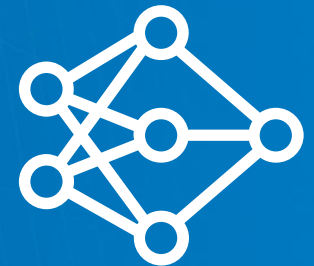


Machine Learning with MATLAB

Simon Thor
KTH MATLAB student ambassador



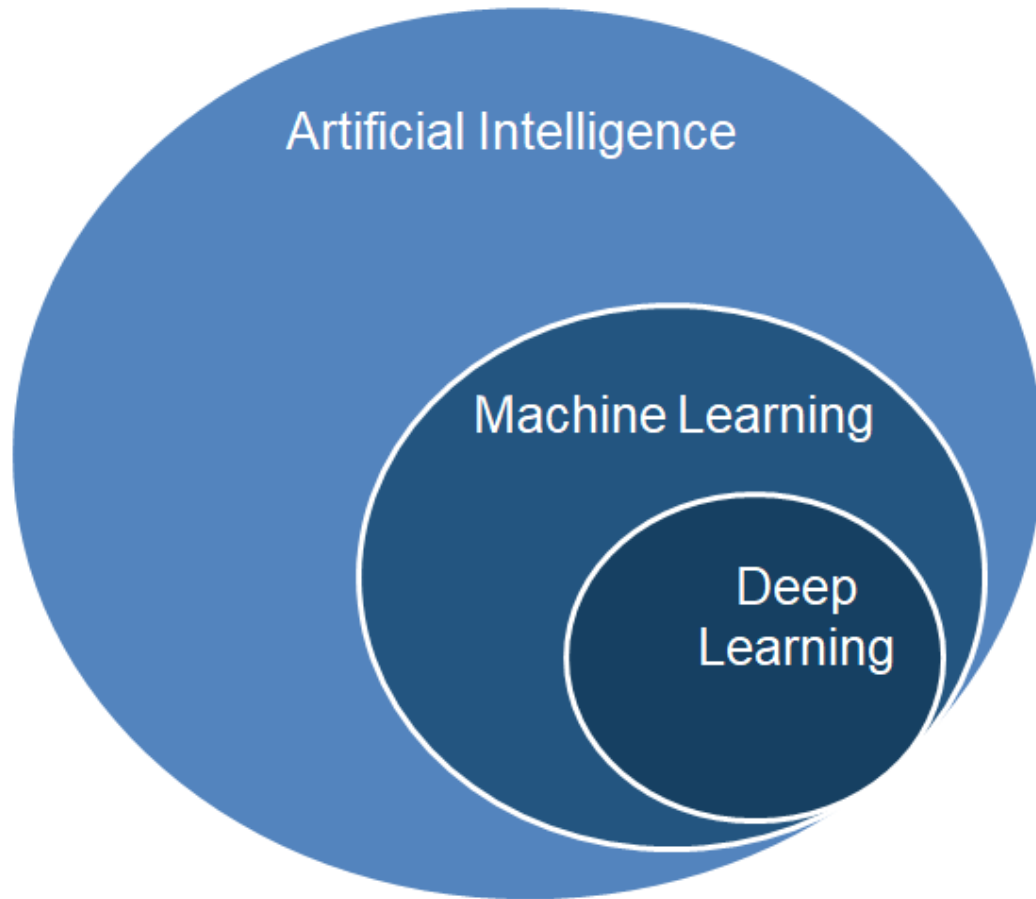
What is MATLAB@KTH?

- Code and presentation available on Github:
<https://github.com/simonthor/kth-matlab-ambassador/tree/master/Seminars/Machine%20Learning%20with%20MATLAB>
- Join the email list for future events: <https://forms.gle/qRgSvgyPCborepQd8>
- Facebook group: <https://www.facebook.com/groups/MATLAB.KTH>
- Instagram: https://www.instagram.com/matlab_kth/
- Merch!

How much do you know about machine learning and MATLAB?

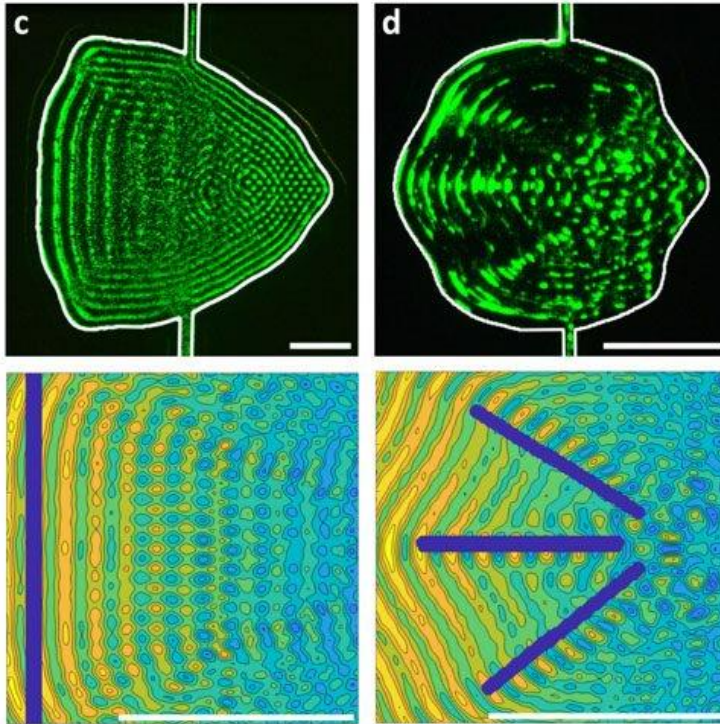
- Go to **menti.com**
- Enter code **5355 9032**
- Answer the poll!

MATLAB for Artificial Intelligence



- Machine Learning
- Deep Learning
- Reinforcement Learning
- Predictive Maintenance
- Data Science / Data Analytics
- Signal Processing
- Image Processing
- ...and more

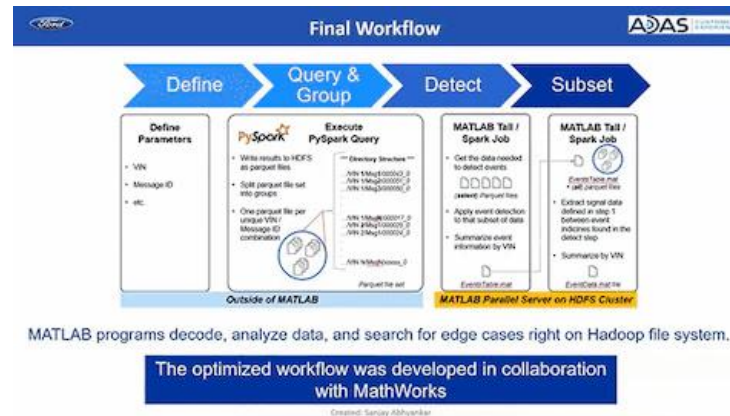
Machine Learning Applications with MATLAB



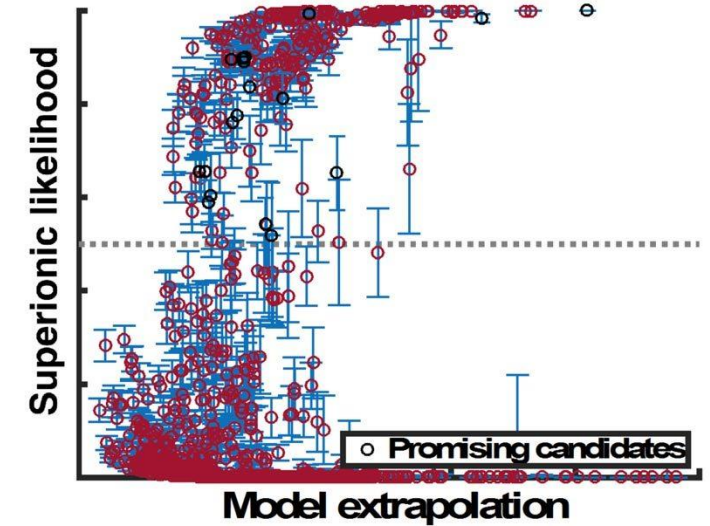
Physics-informed machine learning (MIT)



Deep learning (Airbus)



MATLAB with Apache Spark (Ford)

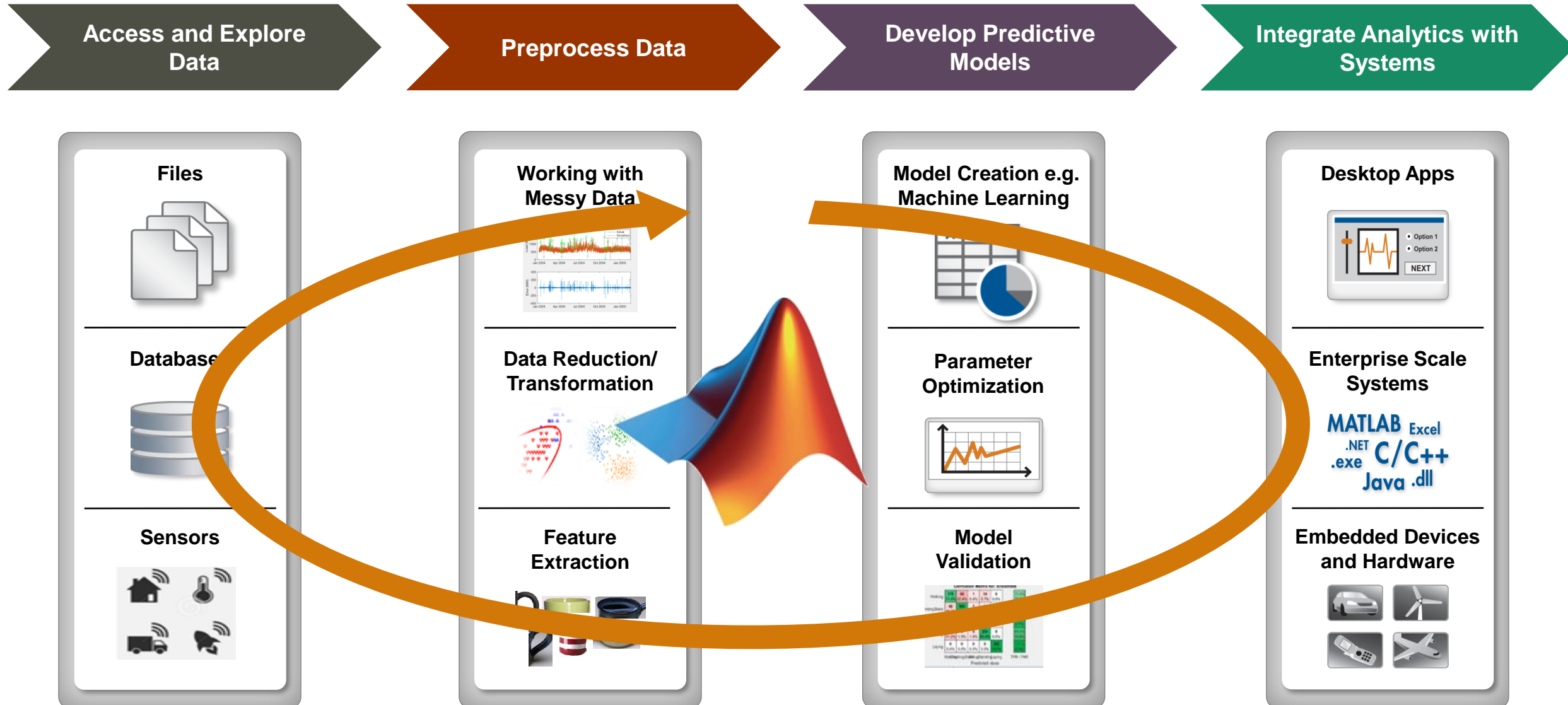


Battery development (Stanford)

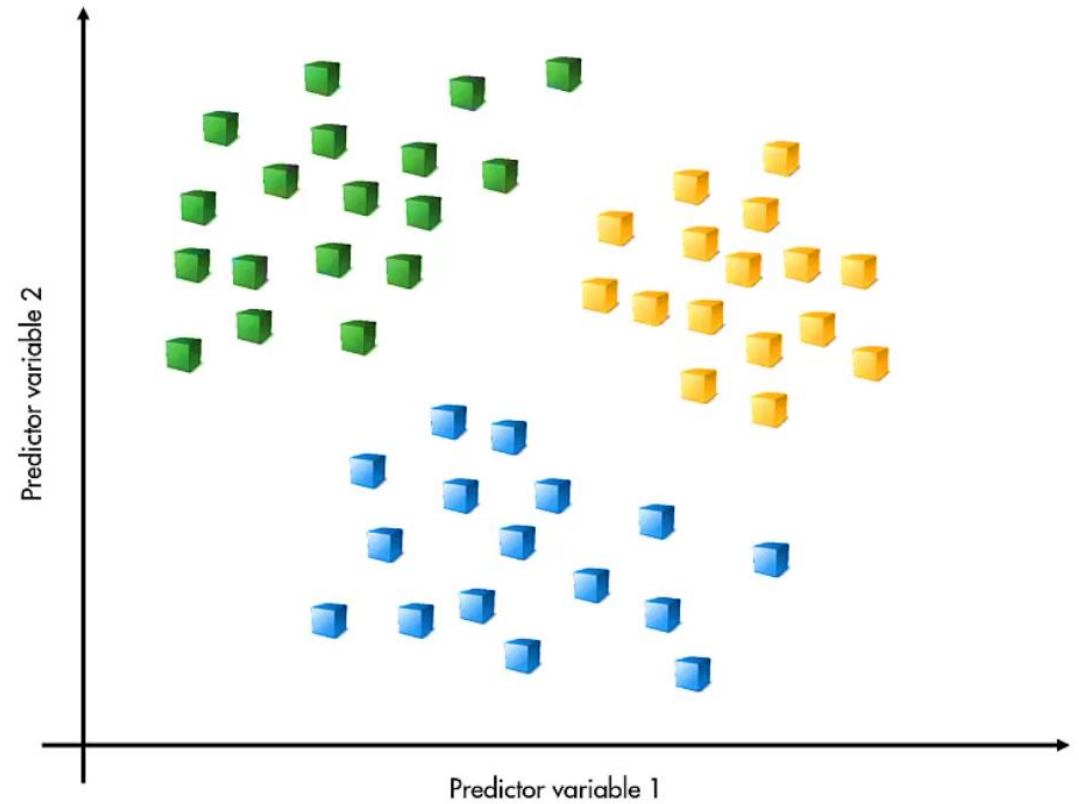
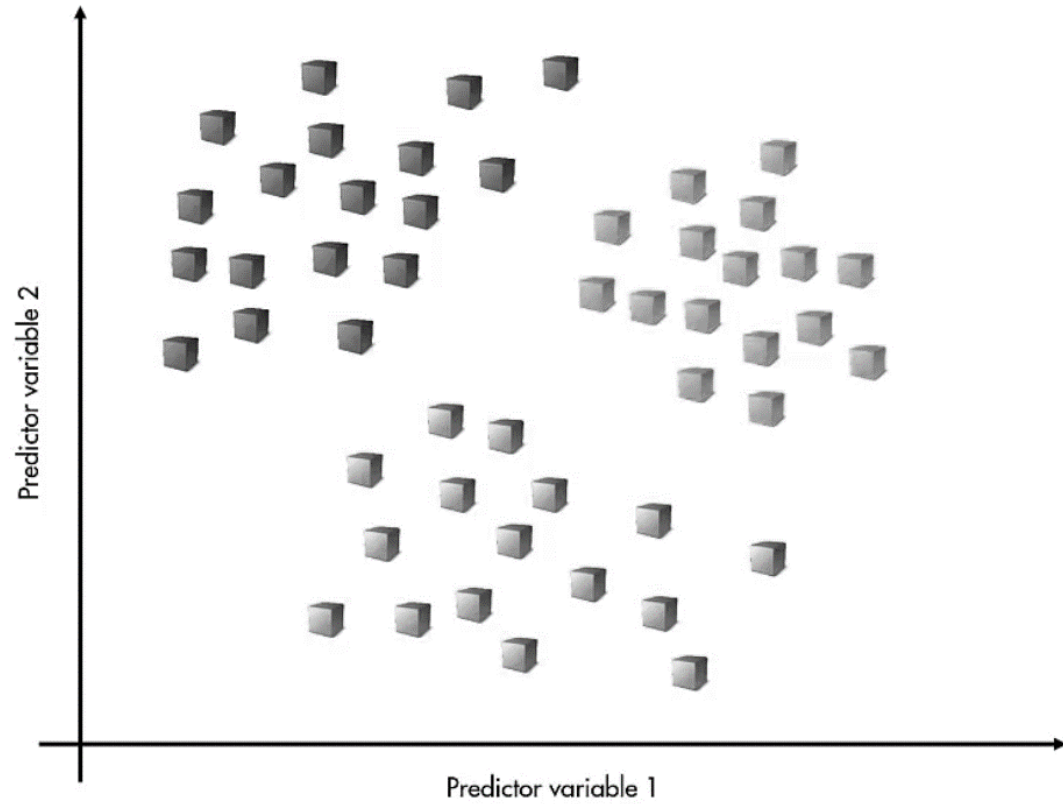


Over-steering detection (BMW)

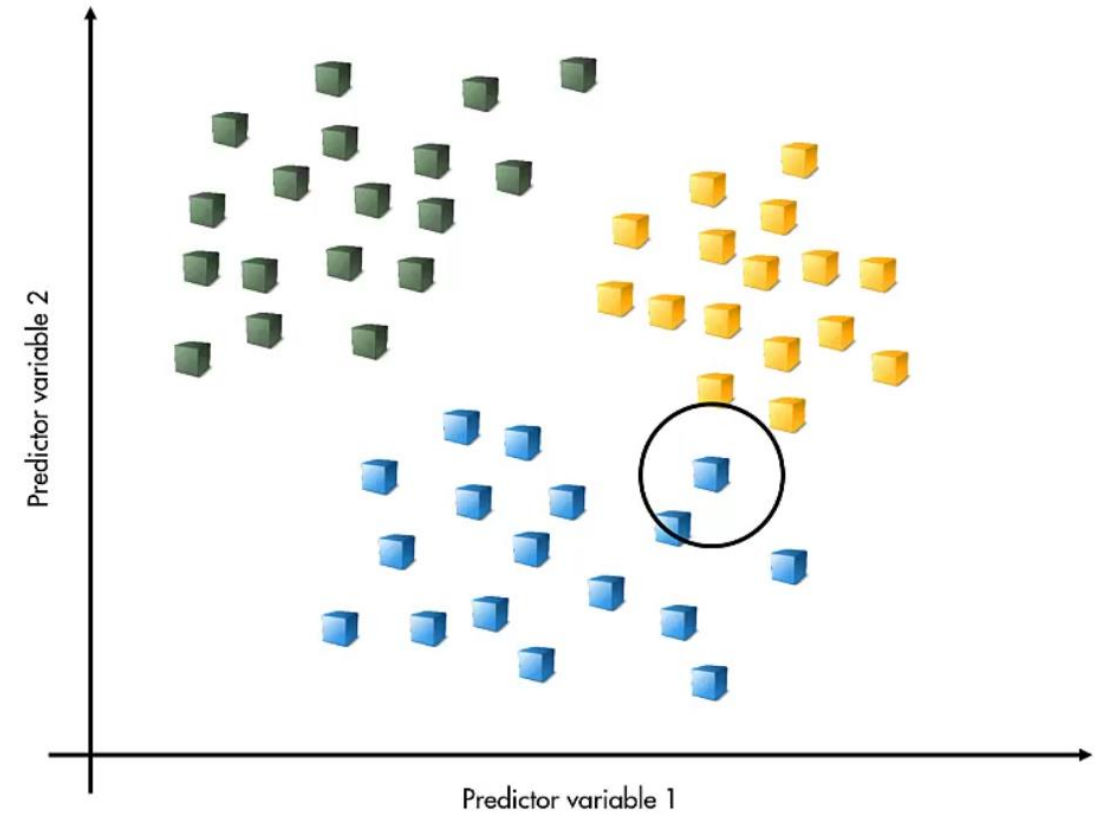
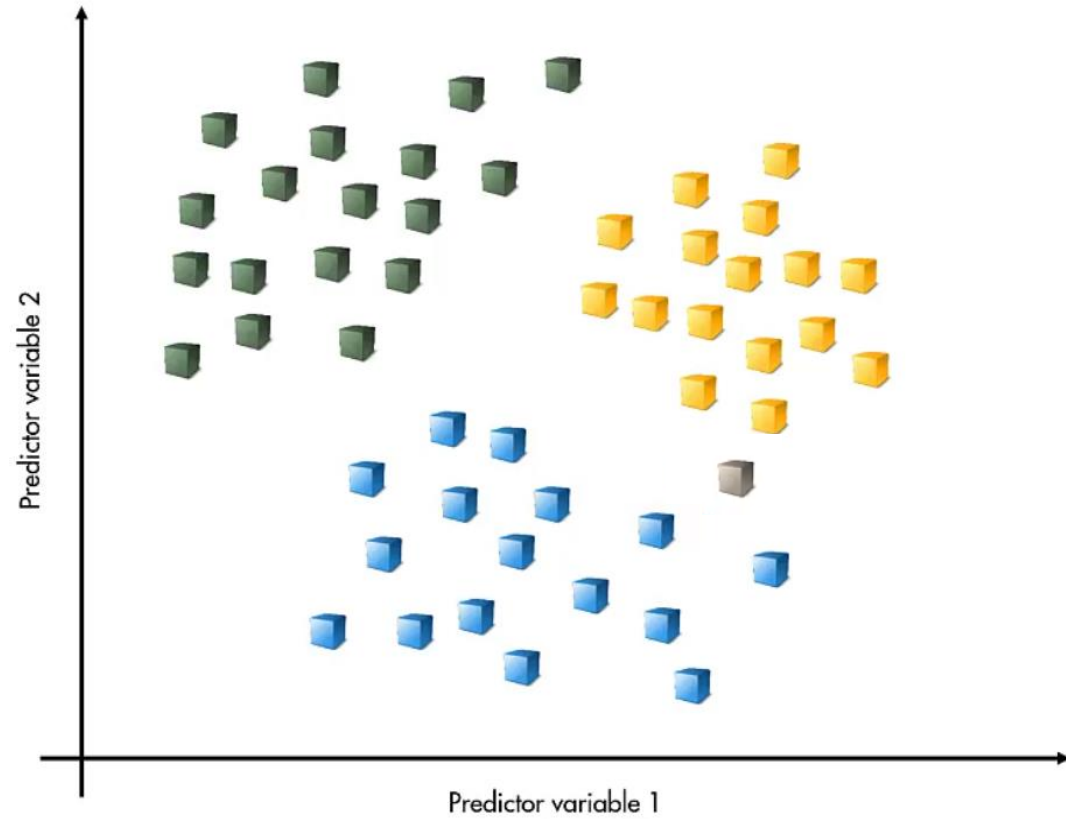
Machine Learning Workflow



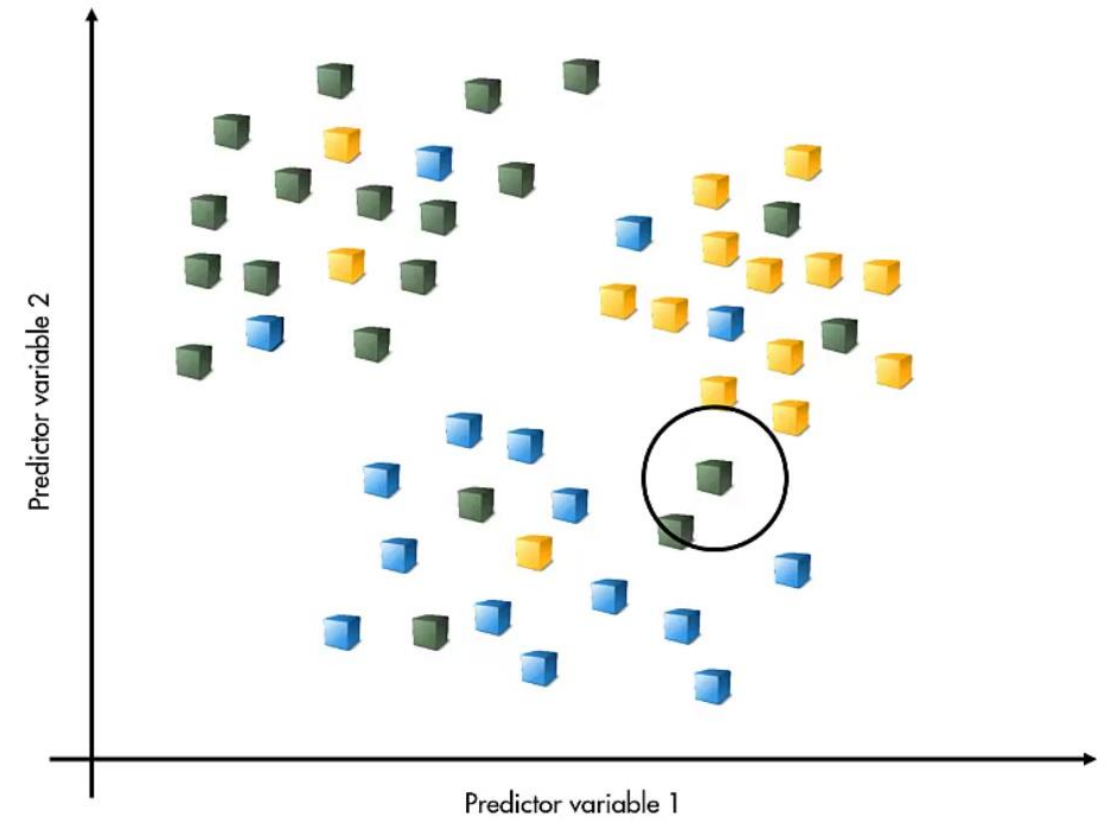
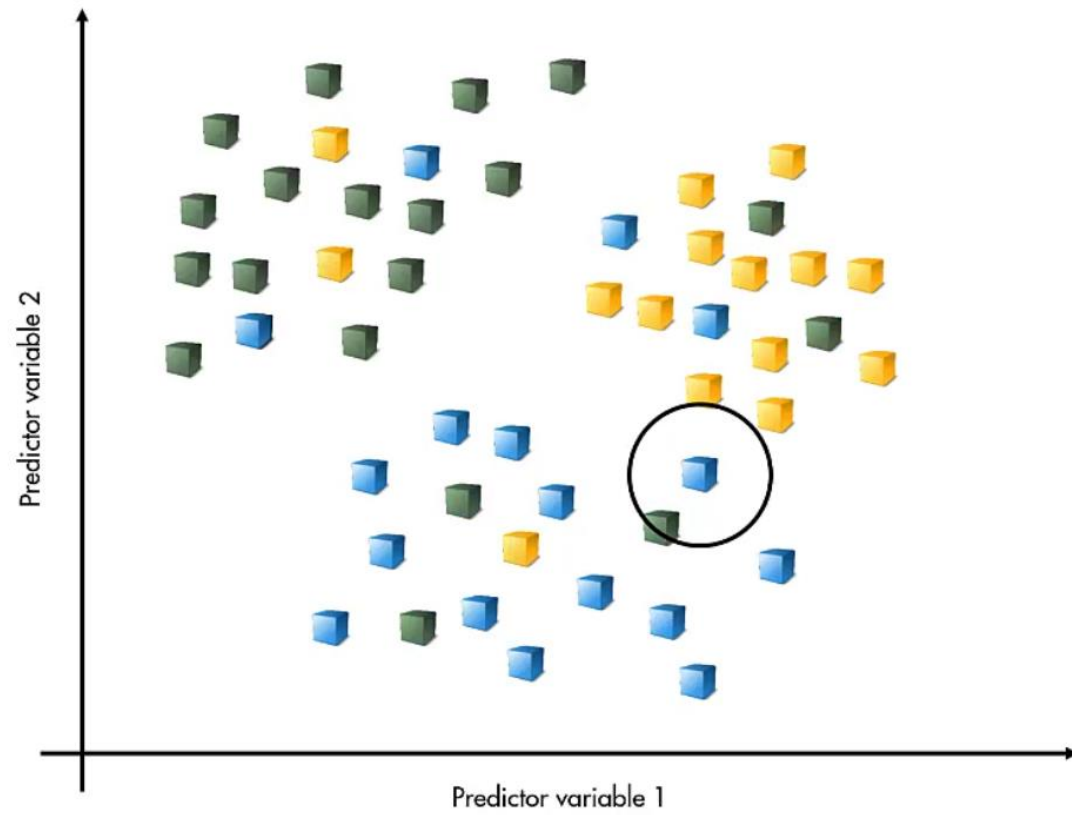
K-Nearest Neighbor Classification



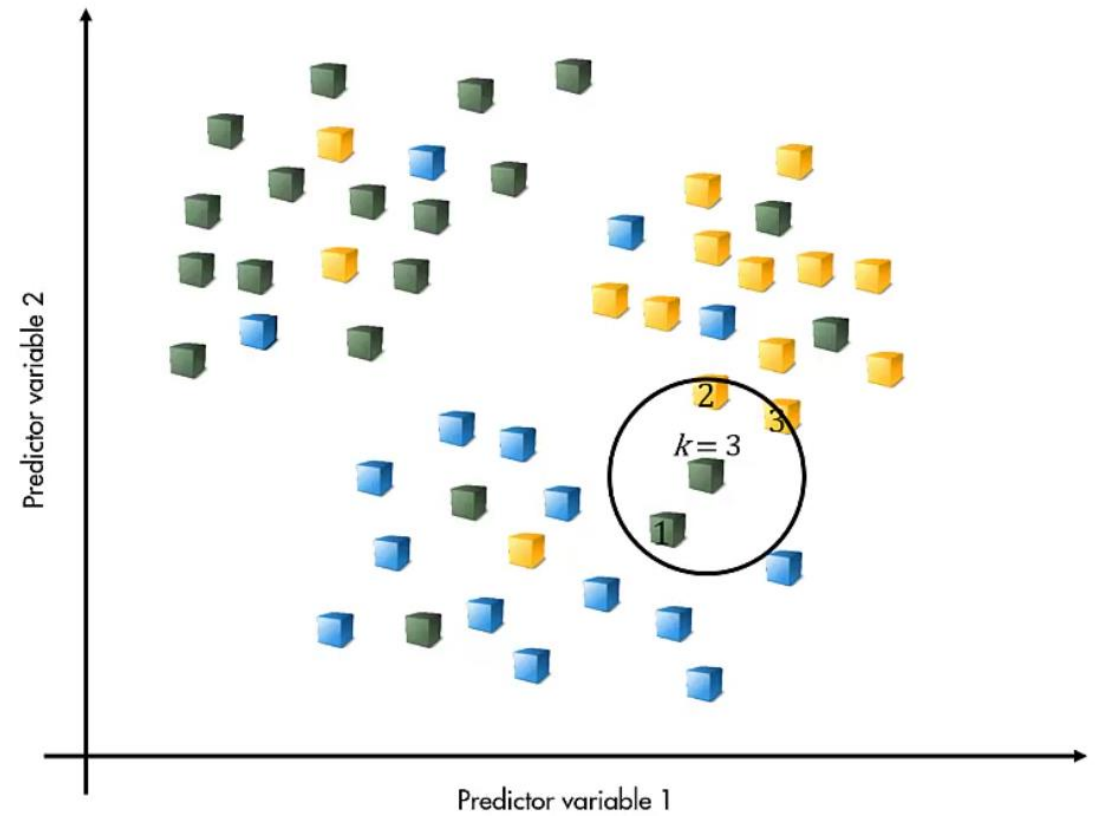
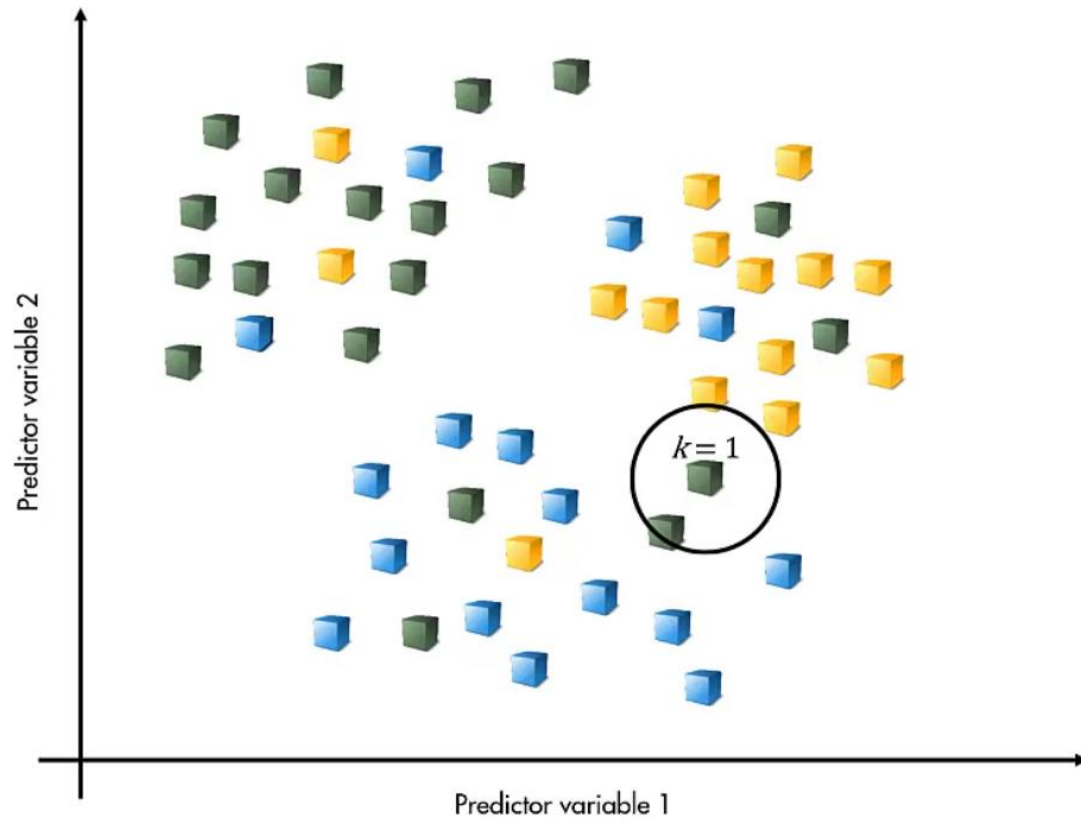
K-Nearest Neighbor Classification



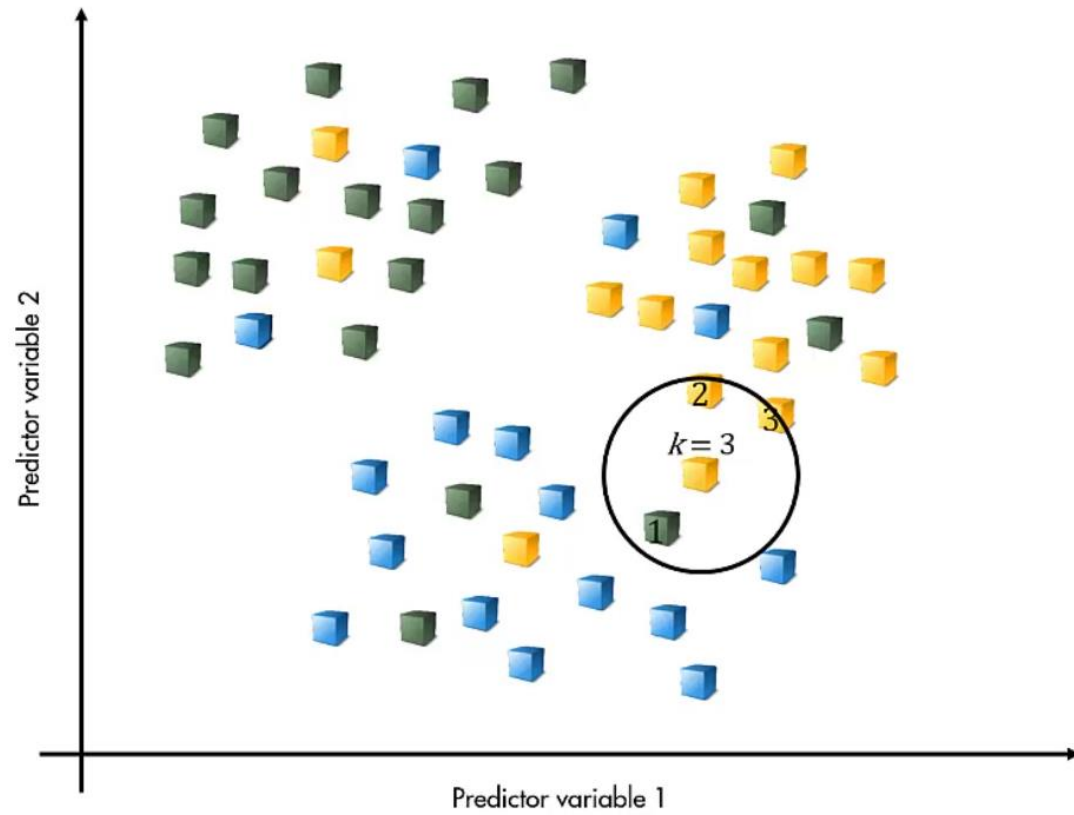
K-Nearest Neighbor Classification



K-Nearest Neighbor Classification

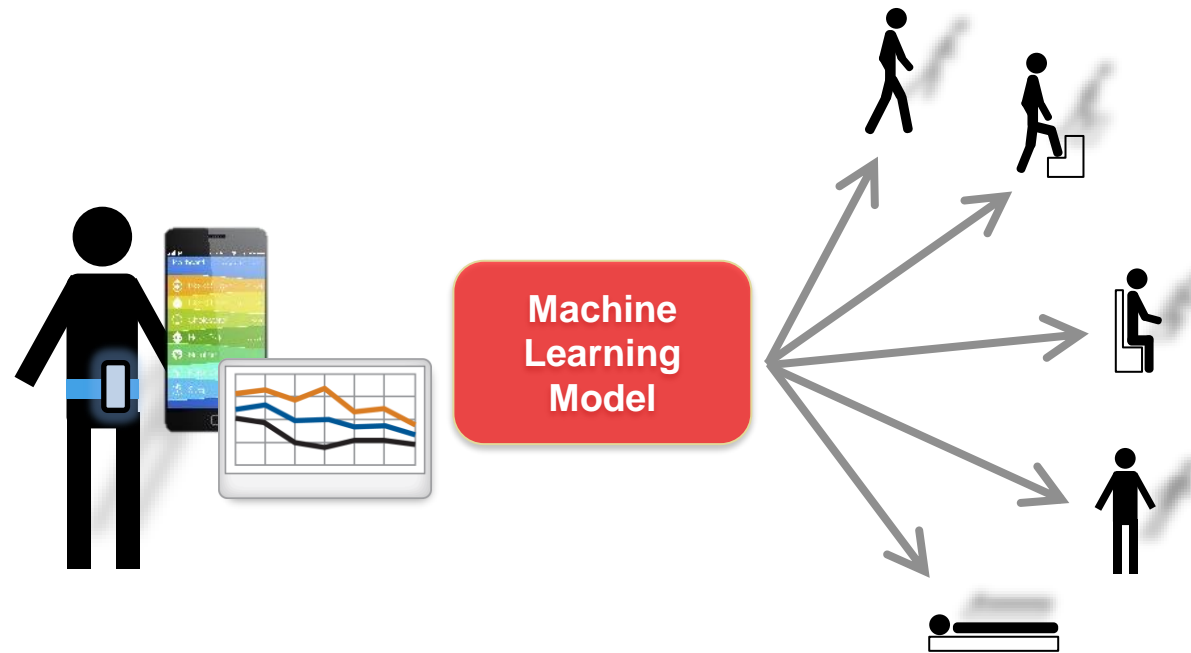


K-Nearest Neighbor Classification



Example: Human Activity Recognition

Classification



Data:

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






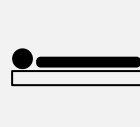
Dataset courtesy of:

Davide Anguita, Alessandro Ghio, Luca Oneto, Xavier Parra and Jorge L. Reyes-Ortiz.
Human Activity Recognition on Smartphones using a Multiclass Hardware-Friendly Support Vector Machine.
International Workshop of Ambient Assisted Living (IWAAL 2012). Vitoria-Gasteiz, Spain. Dec 2012
<http://archive.ics.uci.edu/ml/datasets/Human+Activity+Recognition+Using+Smartphones>

Example: Human Activity Recognition Classification

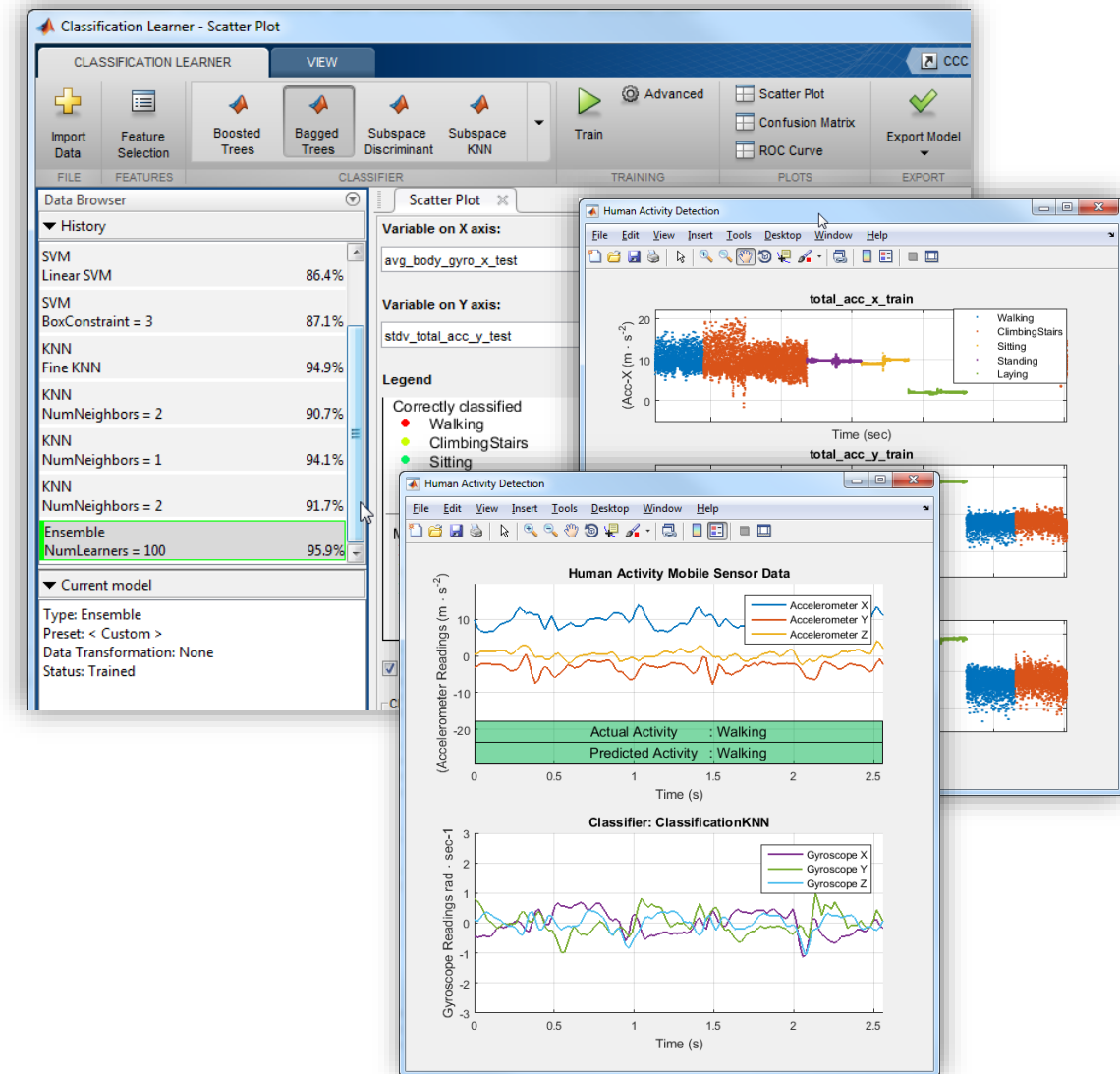
Goal: Train a model to classify human activity from sensor data

Data:

Predictors	3-axis Accelerometer and Gyroscope data	
Response	Activity:	    

Approach:

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



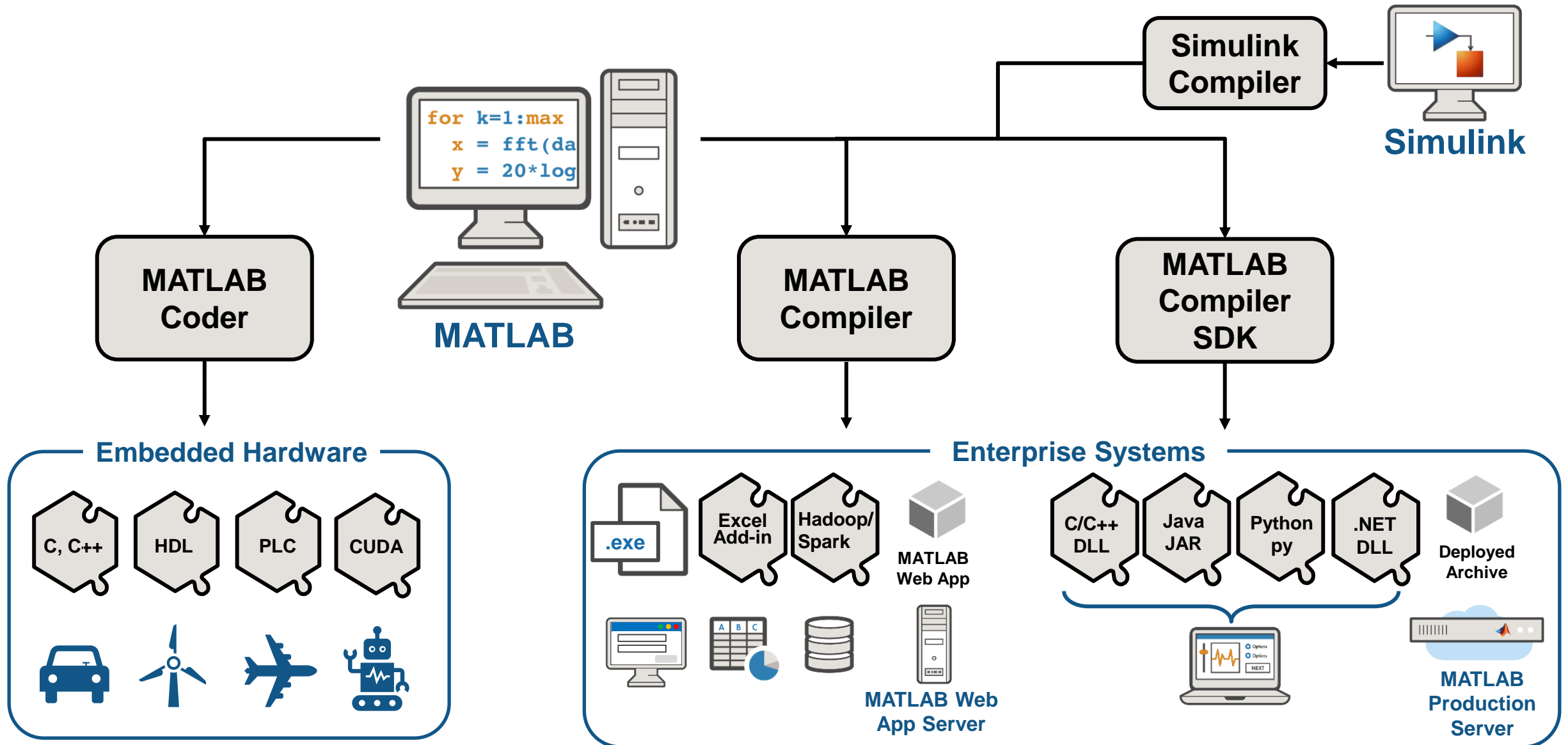
Demo

- If you want to follow along:
- Go to this link to access and run the code on MATLAB Online:

<https://tinyurl.com/KTHMATLABML> (case sensitive)

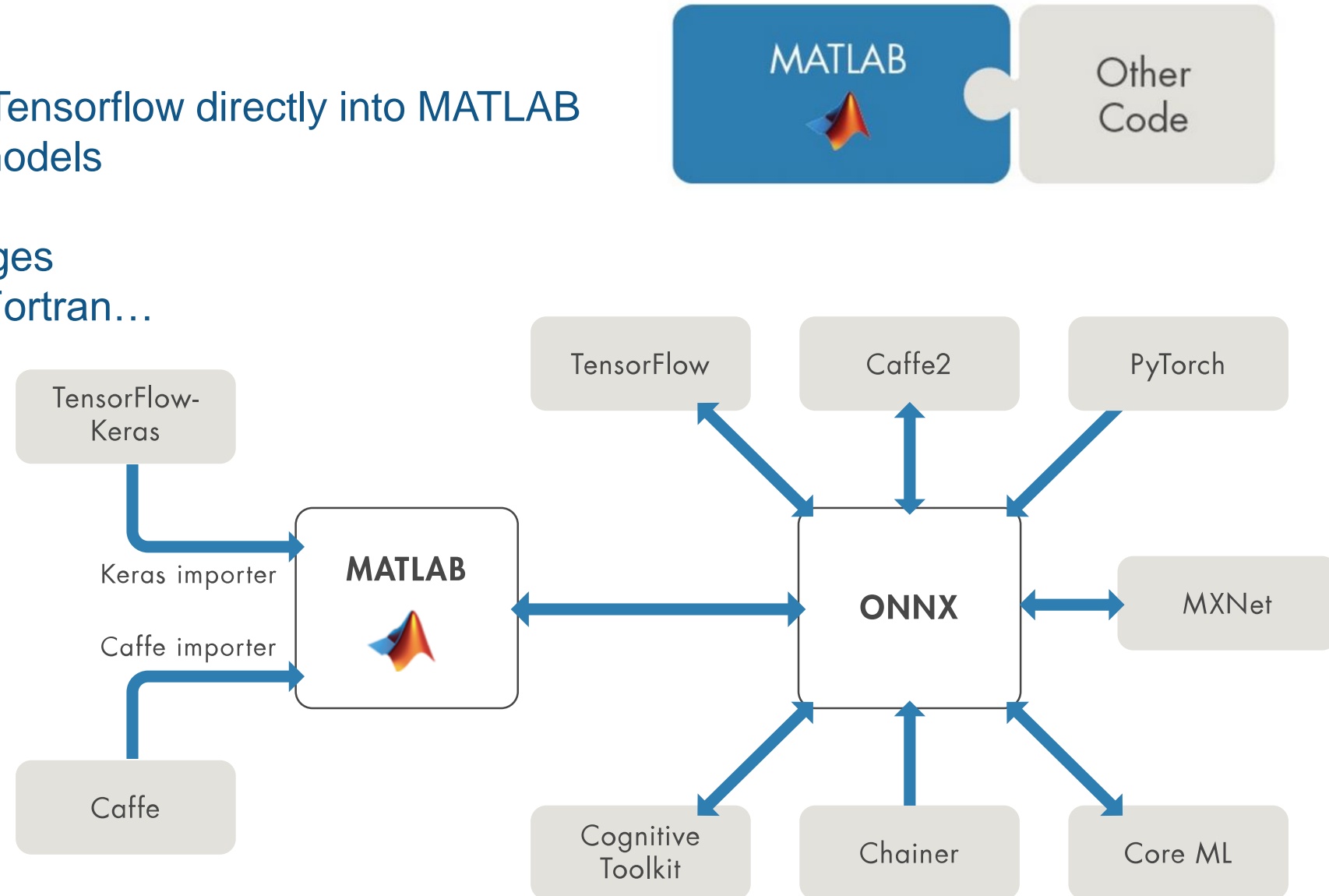
- Or download the code and run it locally with MATLAB
 - Requires statistics and machine learning toolbox

Deployment with MATLAB

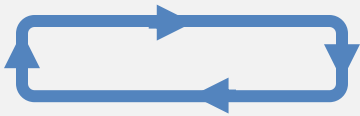


Importing and exporting models

- Import Keras models from Tensorflow directly into MATLAB
- Export and import ONNX models
- Interface with other languages
 - Python, C/C++, Java, Fortran...
- Does not have to be MATLAB **or** a different language!
- Use the right tool for the right job



MATLAB Strengths for Machine Learning

Challenge	Solution
Data diversity	Extensive data support Work with signal, images, financial, textual, and 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 programing Select best model and easily fine-tune model parameters
Platform diversity	Run analytics anywhere Code generation for embedded targets Deploy to broad range of enterprise system architectures
	Flexible architecture for customized workflows Complete machine learning platform

Self-paced Online Courses

Getting Started (12)

MATLAB (4)

Simulink (5)

AI, Machine Learning, and Deep Learning (5)

Math and Optimization (6)

Image and Signal Processing (3)

Explore over 50 virtual and in-person **classroom courses**

AI, Machine Learning, and Deep Learning



Machine Learning Onramp

 40%

6 modules | 2 hours | [Languages](#)

Learn the basics of practical machine learning methods for classification problems.



Machine Learning with MATLAB

7 modules | 12 hours | [Languages](#)

Explore data and build predictive models.



Deep Learning Onramp

 5%

5 modules | 2 hours | [Languages](#)

Get started quickly using deep learning methods to perform image recognition.



Deep Learning with MATLAB

 55%

13 modules | 8 hours | [Languages](#)

Learn the theory and practice of building deep neural networks with real-life image and sequence data.



Reinforcement Learning Onramp

 36%

5 modules | 3 hours | [Languages](#)

Master the basics of creating intelligent controllers that learn from experience.

"The interactive MATLAB tutorials were perfect for engaging students and getting them up to speed quickly."

—Dr. Yu-li Wang, Carnegie Mellon University

Resources

- [Overview](#)
- [Cheat sheet](#)
- [Introductory eBook](#)
- [Mastering Machine Learning eBook](#)
- [Machine Learning Tech Talks](#)
- [Classification Learner App in your browser](#)



Part 1: Machine Learning Fundamentals

Explore the fundamentals behind machine learning, focusing on unsupervised and supervised learning. Learn about the common techniques, including clustering, classification, and regression.



Part 2: Unsupervised Machine Learning

Get an overview of unsupervised machine learning, which looks for patterns in datasets that don't have labeled responses. This approach lets you explore your data when you're not sure what information the data contains.



Part 3: Supervised Machine Learning

Learn how to use supervised machine learning to train a model to map inputs to outputs and predict the response for new inputs.



Part 4: Getting Started with Machine Learning

Walk through a machine learning workflow step by step, and get insight into several key decision points along the way. The example workflow shows how to use machine learning to develop a cell phone health-monitoring app.

Thank you! Questions?



Check out MATLAB@KTH: <https://www.facebook.com/groups/MATLAB.KTH>
And KTH AI Society: <https://kthais.com>

Presentation based on Rohit Agrawal's Lunch & Learn Webinar Series with MATLAB
Fridays for Lithuanian Universities