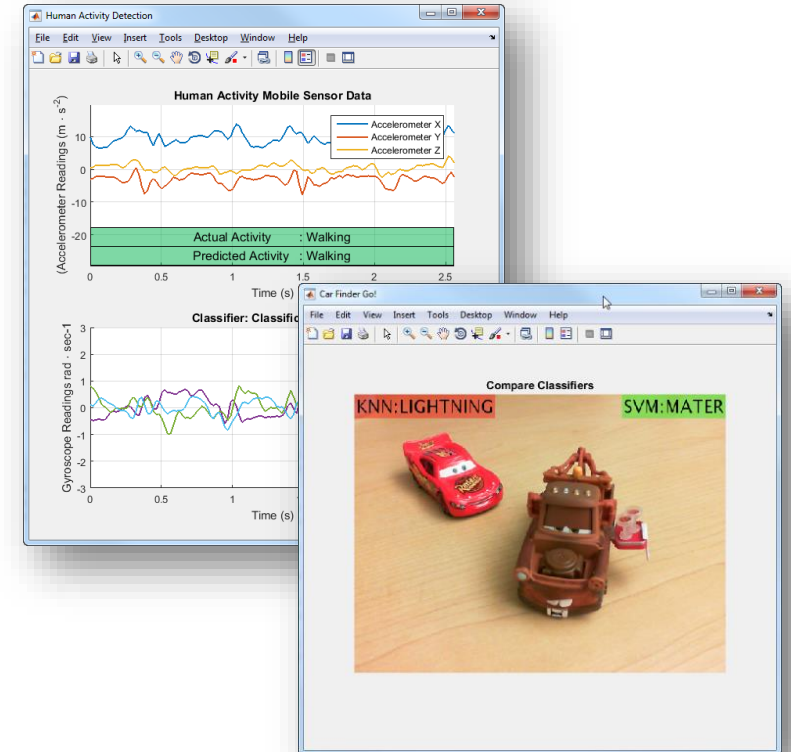


Machine Learning Made Easy

Shashank Prasanna

Product Marketing Manager,
Statistics and Machine Learning

shashank.prasanna@mathworks.com

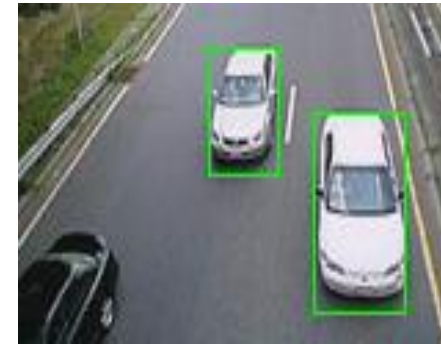
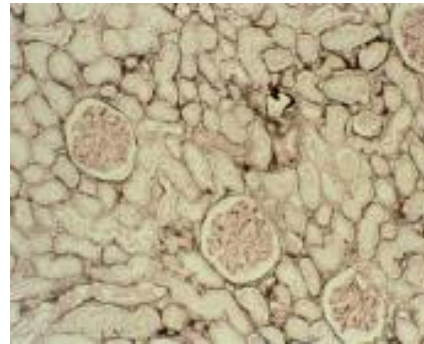
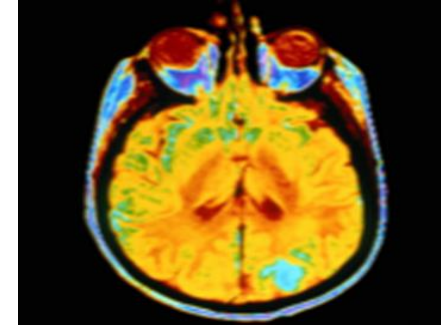


Agenda

- Machine Learning
 - What is Machine Learning and why do we need it?
 - Common challenges in Machine Learning
- Example 1: Human activity learning using mobile phone data
 - Learning from sensor data
- Example 2: Real-time car identification using images
 - Learning from images
- Summary & Key Takeaways

Machine Learning is Everywhere

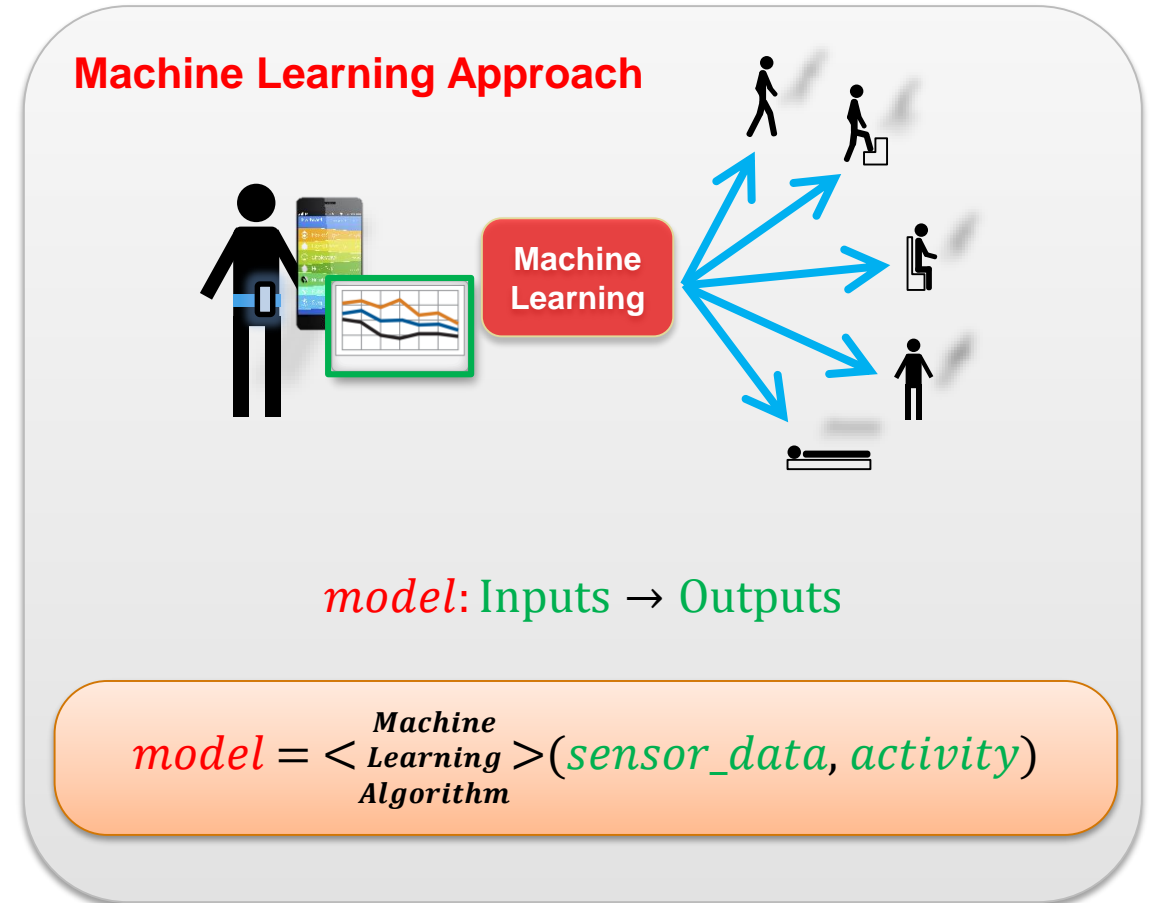
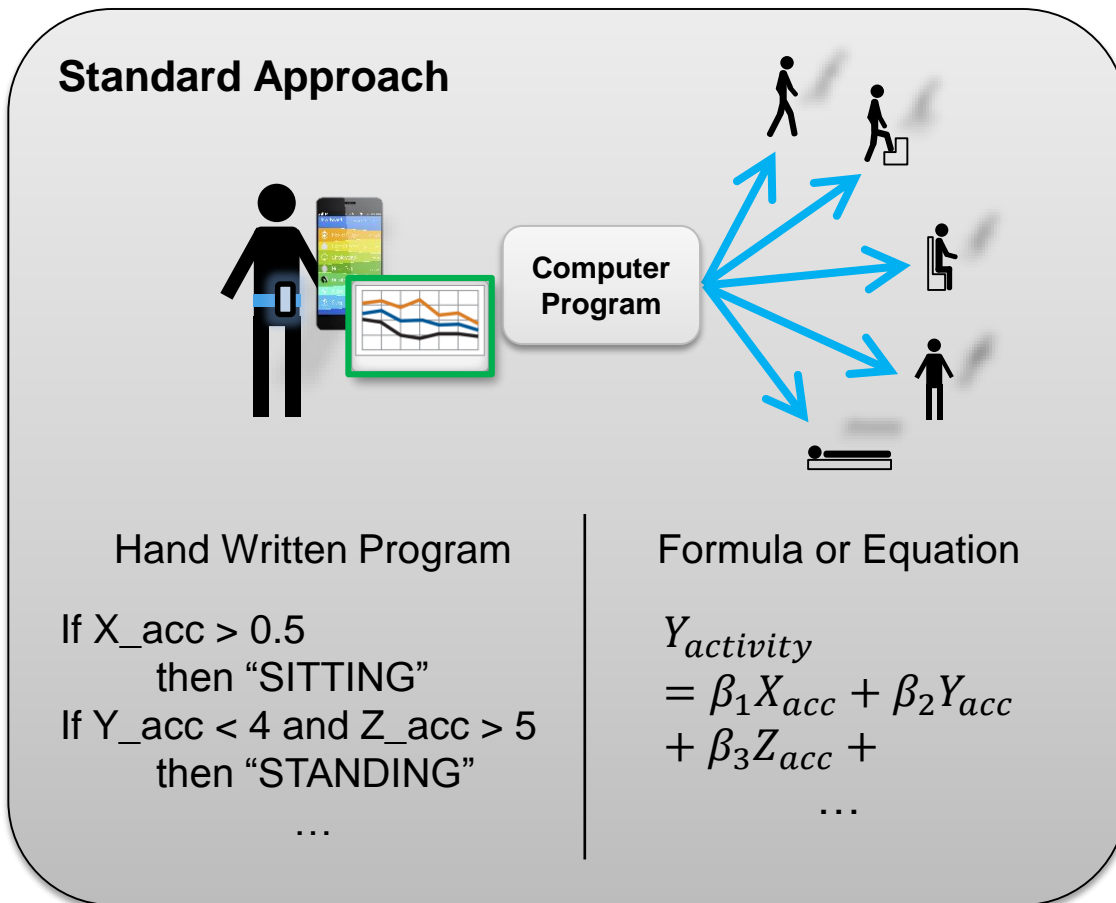
- Image Recognition
- Speech Recognition
- Stock Prediction
- Medical Diagnosis
- Data Analytics
- Robotics
- and more...



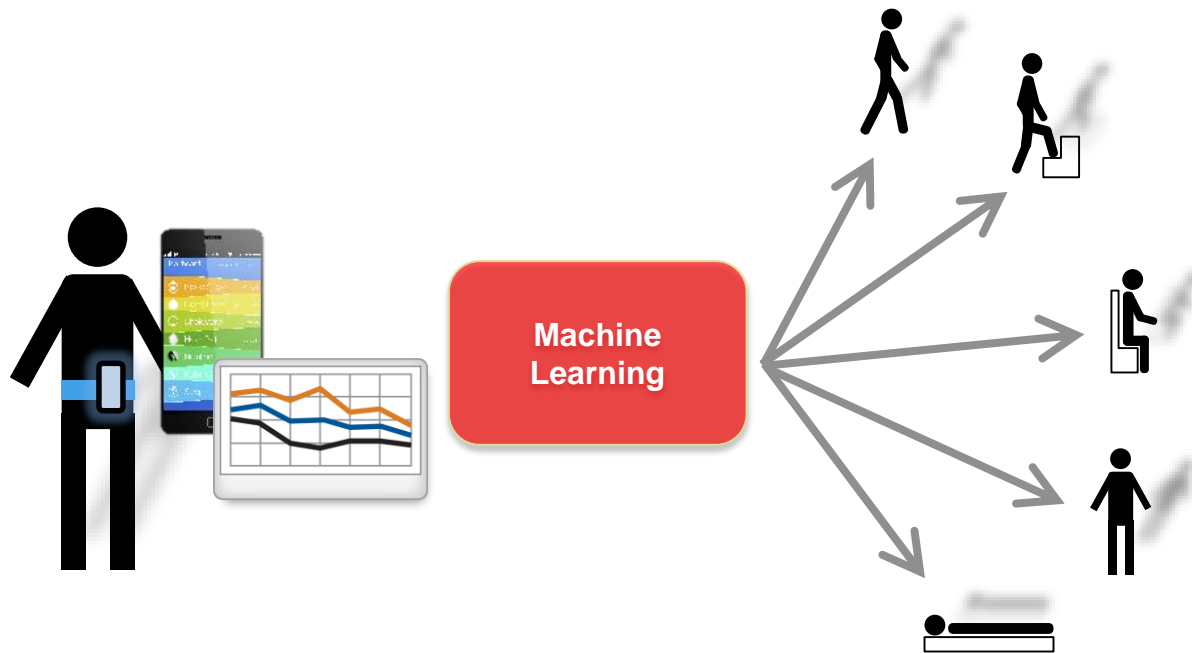
Machine Learning

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

Task: Human Activity Detection

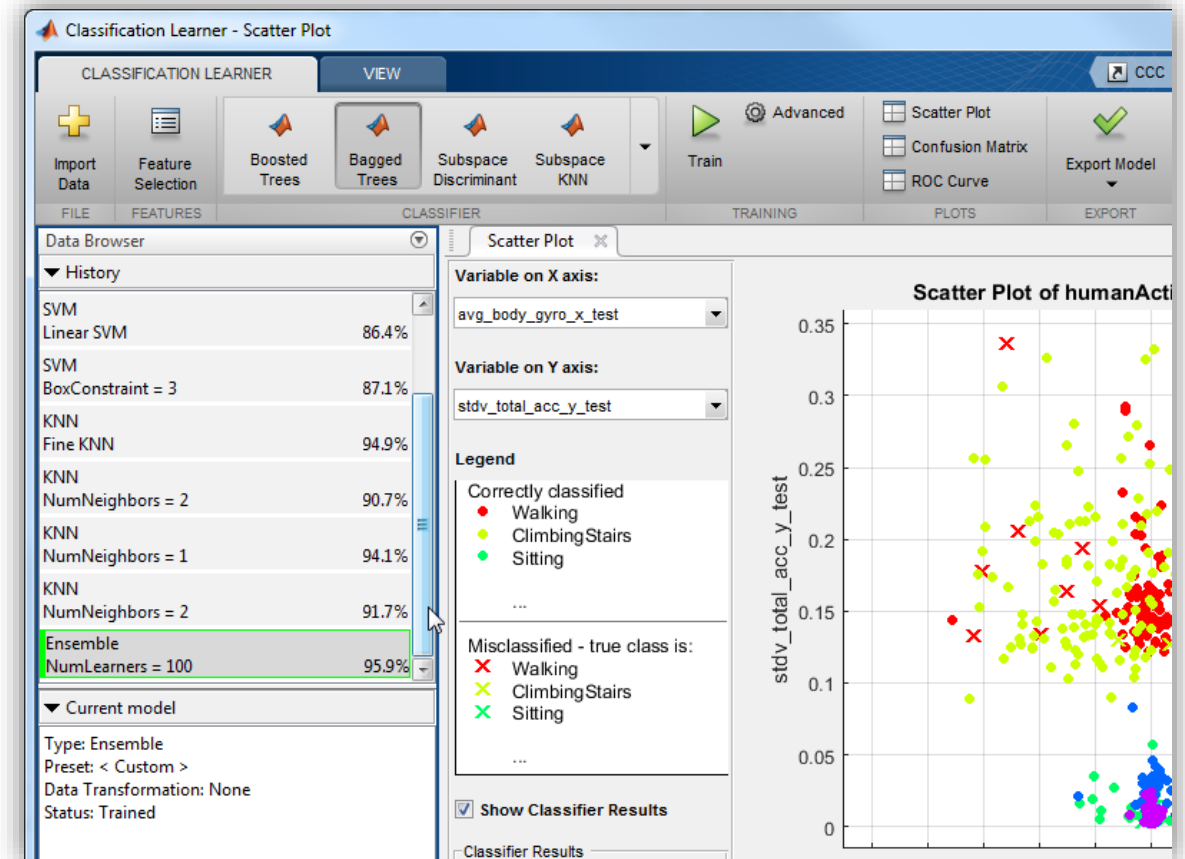


Example: Human Activity Learning Using Mobile Phone Data



Data:


- 3-axial Accelerometer data
- 3-axial Gyroscope data



**“essentially, all models are wrong,
but some are useful”
– George Box**

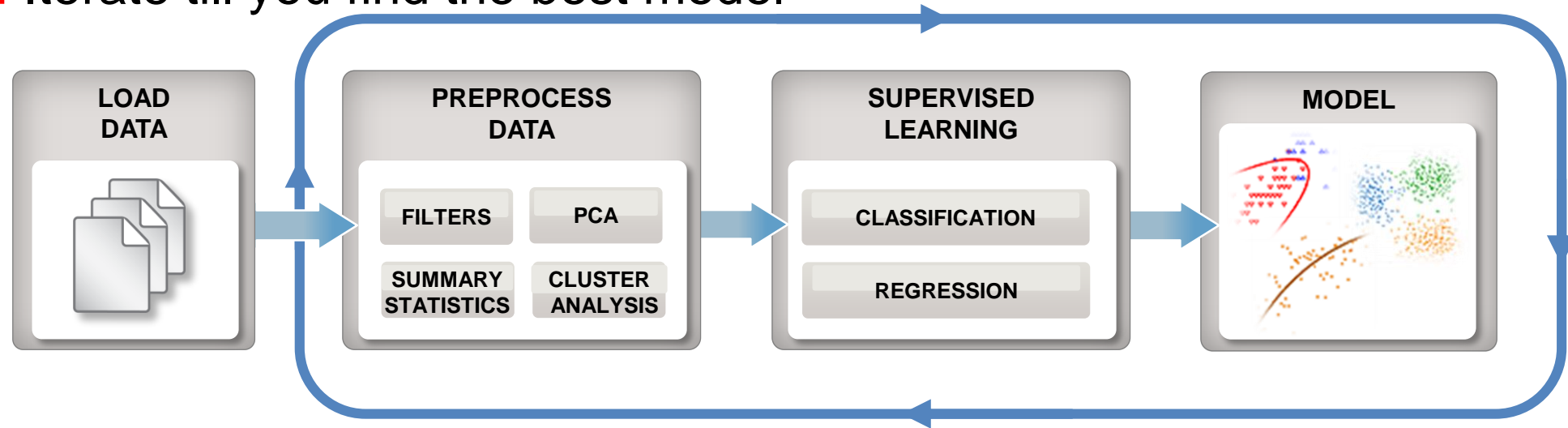
Challenges in Machine Learning

Hard to get started

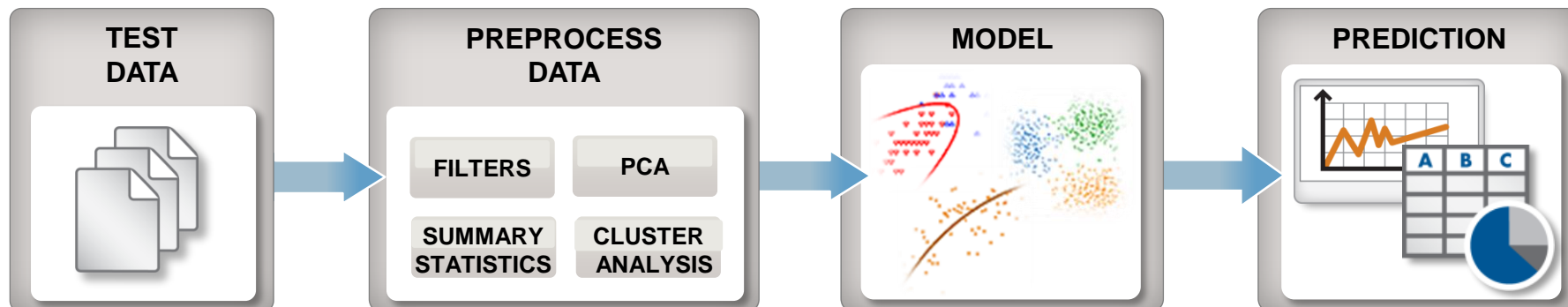
Steps	Challenge
Access, explore and analyze data	Data diversity Numeric, Images, Signals, Text – not always tabular
Preprocess data	Lack of domain tools Filtering and feature extraction Feature selection and transformation
Train models	Time consuming Train several models to find the “best”
Assess model performance	Avoid pitfalls Over Fitting Speed-Accuracy-Complexity tradeoffs
Iterate	

Machine Learning Workflow for Example 1

Train: Iterate till you find the best model

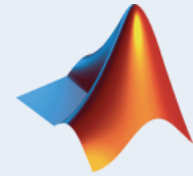


Predict: Integrate trained models into applications



Agenda






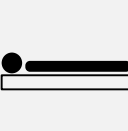
- Machine Learning
 - What is Machine Learning and why do we need it?
 - Common challenges in Machine Learning
- Example 1: Human activity learning using mobile phone data
 - Learning from sensor data
- Example 2: Real-time car identification using images
 - Learning from images
- Summary & Key Takeaways



Example 1: Human Activity Learning Using Mobile Phone Data

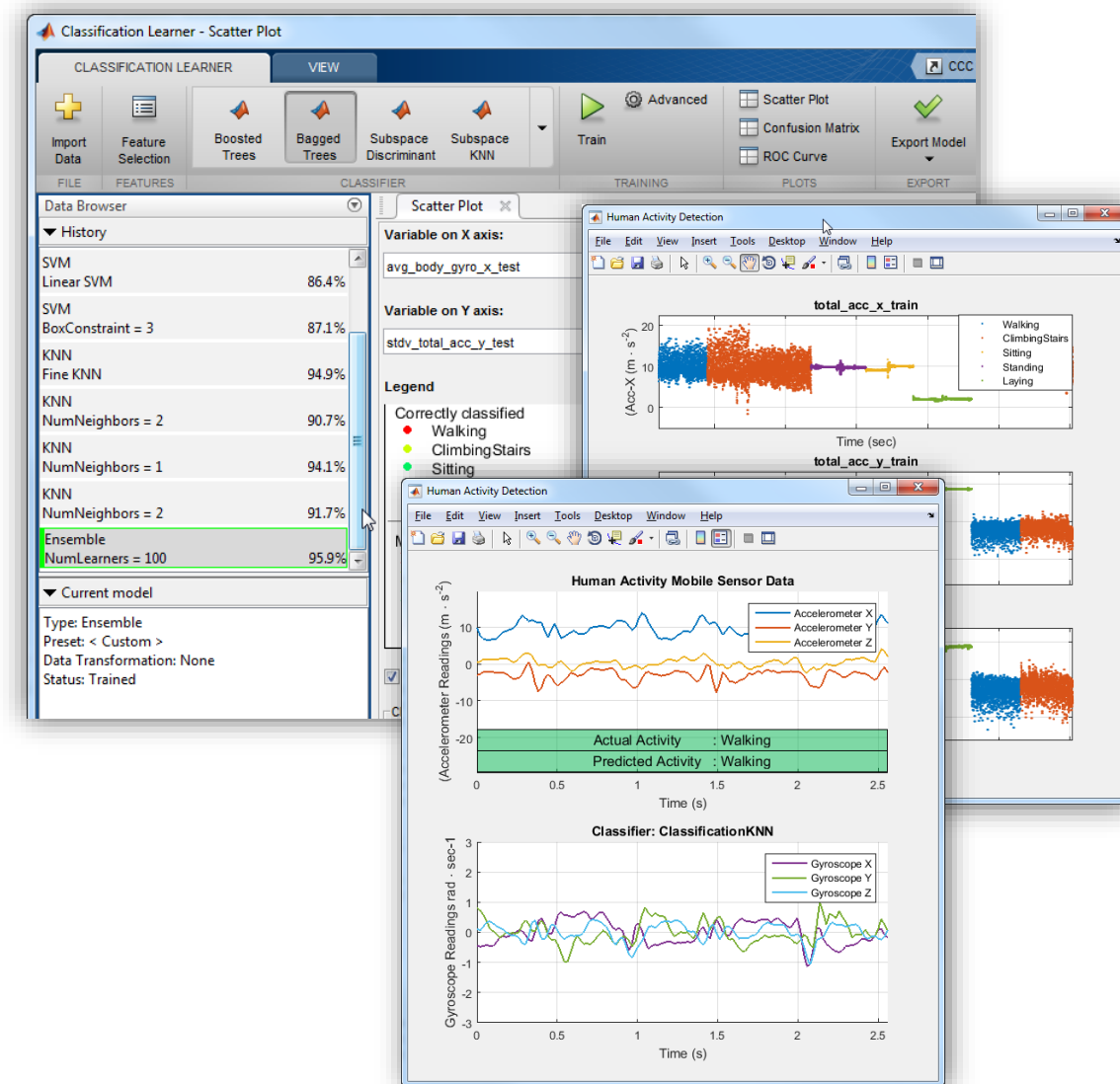
Objective: Train a classifier to classify human activity from sensor data

Data:

Predictors	3-axial Accelerometer and Gyroscope data	
Response	Activity:	    

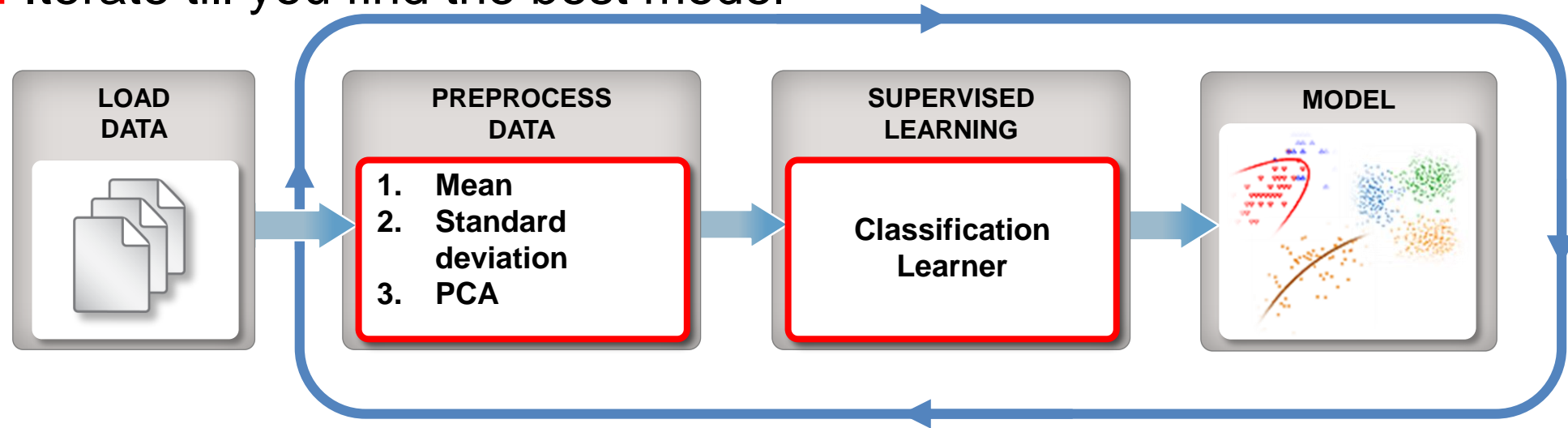
Approach:

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

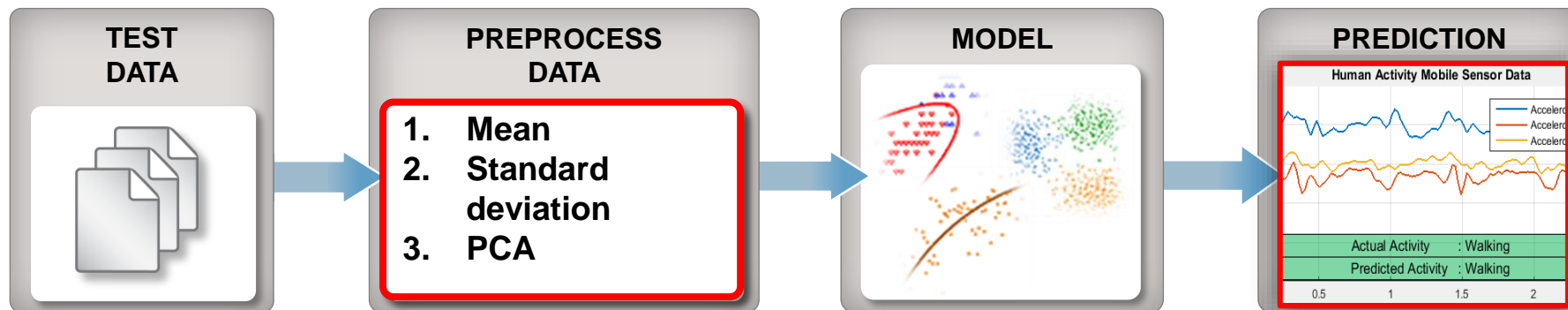


Machine Learning Workflow for Example 1

Train: Iterate till you find the best model

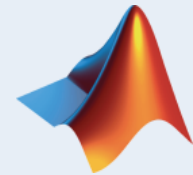


Predict: Integrate trained models into applications



Agenda


- Machine Learning
 - What is Machine Learning and why do we need it?
 - Common challenges in Machine Learning
- Example 1: Human activity learning using mobile phone data
 - Learning from sensor data
- Example 2: Real-time car identification using images
 - Learning from images
- Summary & Key Takeaways



Example 2: Real-time Car Identification Using Images

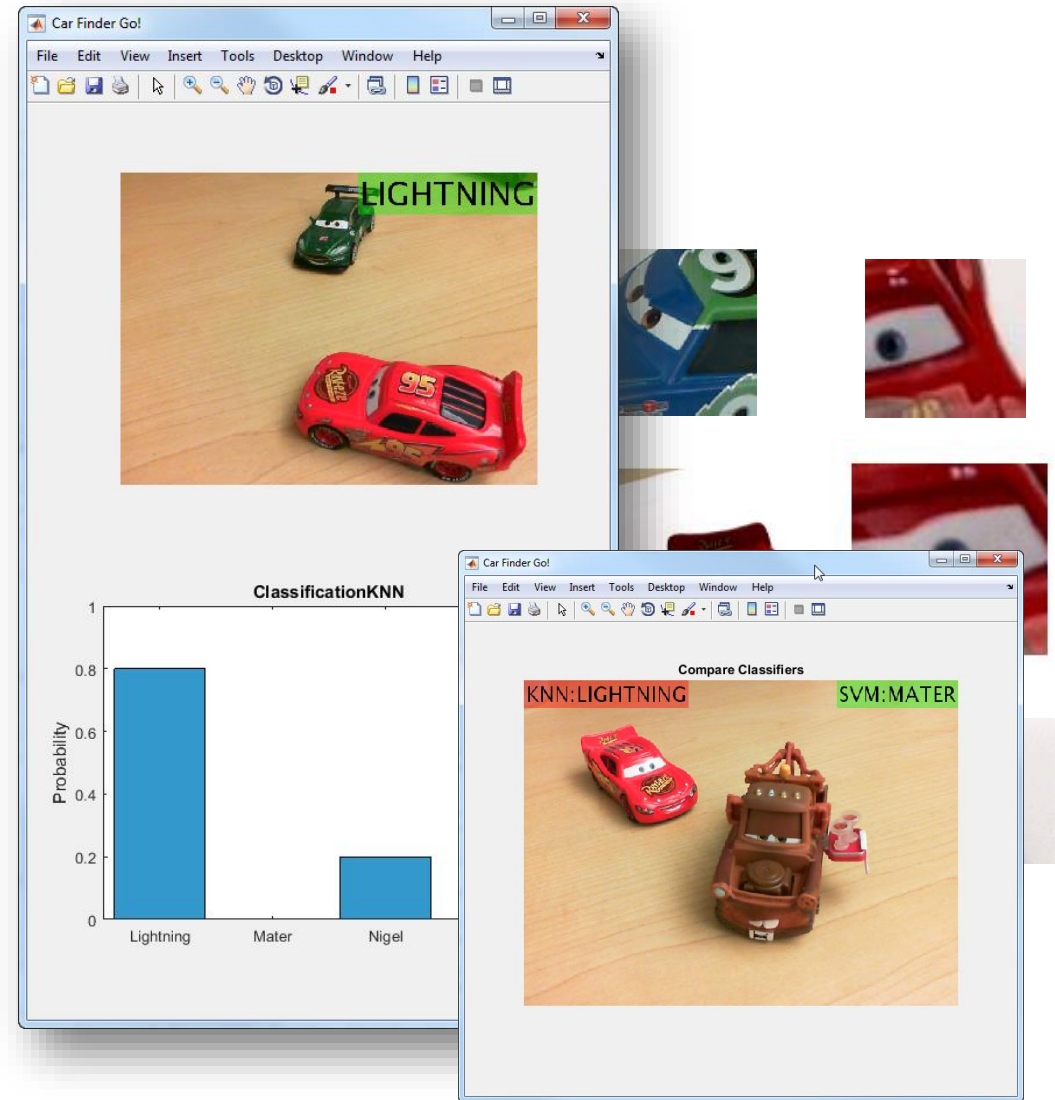
Objective: Train a classifier to identify car type from a webcam video

Data:

Predictors	Several images of cars: 
Response	NIGEL, LIGHTNING, SANDDUNE, MATER

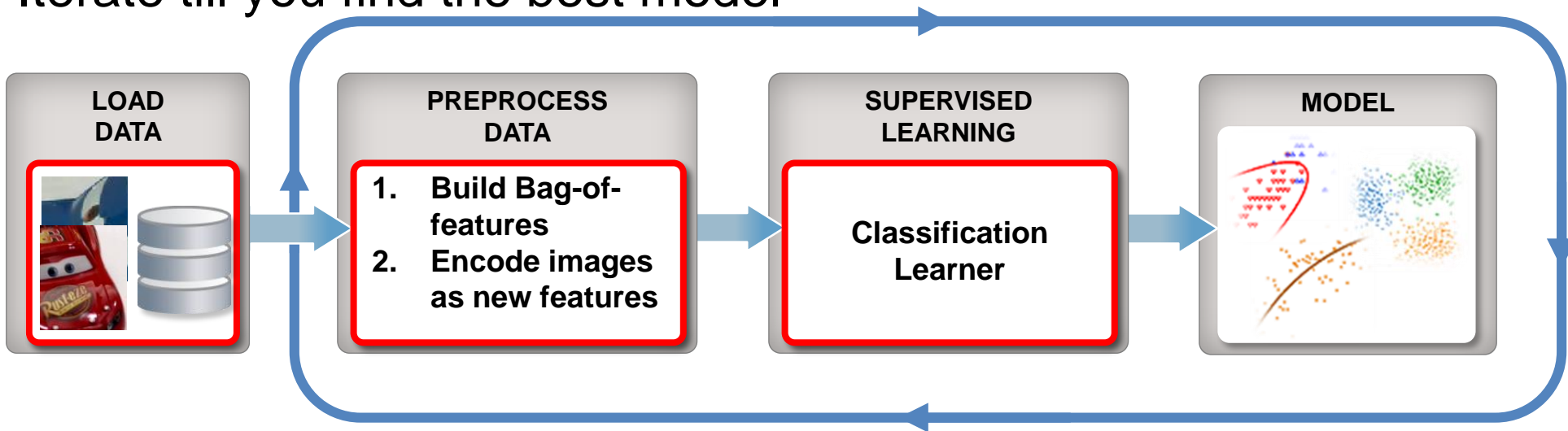
Approach:

- Extract features using Bag-of-words
- Train and compare classifiers
- Classify streaming video from a webcam

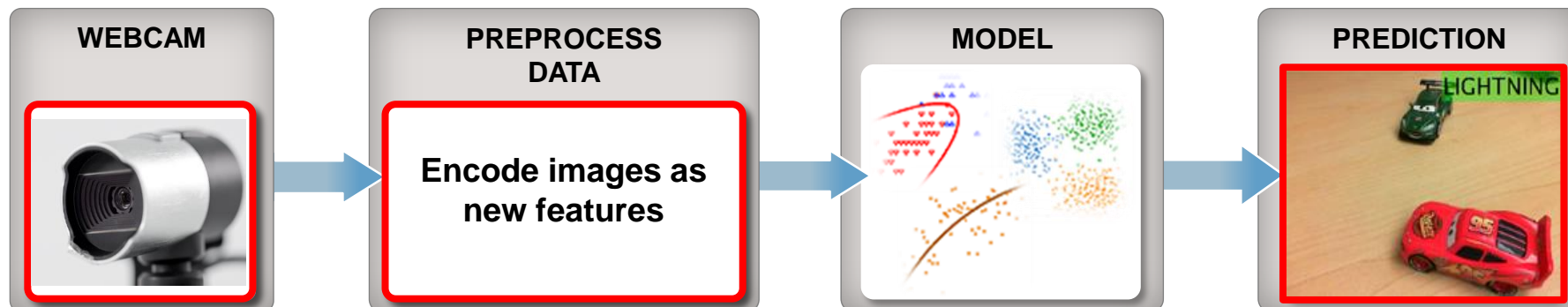


Machine Learning Workflow for Example 2

Train: Iterate till you find the best model

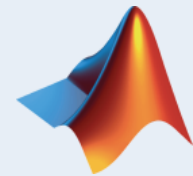


Predict: Integrate trained models into applications




Agenda

- Machine Learning
 - What is Machine Learning and why do we need it?
 - Common challenges in Machine Learning
- Example 1: Human activity learning using mobile phone data
 - Learning from sensor data
- Example 2: Real-time car identification using images
 - Learning from images
- Summary & Key Takeaways

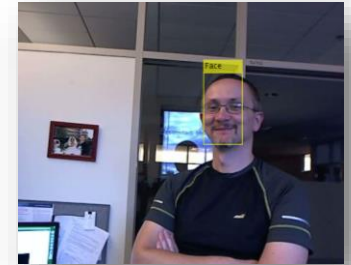


MATLAB Strengths for Machine Learning

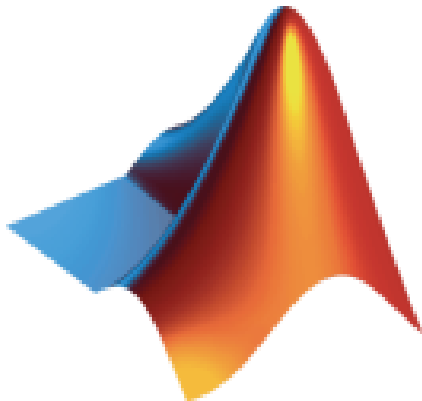
Challenge	Solution
Data diversity	Extensive data support Import and work with signal, images, financial, Textual, geospatial, and several others formats
Lack of domain tools	High-quality libraries Industry-standard algorithms for Finance, Statistics, Signal, Image processing & more
Time consuming	Interactive, app-driven workflows Focus on machine learning, not programming
Avoid pitfalls Over Fitting, Speed-Accuracy-Complexity	Integrated best practices Model validation tools built into app Rich documentation with step by step guidance
	Flexible architecture for customized workflows Complete machine learning platform

Key Takeaways

- Consider Machine Learning when:
 - Hand written rules and equations are too complex
 - *Face recognition, speech recognition, recognizing patterns*
 - Rules of a task are constantly changing
 - *Fraud detection from transactions, anomaly in sensor data*
 - Nature of the data changes and the program needs to adapt
 - *Automated trading, energy demand forecasting, predicting shopping trends*



- MATLAB for Machine Learning



Email me if you have further questions



What's New

From Shashank Prasanna,
Statistics and Machine Learning
Toolbox Technical Expert

[See recorded webinars](#)

[» Email Shashank](#)

Additional Resources

Documentation:

The screenshot shows the MathWorks documentation interface for R2015a. The main heading is "Machine Learning" with a sub-heading "Supervised, unsupervised, and ensemble learning". The page provides a detailed overview of machine learning, explaining its goal to build models that learn from data. It distinguishes between supervised learning (classification and regression) and unsupervised learning (clustering and dimensionality reduction). A "Machine Learning Basics" section lists several key topics for further reading, such as "Steps in Supervised Learning", "What Are Linear Regression Models?", and "Introduction to Cluster Analysis". The page also includes sub-sections for "Supervised Learning", "Unsupervised Learning", and "Ensemble Learning". A feedback prompt at the bottom asks "Was this topic helpful?" with "Yes" and "No" buttons.

mathworks.com/machine-learning

The screenshot displays the "Machine Learning with MATLAB Webinar" page. The main heading is "Machine Learning with MATLAB Webinar" with a sub-heading "Learn how to get started using machine learning tools to detect patterns and build predictive models from your data sets." A prominent "View webinar" button is visible. Below the main heading, the page explains that machine learning algorithms use computational methods to learn from data without a predetermined model. It lists various applications such as computational finance, computational biology, energy production, and natural language processing. The page also notes that machine learning is often used in big data applications. At the bottom, there are three columns highlighting key machine learning concepts: "Classification" (building models to classify data), "Regression" (building models to predict continuous data), and "Clustering" (finding natural groupings in data). Each column includes a small illustrative figure and a list of relevant algorithms.

Q & A