing and Model-Based Design. Widely used throughout industry, government and academia, these products are accelerating the pace of discovery, innovation, development, and learning in engineering and science


There is always something for everyone, to experience changes.
Data Analytics
Deep Learning
Internet of Things
Mechatronics
Motor and Power Control
Rapid Prototyping
Hardware in the Loop
Wireless

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Introduction to MATLAB

- Phitcha Phitchayanon
- Application Engineer

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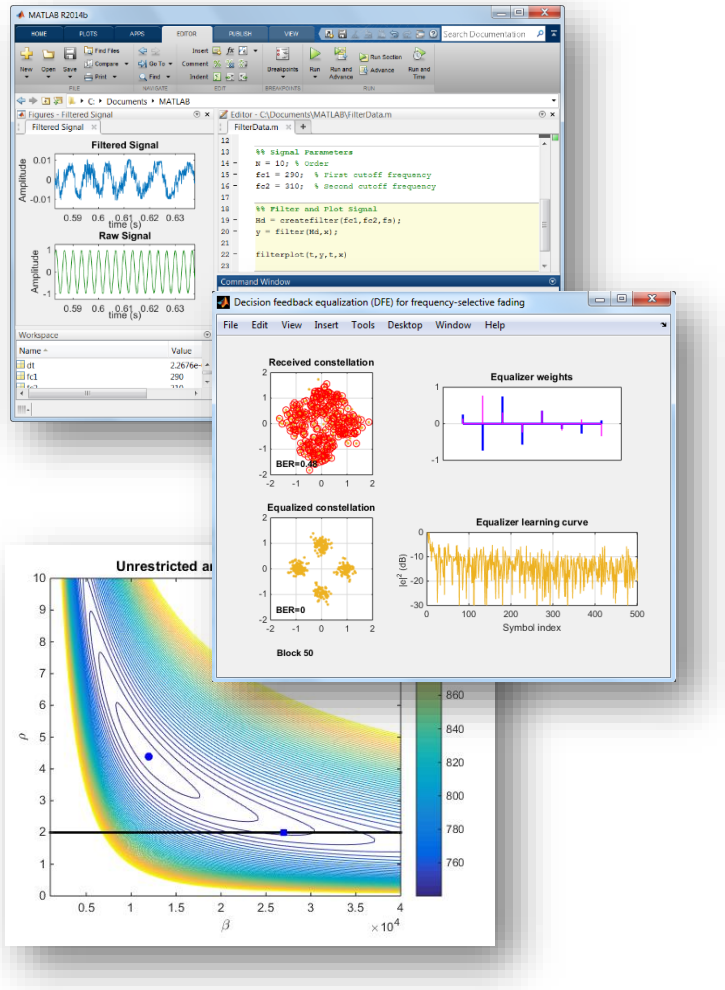
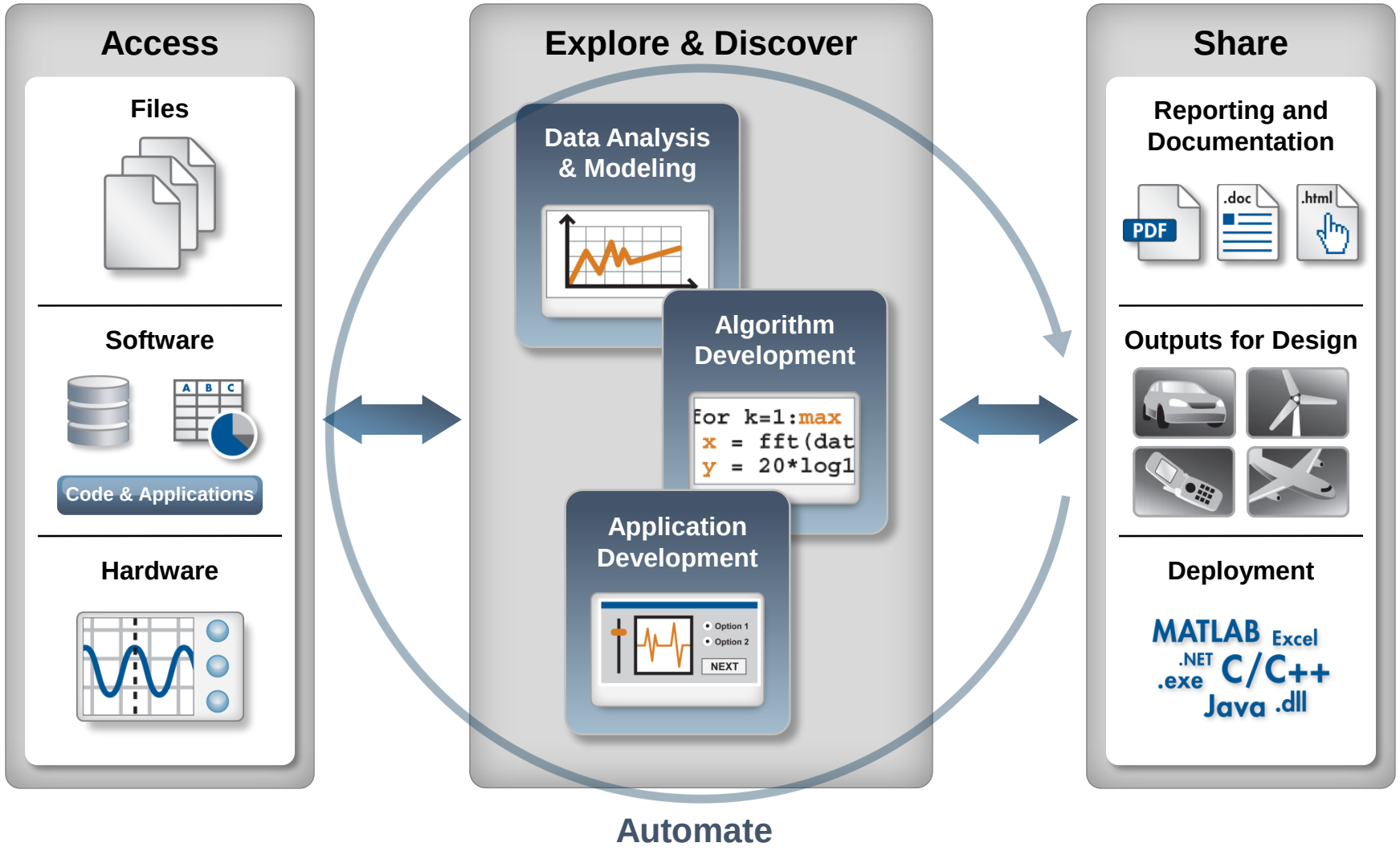
What is MATLAB?

- High-level language
- Interactive development environment
- Used for:
  - Numerical computation
  - Data analysis and visualization
  - Algorithm development and programming
  - Application development and deployment

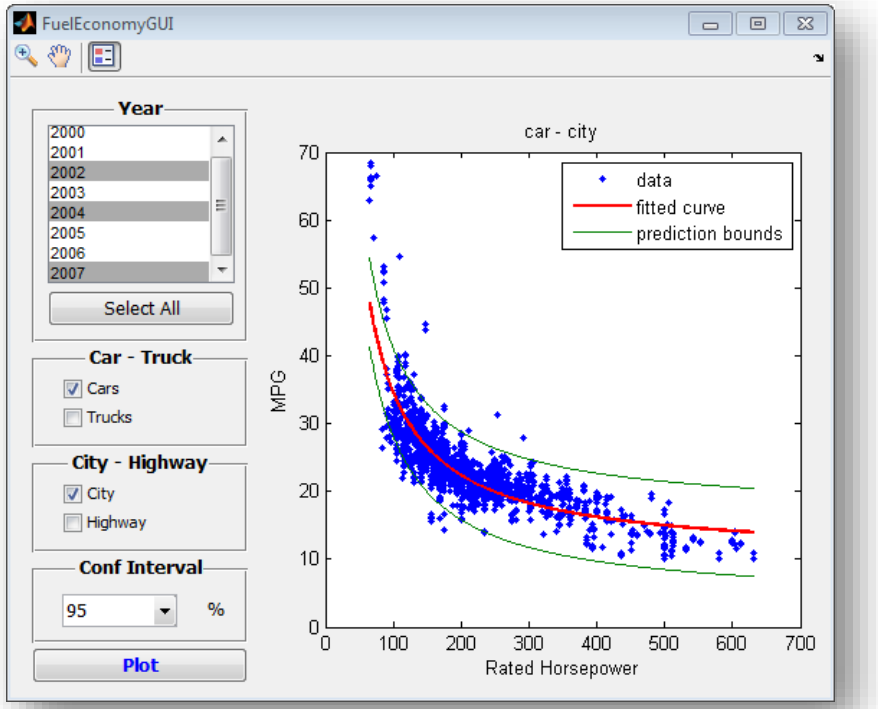


Technical Computing Workflow



Demo: Fuel Economy Analysis

- Goal:
  - Study the relationships between fuel economy, horsepower, and type of vehicle
- Approach:
  - Access data from Excel
  - Interactively visualize and explore trends
  - Create a model
  - Document results



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Go to MATLAB

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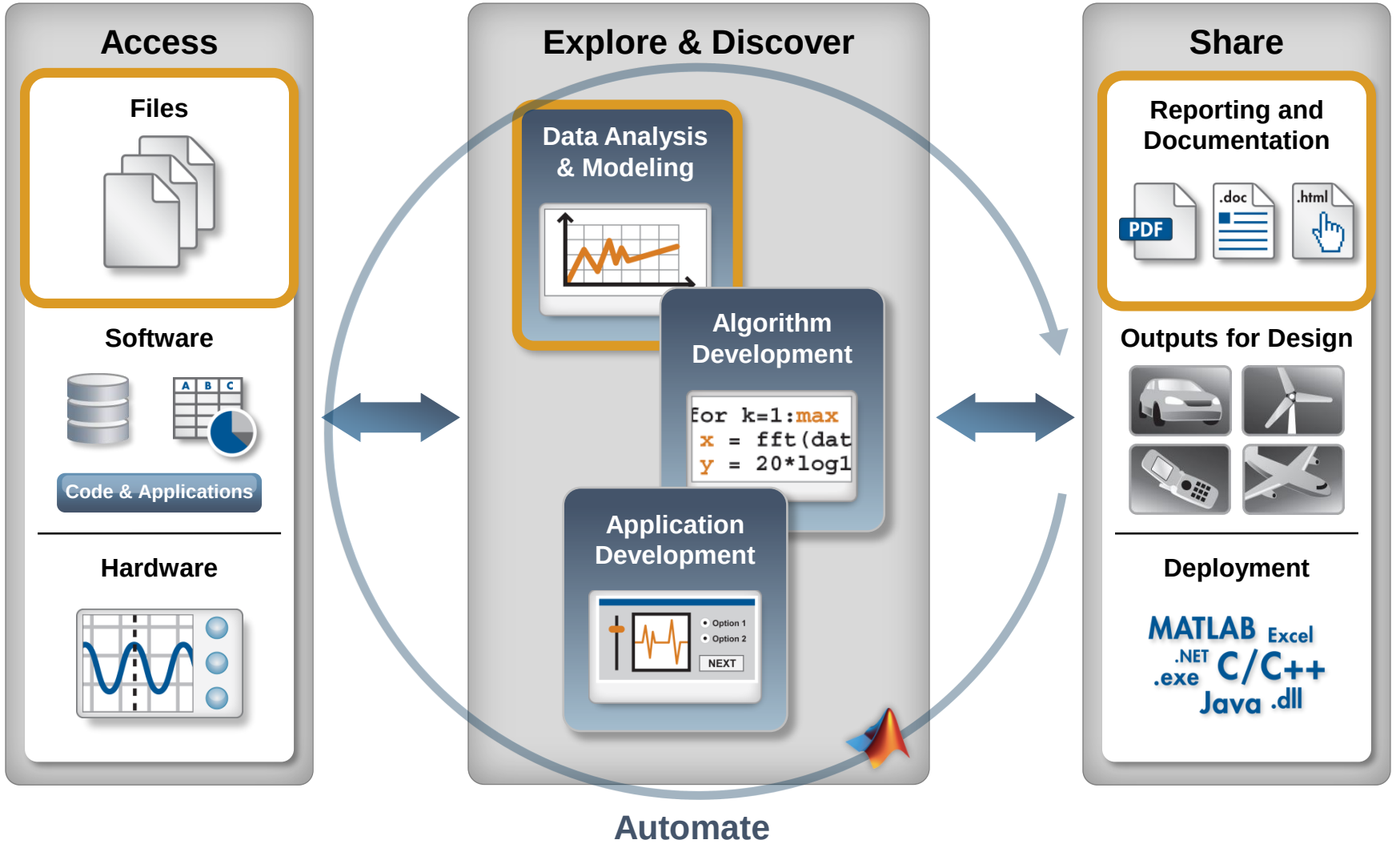
Demo: Fuel Economy Analysis

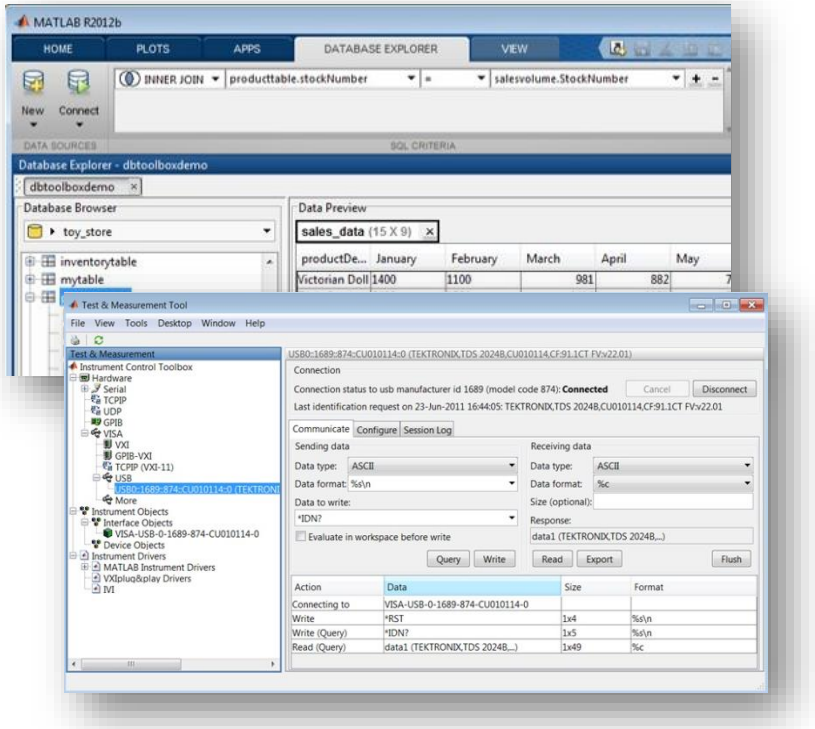
Products Used
- MATLAB
- Statistics and Machine Learning Toolbox
- Curve Fitting Toolbox



Accessing Data from MATLAB

Access | Explore & Discover | Share

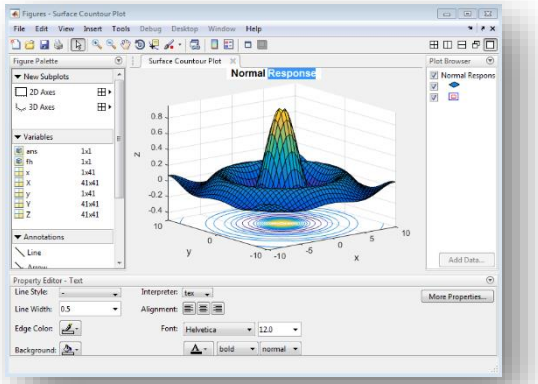
- Files
  - Excel, text, or binary
  - Audio and video, image
  - Scientific formats and XML
- Applications and languages
  - C/C++, Java, FORTRAN
  - COM, .NET, shared libraries
  - Databases
    (*Database Toolbox*)
- Measurement hardware
  - Data acquisition hardware
    (Data Acquisition Toolbox)
  - Stand-alone instruments and devices
    (Instrument Control Toolbox)



Data Analysis and Visualization in MATLAB

Access | **Explore & Discover** | Share

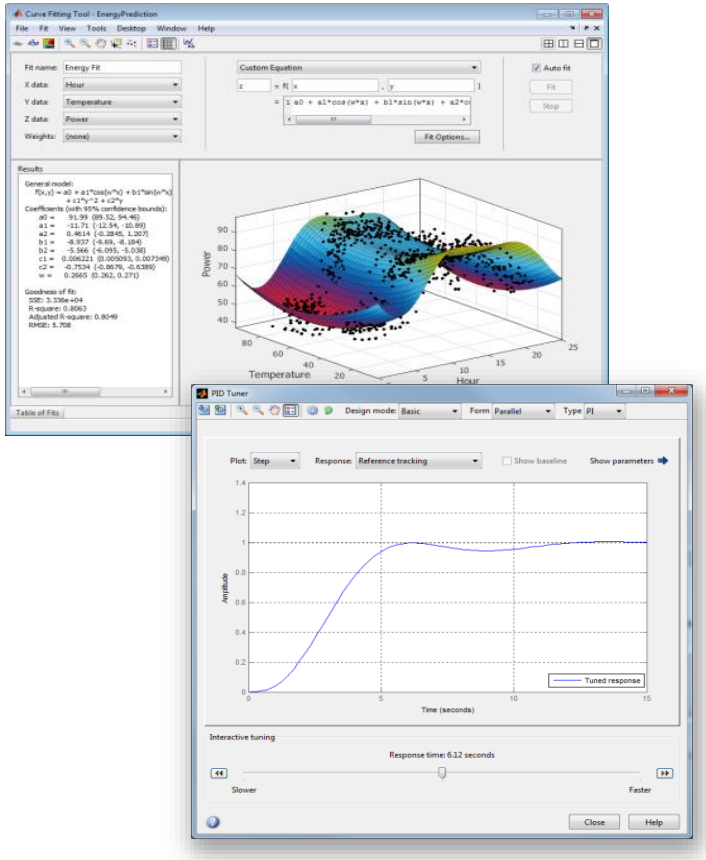
- Built-in engineering and mathematical functions
  - Interpolation, filtering, smoothing, Fourier analysis
- Extensive plotting capabilities
  - 2-D, 3-D, and volume visualization
  - Tools for creating custom plots



Expanding the Capabilities of MATLAB

Access | **Explore & Discover** | Share

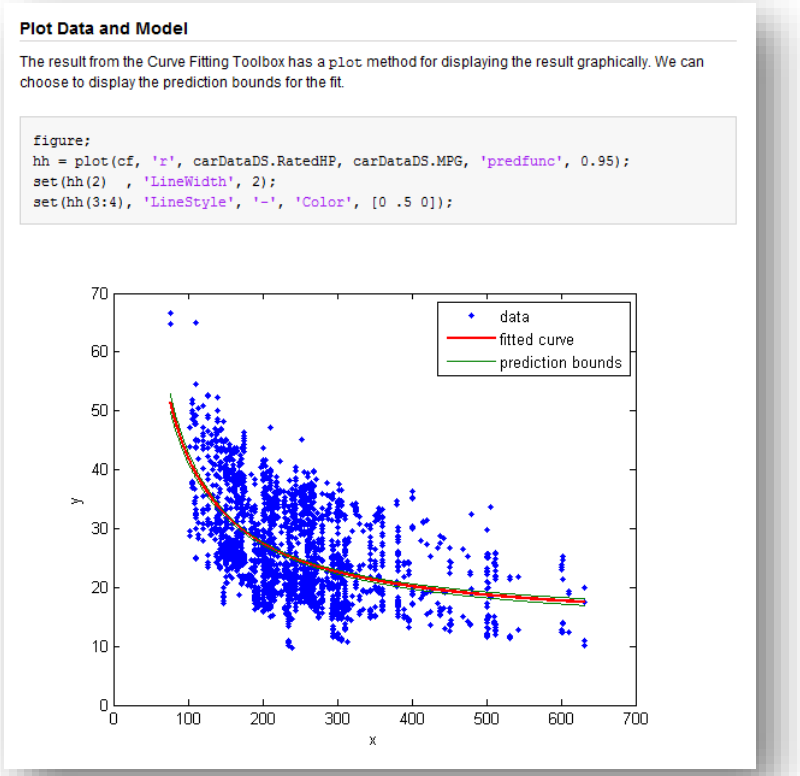
- MathWorks add-on tools for:
  - Math, statistics, and optimization
  - Control system design and analysis
  - Signal processing and communications
  - Image processing and computer vision
  - Parallel computing and more…
- Partner products provide:
  - Additional interfaces
  - Domain-specific analysis
  - Support for niche applications



Sharing Results from MATLAB

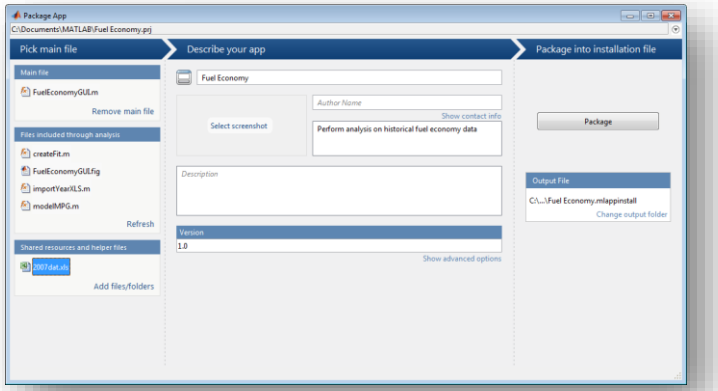
Access | Explore & Discover | **Share**

- Automatically generate reports
  - Publish MATLAB files
  - Customize reports using MATLAB Report Generator
- Package as an app or a custom toolbox
- Deploy applications to other environments



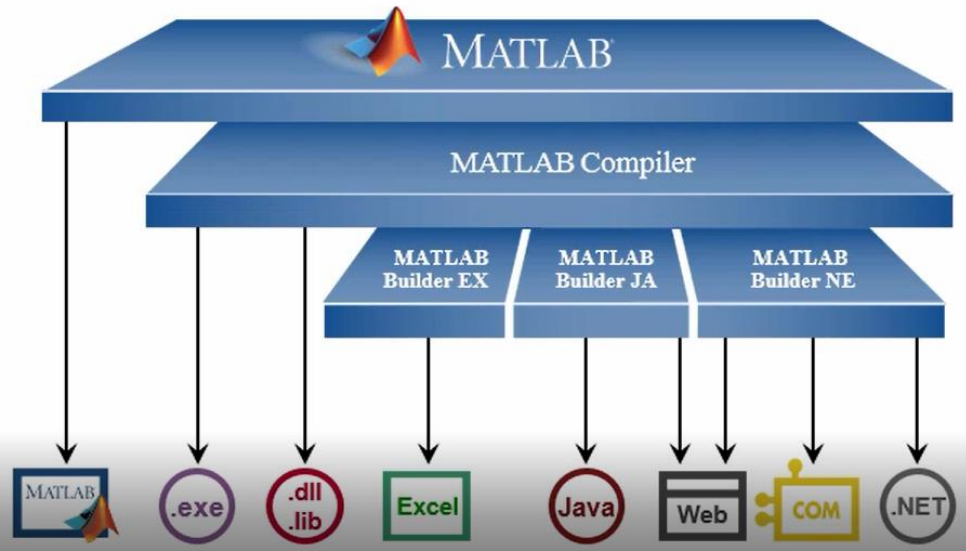
Packaging and Sharing MATLAB Apps

- MATLAB apps
  - Interactive applications to perform technical computing tasks
  - Displayed in apps gallery
- Included in many MATLAB products
- Package your own app
  - Create single file for distribution and installation into gallery
  - Packaging tool:
    - Automatically includes all necessary files
    - Documents required products

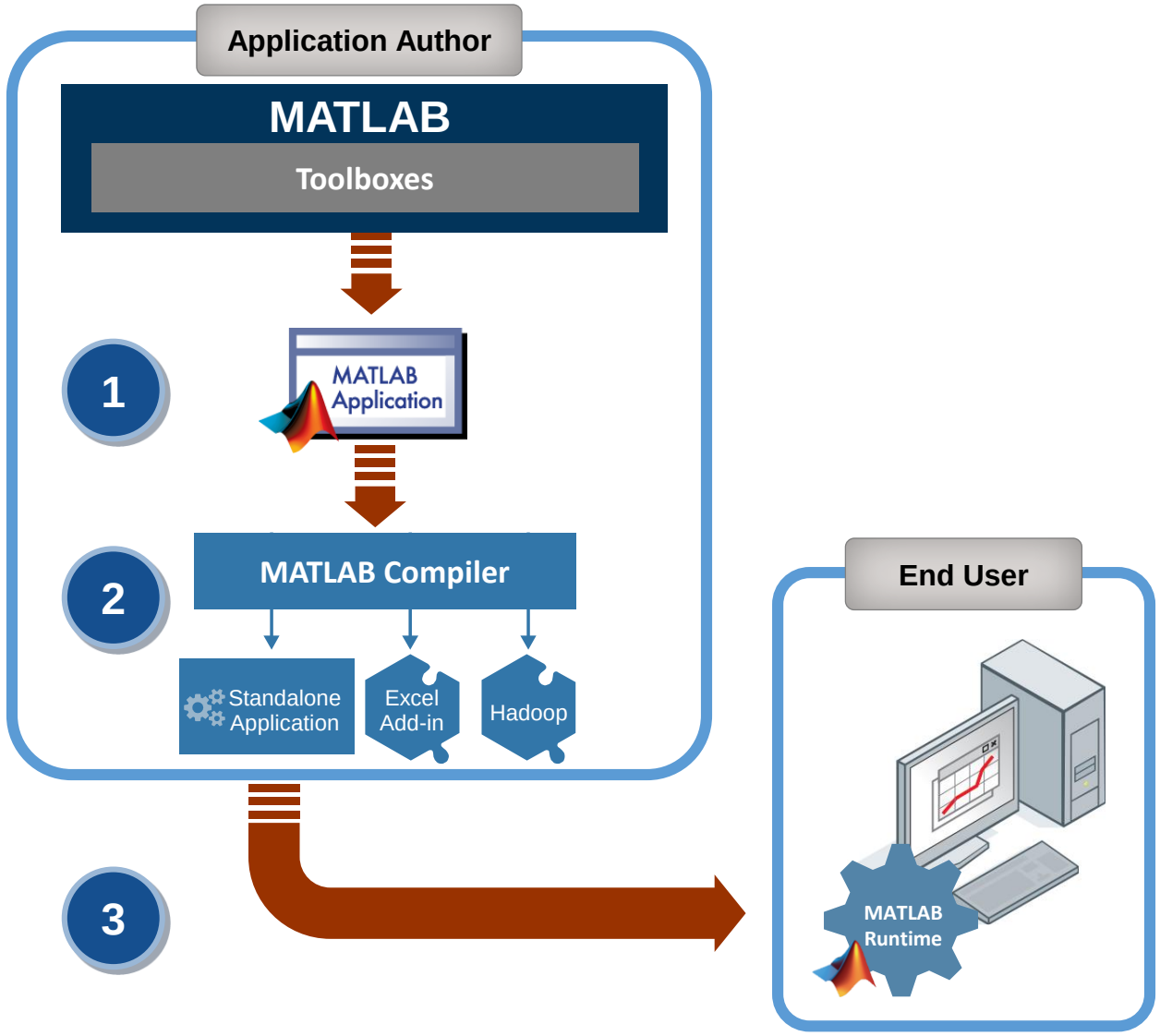


Deploying Applications with MATLAB

- Give MATLAB code to other users
  - MATLAB apps
  - MATLAB files
- Share applications with end users who do not need MATLAB
  - Stand-alone executables
  - Shared libraries
  - Software components

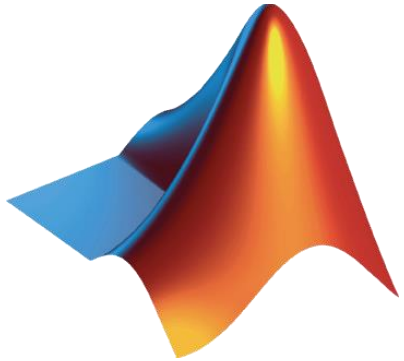


Sharing Standalone Applications



Using MATLAB

- High-level language
  - Native support for vector and matrix operations
  - Built-in math and visualization functions



- Development environment
  - Interactive and easy to get started
  - Ideal for iterative exploration and design

- Technical computing platform
  - Add-on products for a range of application areas
    (e.g., signal processing and communications, image and video processing, control systems, test and measurement)

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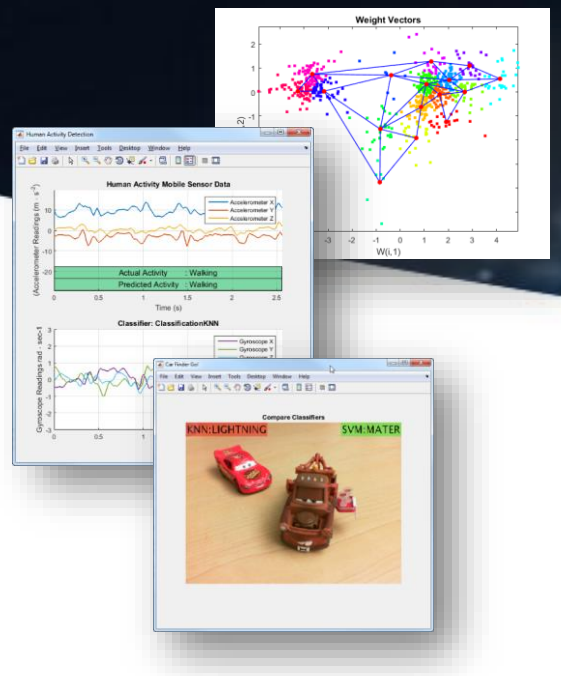
Machine Learning & Deep Learning with MATLAB



- **James Ang**
- Principal Applications Engineer
- ***james.ang@techsource-asia.com***

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Agenda

Introduction to Machine Learning

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

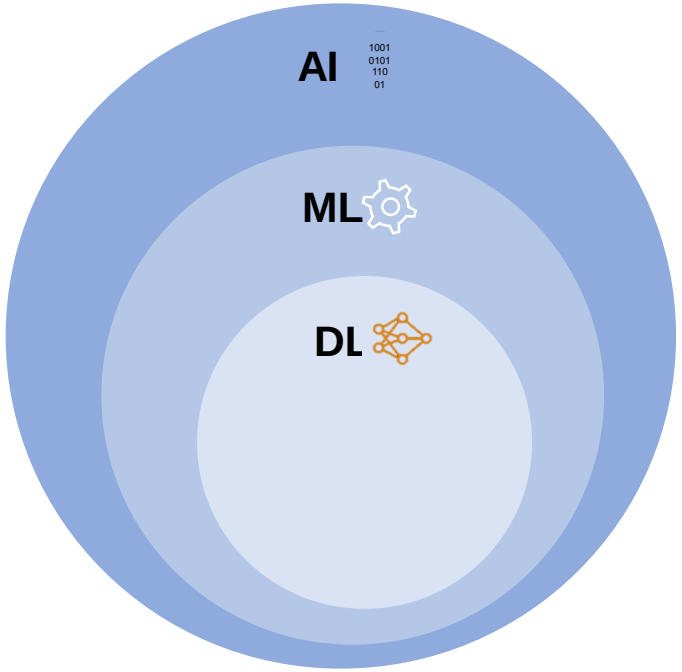
Introduction to Deep Learning

- 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)



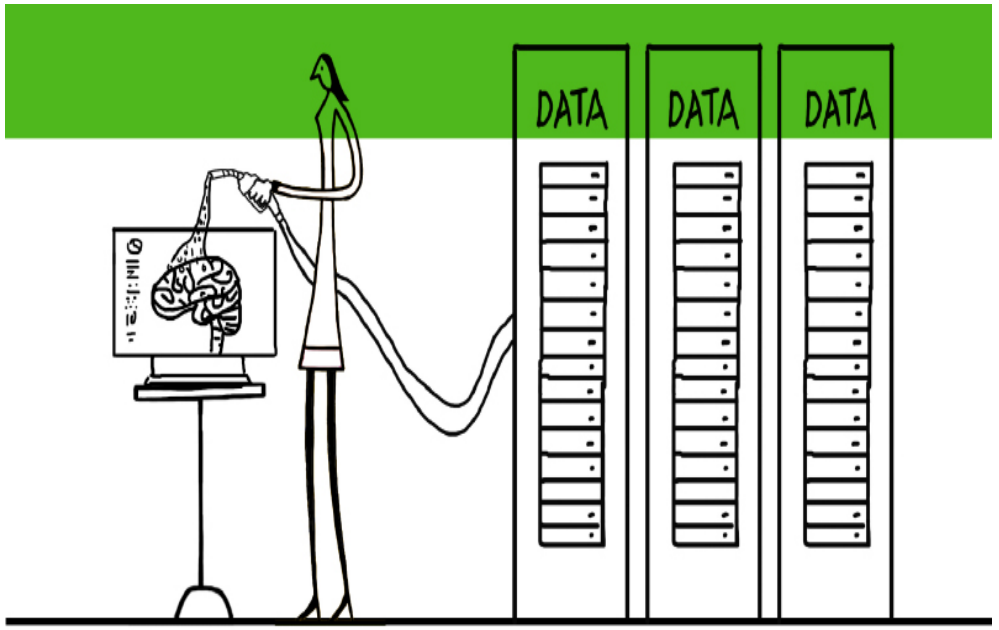
The **simulated intelligence** that tries to mimic human actions or decision making.

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

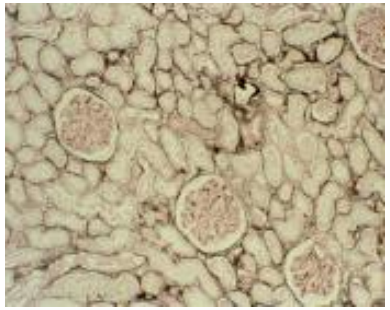
Most common tool for Data analytics modelling



Use features in the data and to create a predictive model

Used Across many Application Areas

Biology

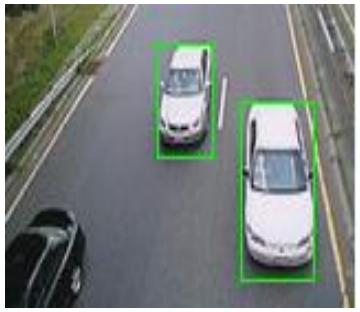


Tumor Detection, Drug Discovery

Agriculture

Predictive Maintenance & Forecasting

Image & Video Processing



Pattern Recognition

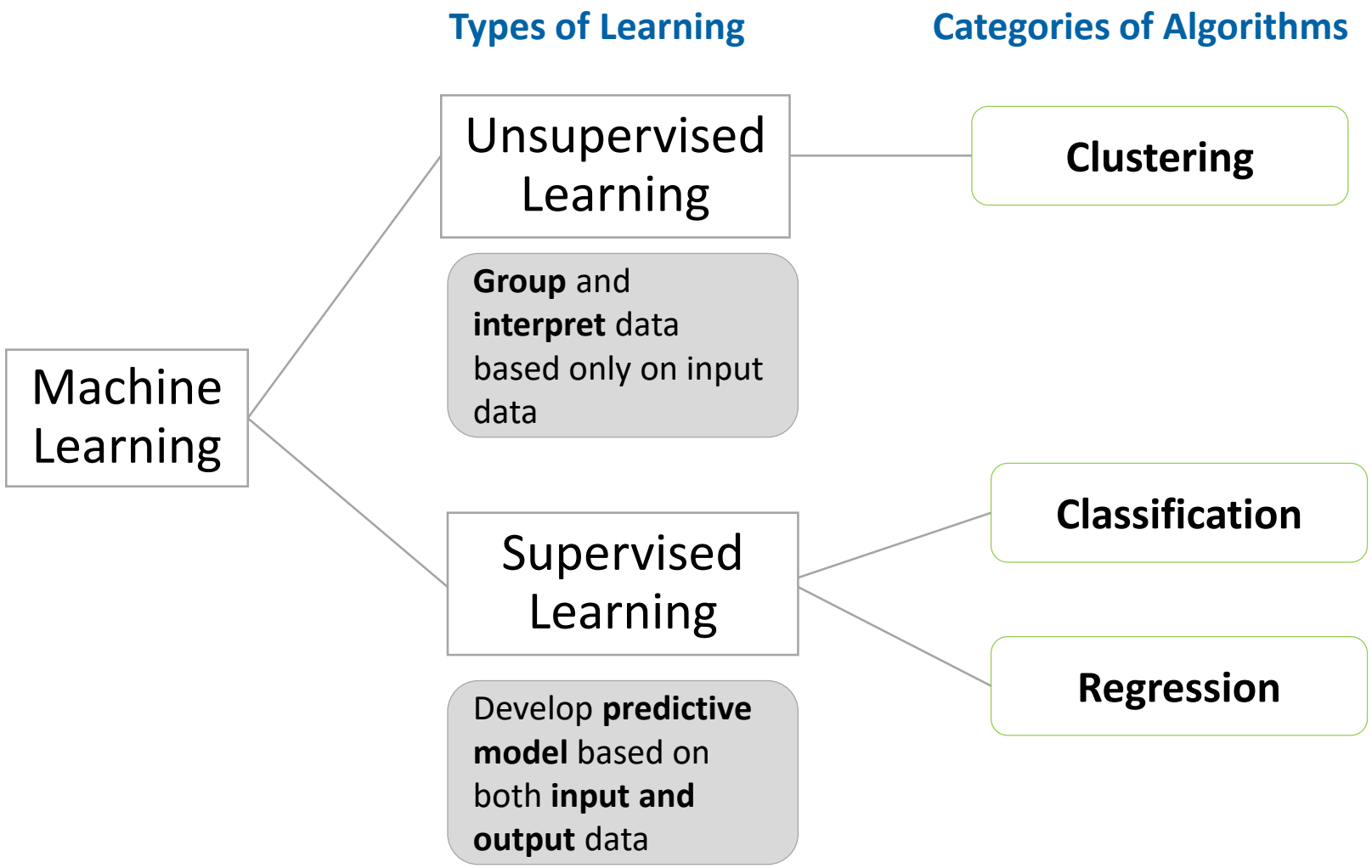
Energy

Load, Price Forecasting, Trading

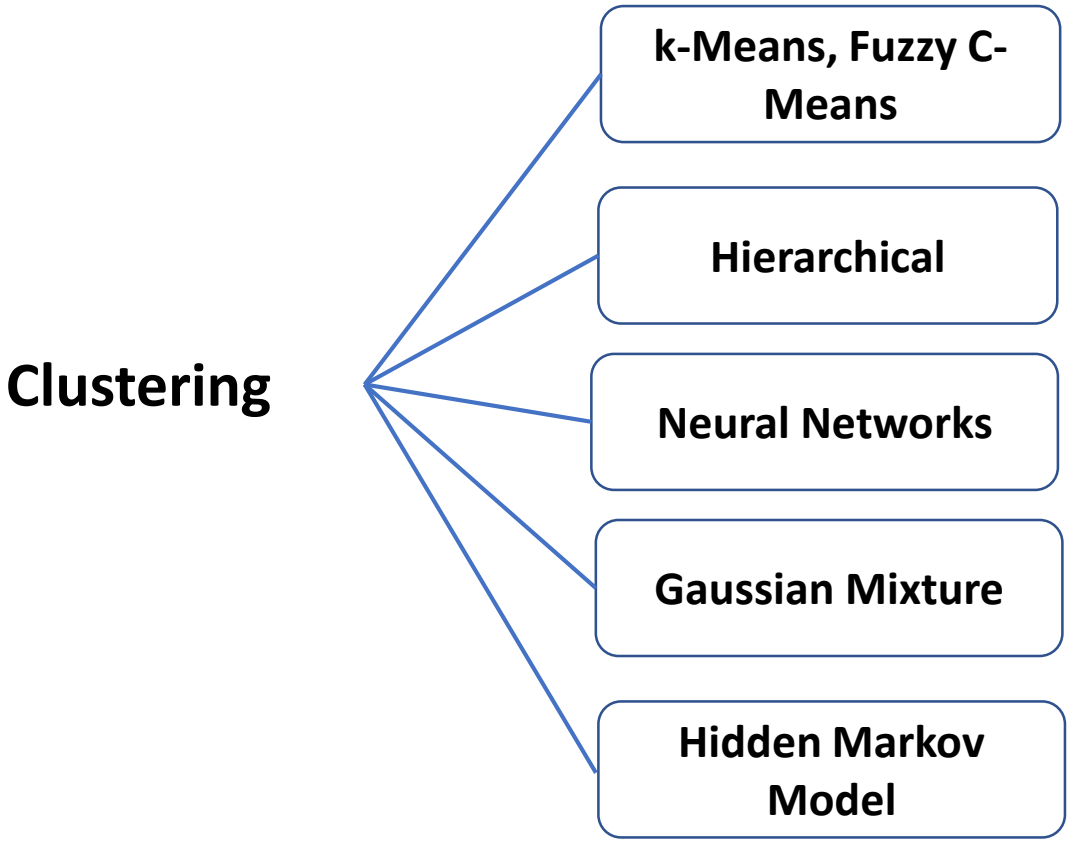
Motivation for Machine Learning

- 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

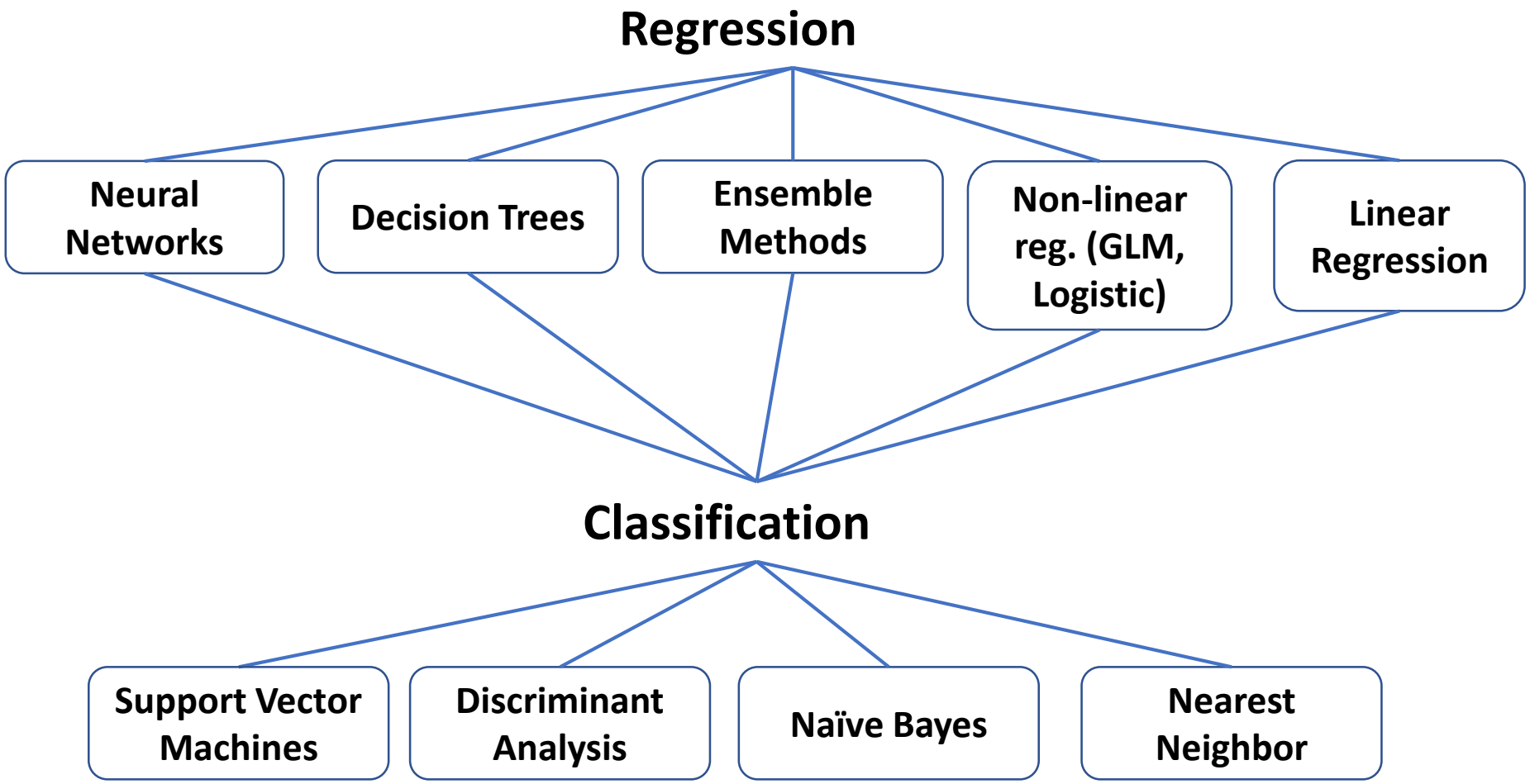
Overview – Machine Learning



Unsupervised Learning

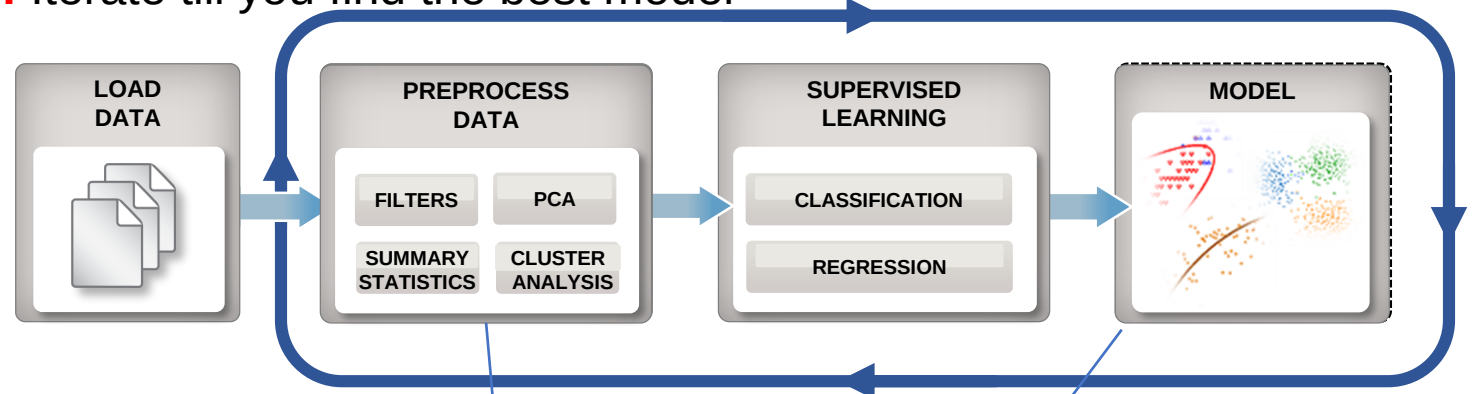


Supervised Learning

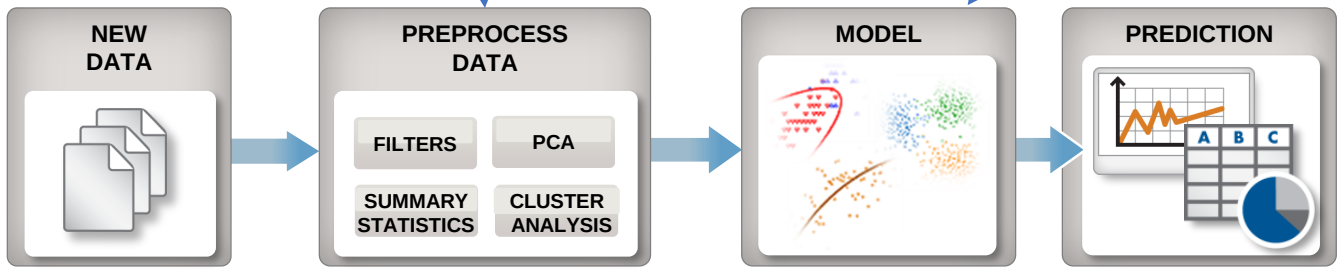


Supervised Learning Workflow

Train: Iterate till you find the best model



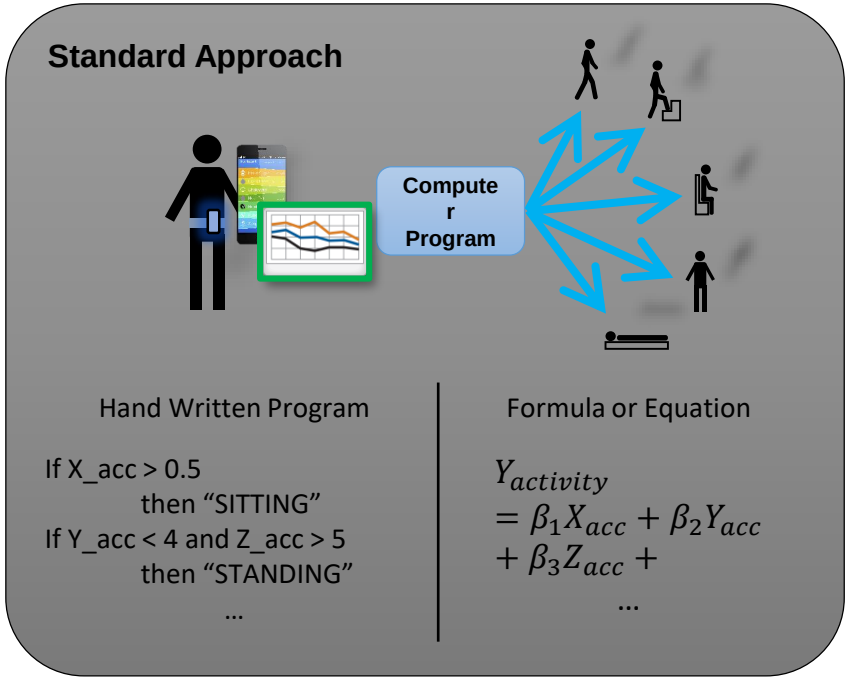
Predict: Integrate trained models into applications

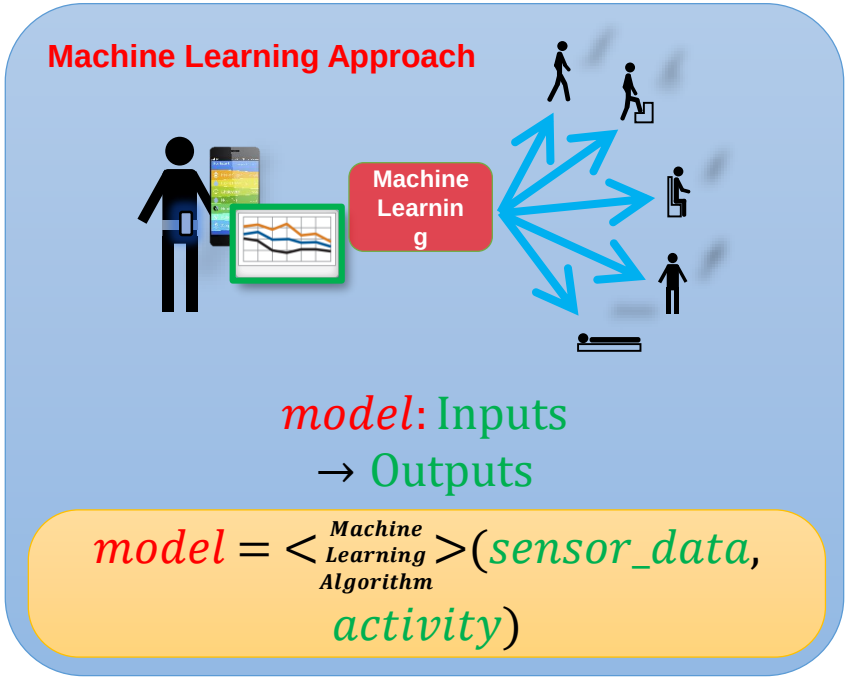


Machine Learning

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

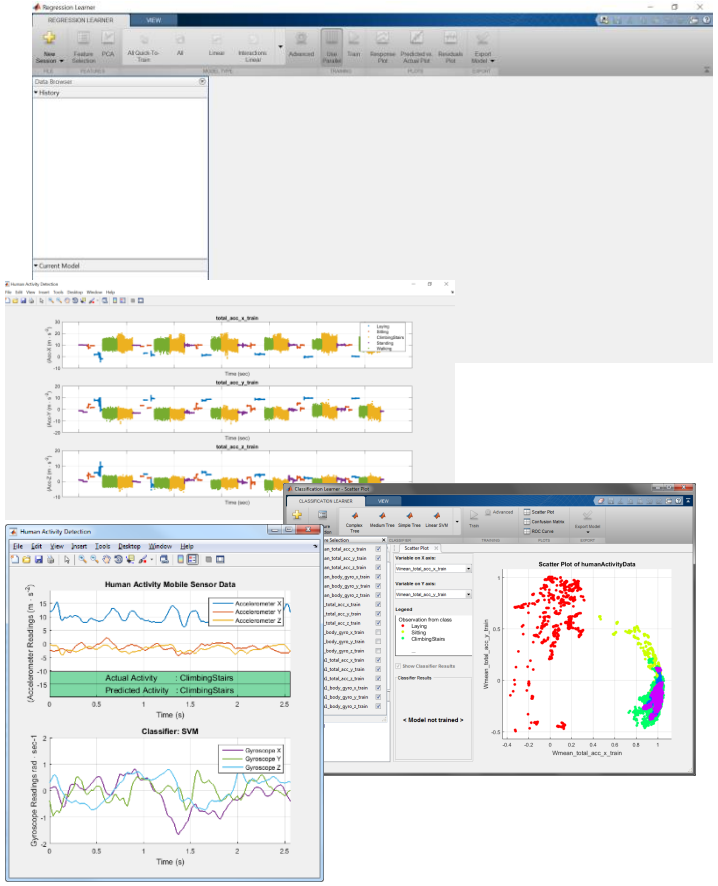
Objective: Train a classifier to classify human activity from sensor data

Data:

Predictors	3-AxialAccelerometer and Gyroscope 
Response	Activity: 

Approach:

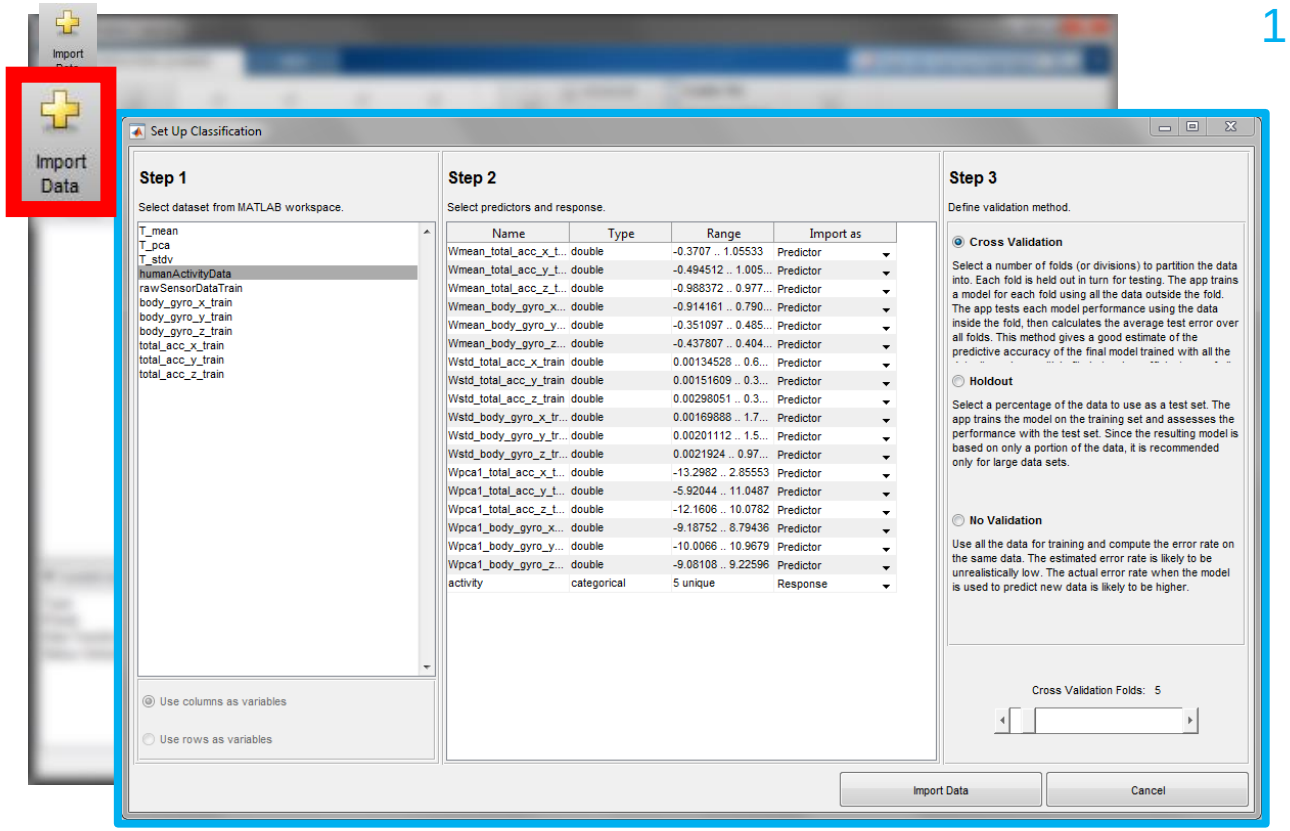
- Extract features from raw sensor signals
- Train and compare classifiers
- Test results on new sensor data



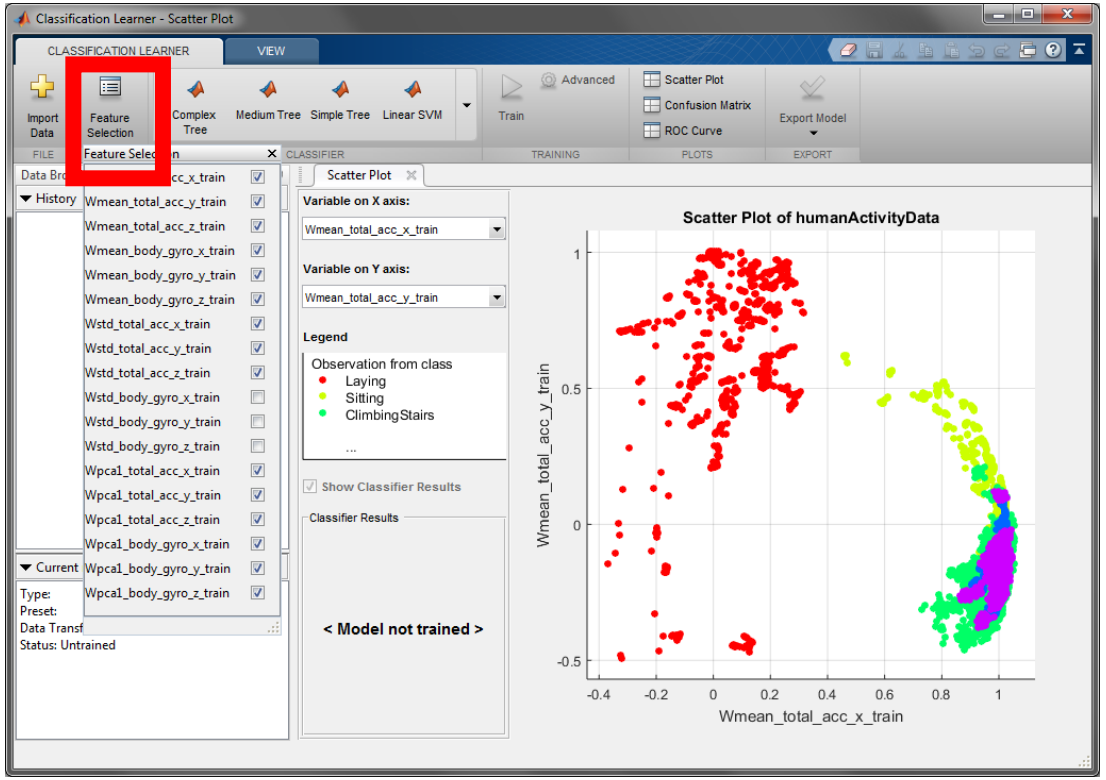
Train a Model with the Classification Learner App

Classification Learner App with data:
Step 1

1. Data import and Cross-validation setup



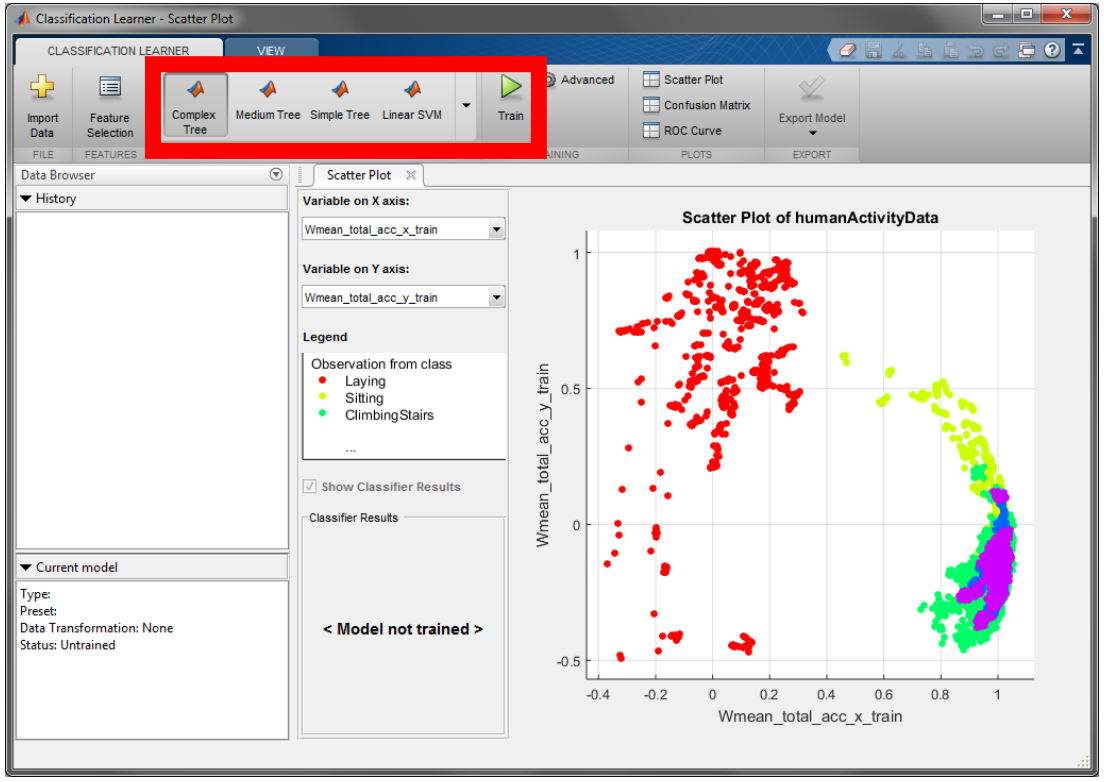
Train a Model with Classification Learner App



Classification Learner App with data:
Step 2

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

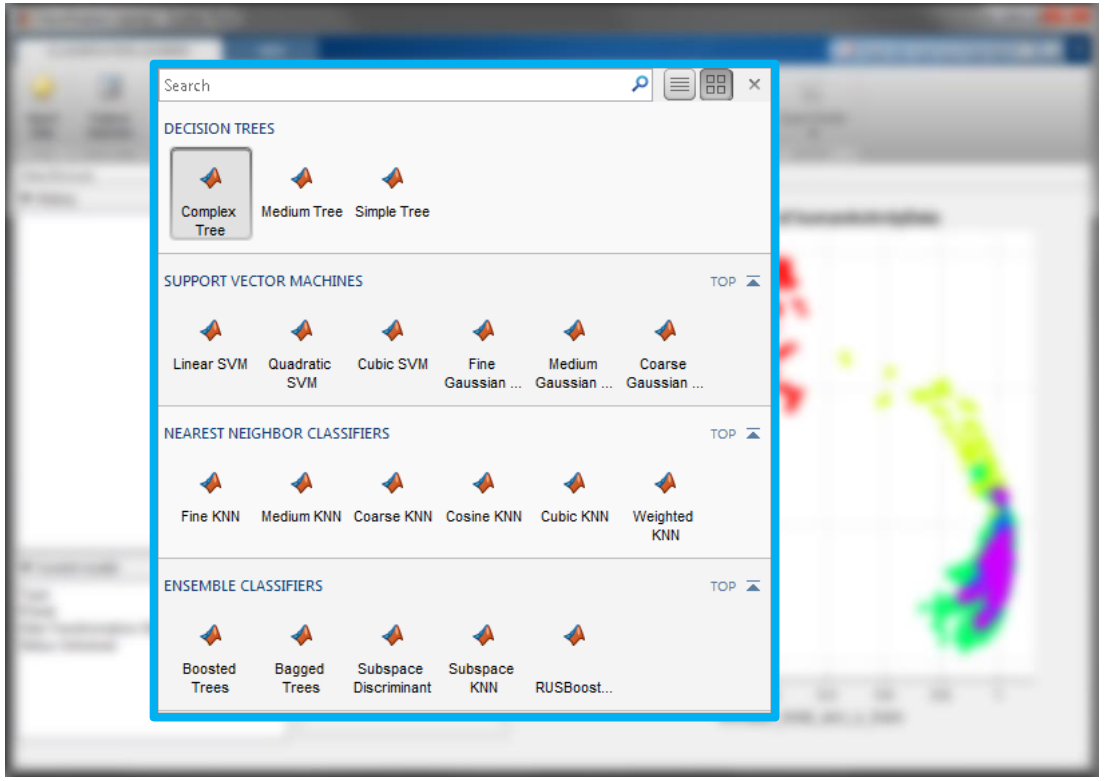
Train a Model with the Classification Learner App



Classification Learner App with data:
Step 3

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

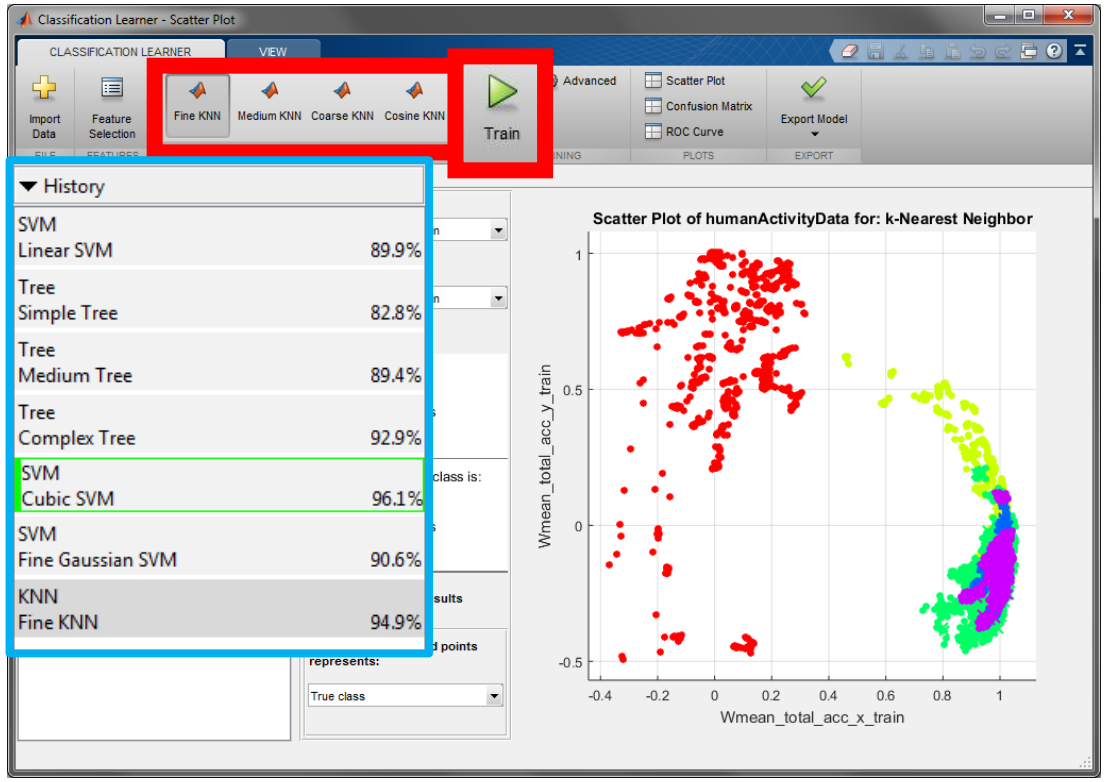
Train a Model with Classification Learner App



Classification Learner App with data:
Step 3 cont…

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

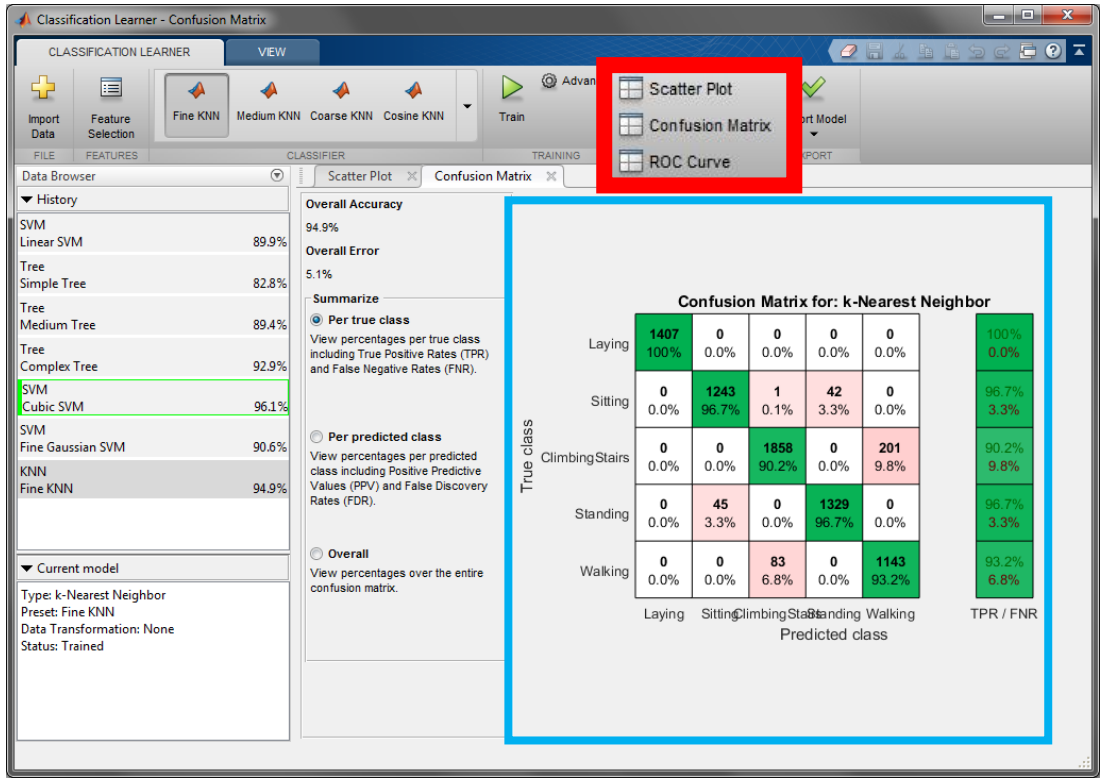
Train a Model with the Classification Learner App



Classification Learner App with data:
Step 3 cont…

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

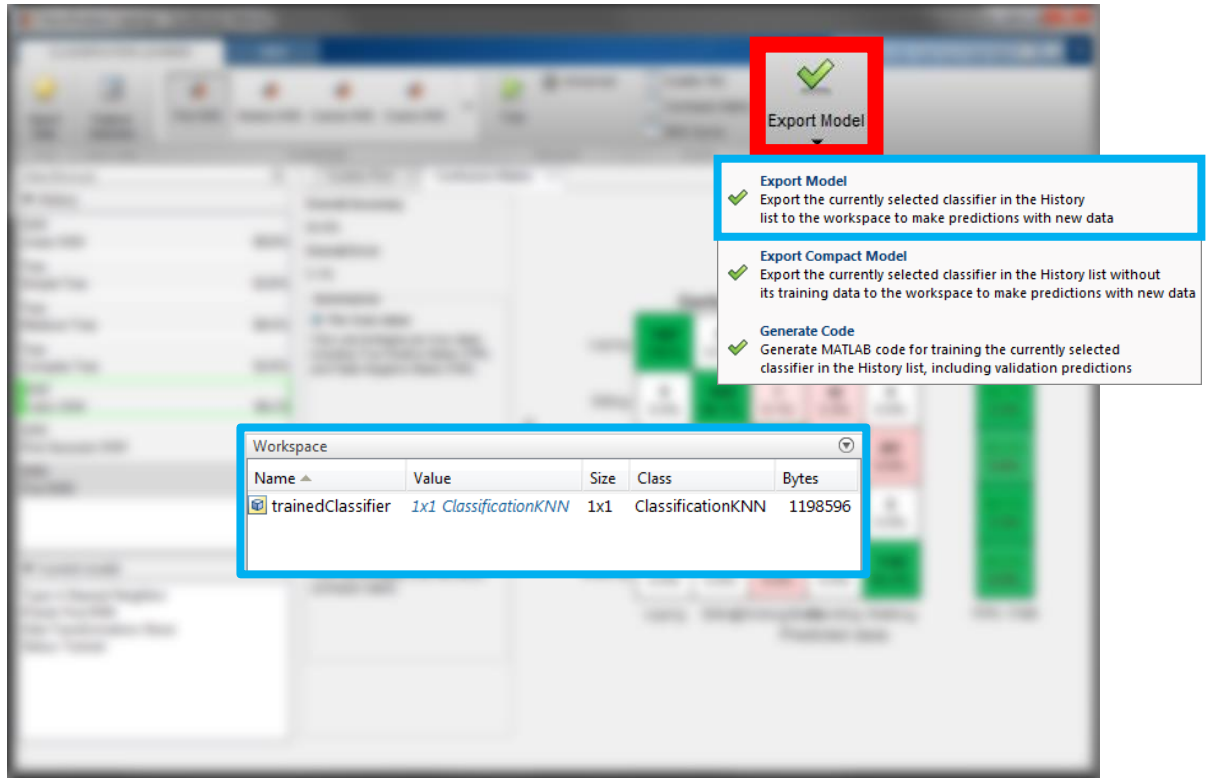
Train a Model with the Classification Learner App



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

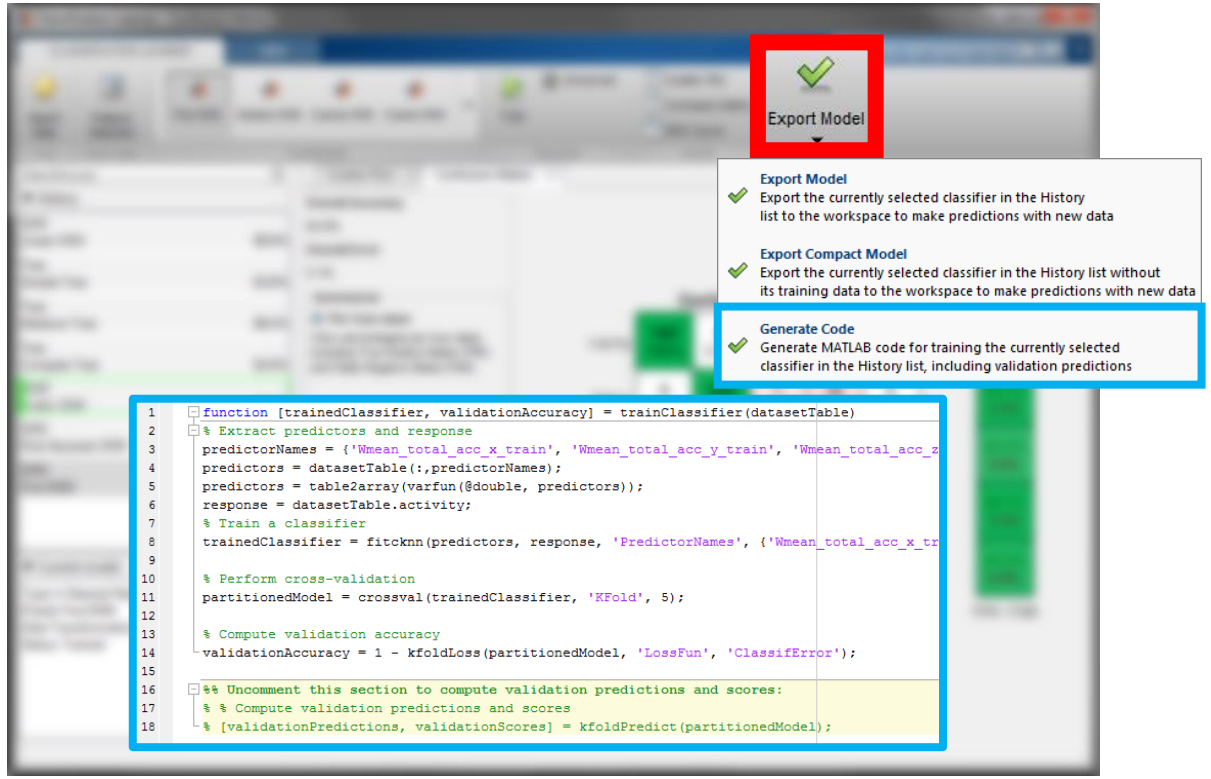
Train a Model with Classification Learner App



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…

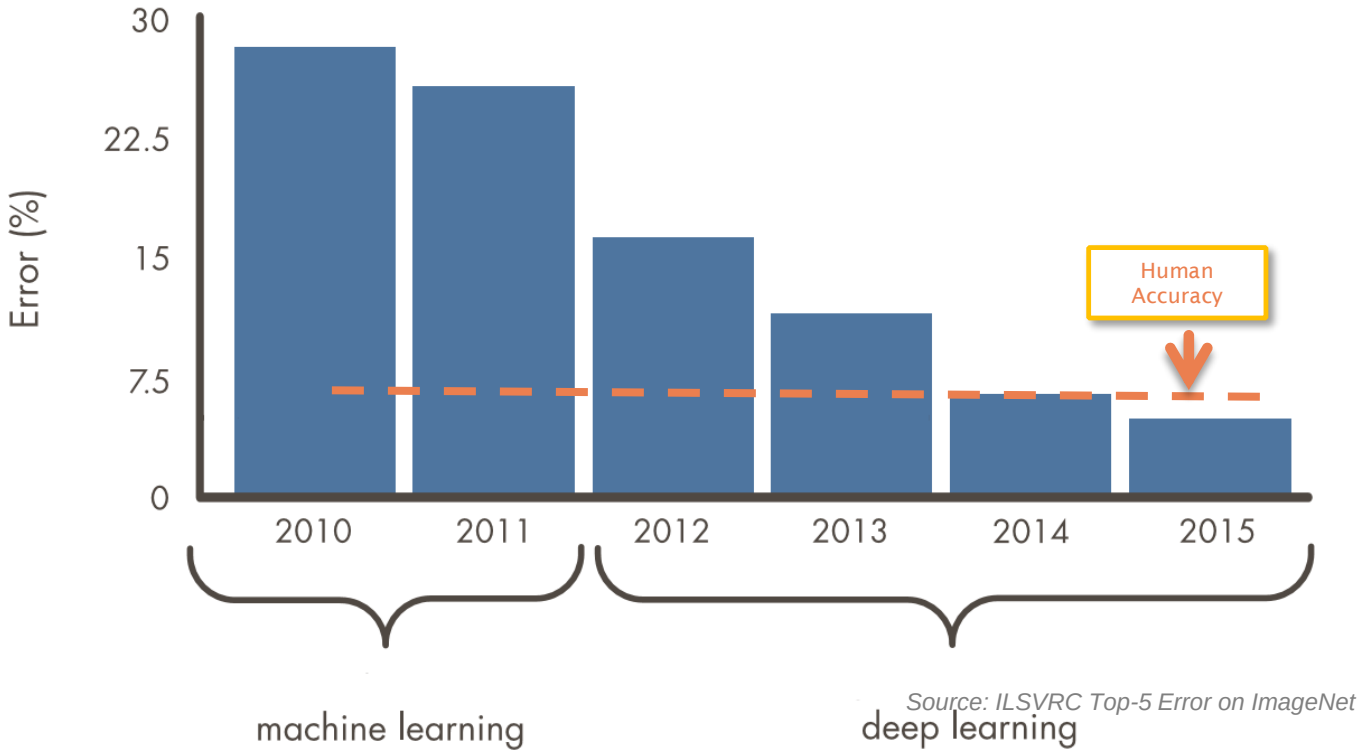
1. Data import and Cross-validation setup
2. Data exploration and feature selection
3. Train multiple models
4. Model comparison and assessment
5. Share model or automate process

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.**

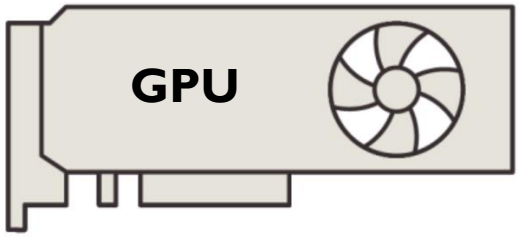
Why is Deep Learning So Popular Now?

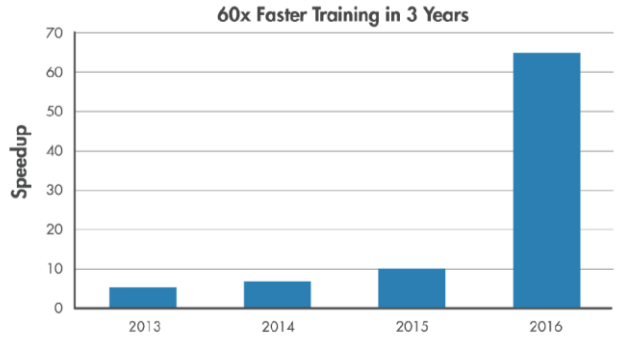


Source: ILSVRC Top-5 Error on ImageNet

Factors promoting Deep Learning

High-Performance Computing





Big Data

AlexNet PRETRAINED MODEL

VGG-16 PRETRAINED MODEL

ResNet-50 PRETRAINED MODEL

ResNet-101 PRETRAINED MODEL

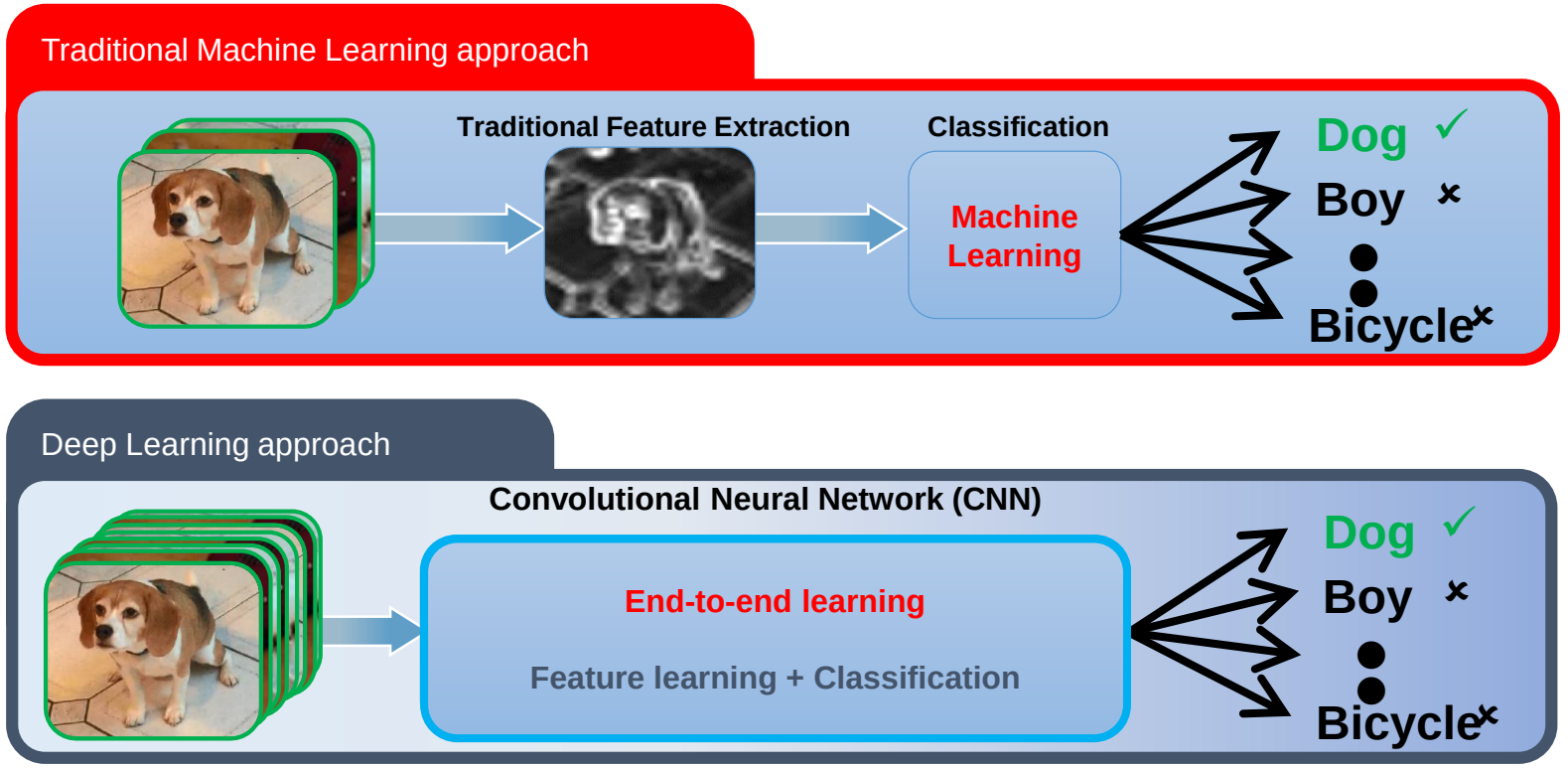
Caffe IMPORTER

GoogLeNet PRETRAINED MODEL

TensorFlow-Keras IMPORTER

Inception-v3 MODELS

Machine Learning vs Deep Learning

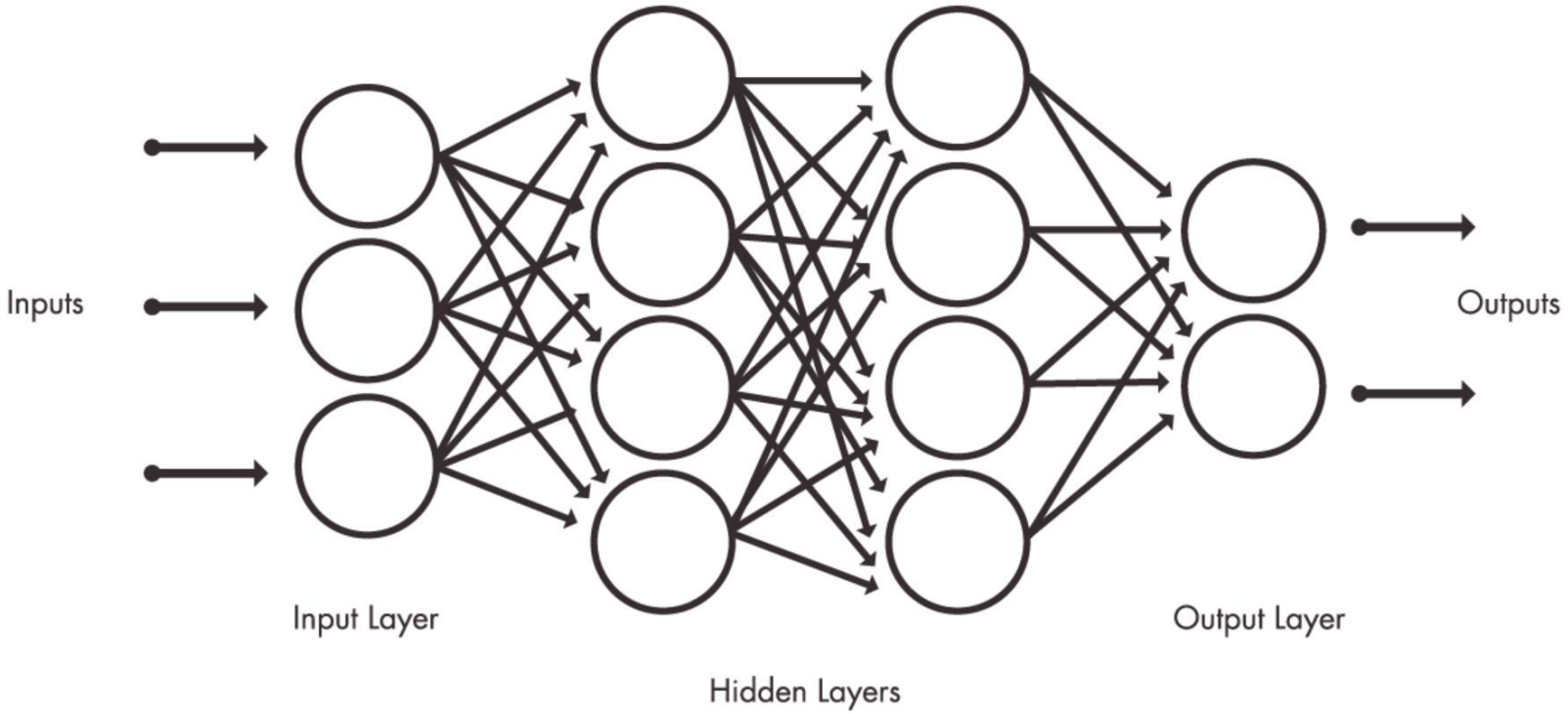


Machine Learning vs Deep Learning

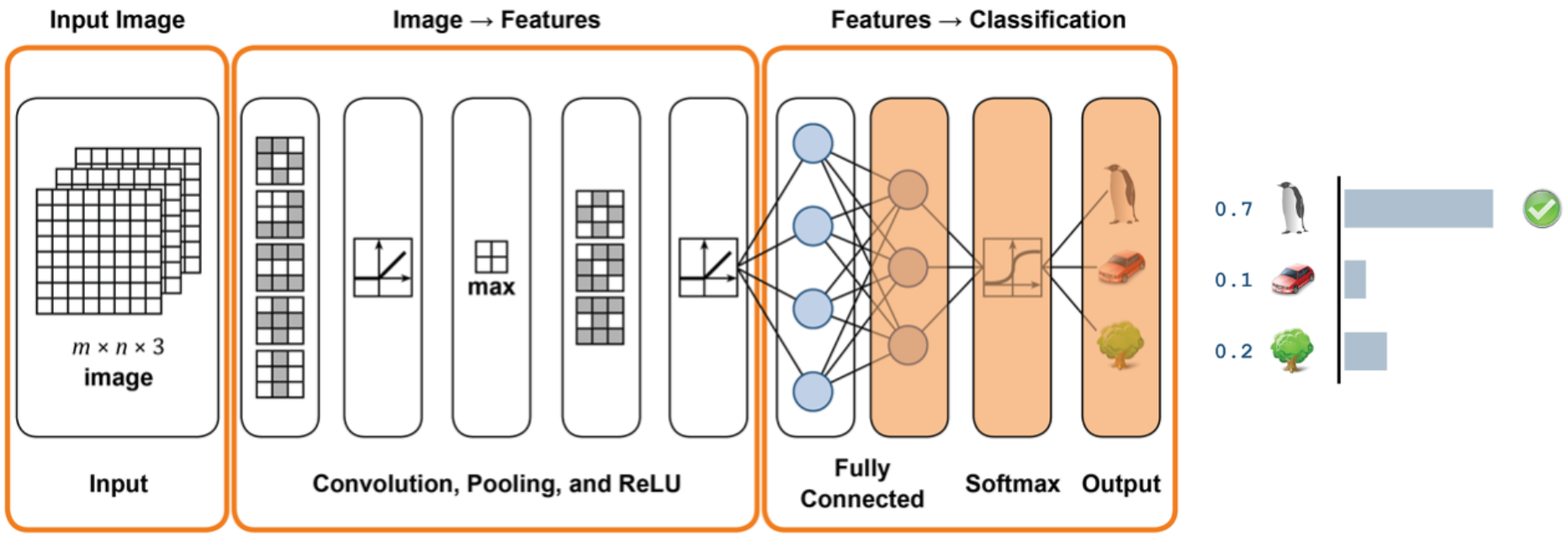
Question: Machine Learning or Deep Learning?

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

Multilayer Neural Network

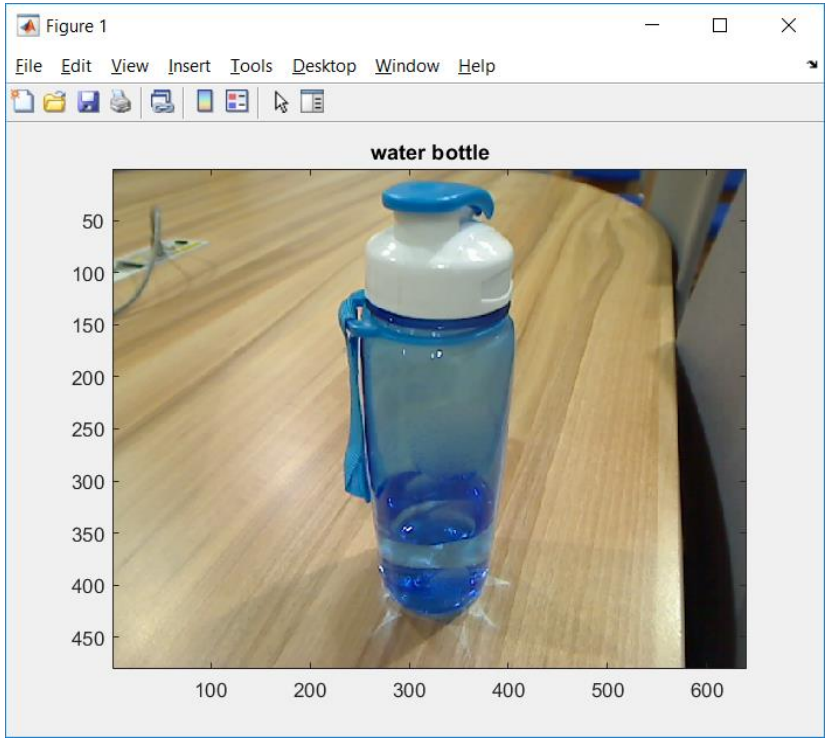


ALEXNET


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

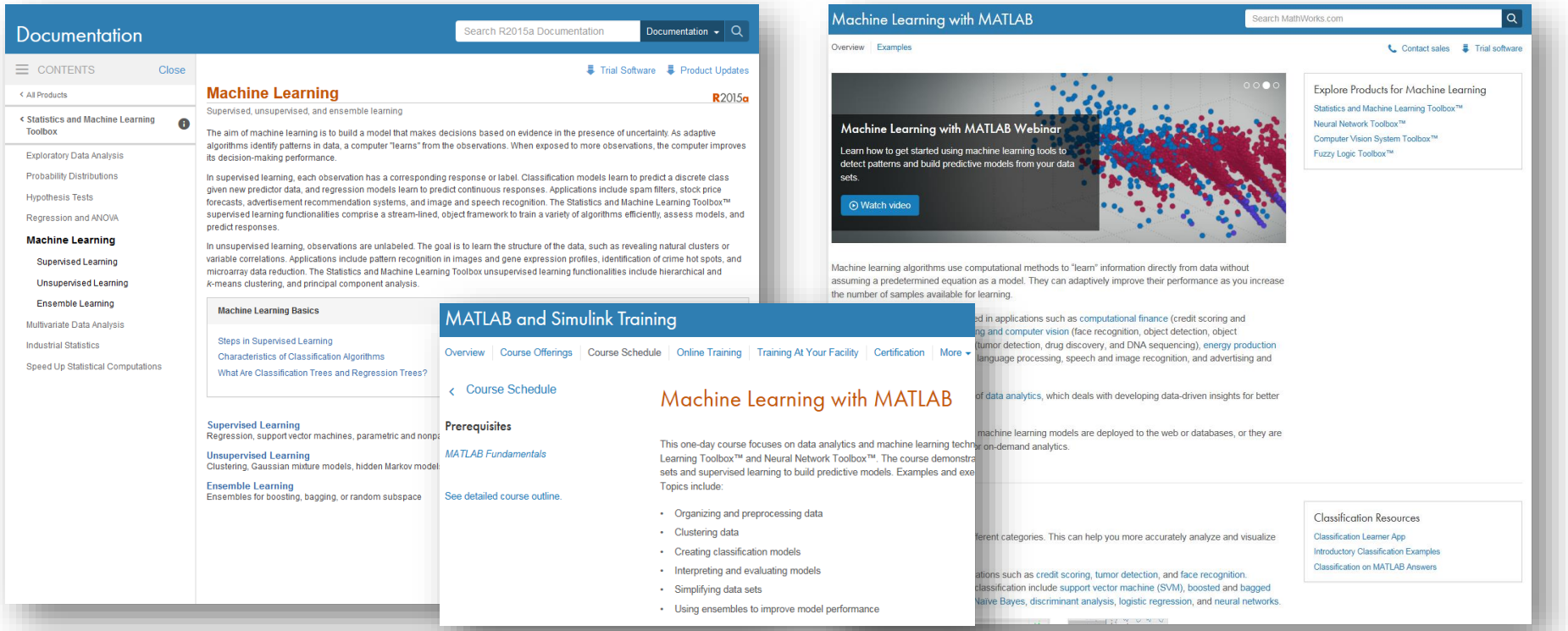
```
%% Get Webcam
webcaminfo = webcamlist;
vid = webcam(webcaminfo{2});
% preview(vid)

%% 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
```



Additional Resources

Documentation

mathworks.com/machine-learning



Training

ASCENDAS SYSTEMS

Introduction to Simulink

- Phitcha Phitchayanon
- Application Engineer

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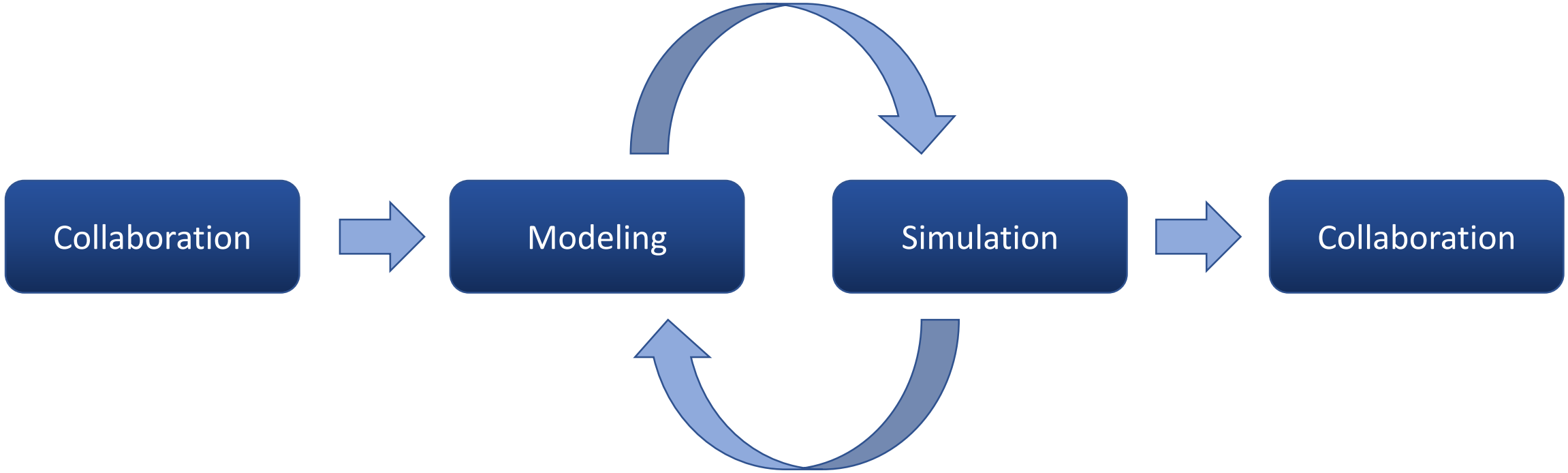
Working with Simulink



1. Tips for model navigation and editing
2. Model simulation, analysis and debugging during and after simulation.
3. Model management and collaborative development tools

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Thank you

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