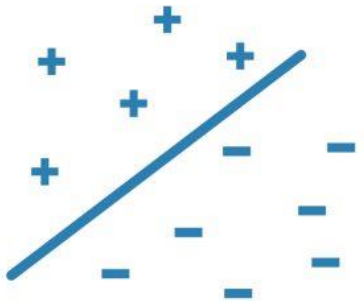
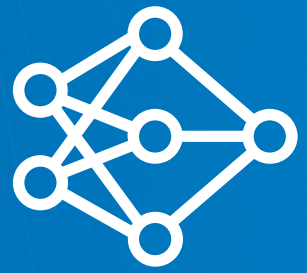
Machine Learning with MATLAB



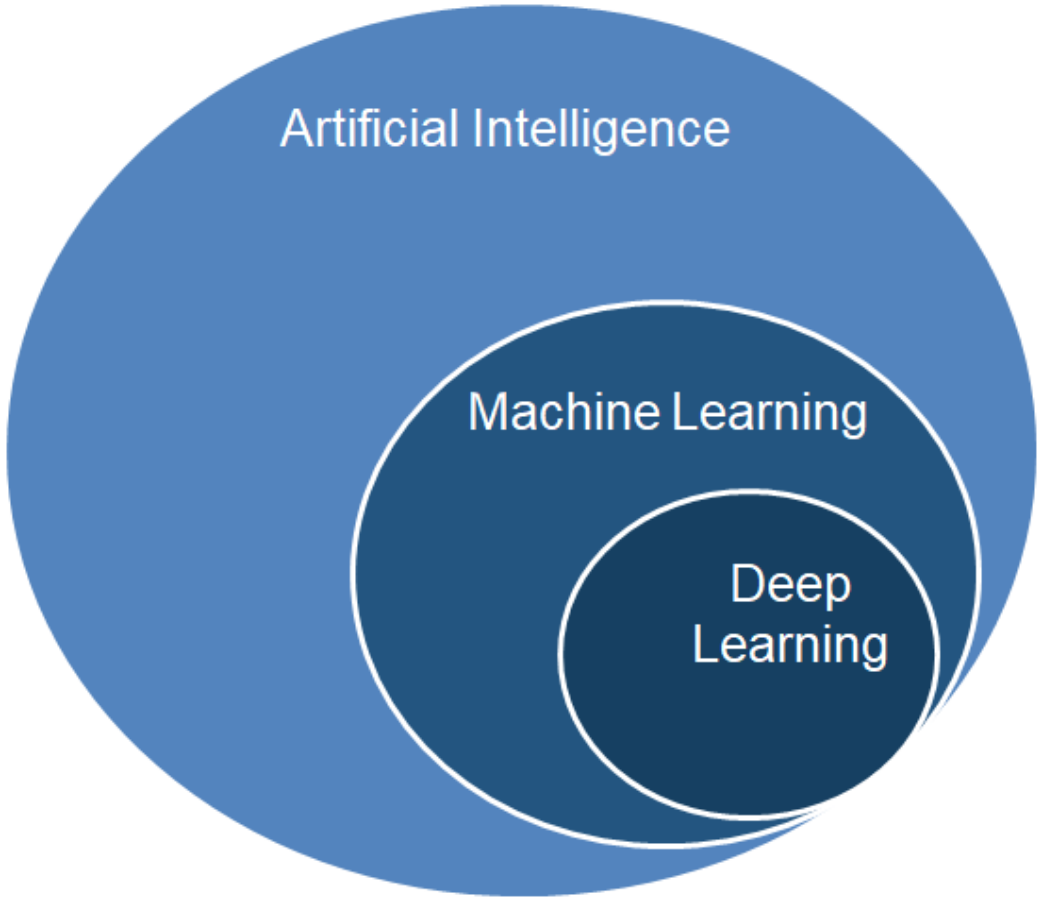
Simon Thor
KTH MATLAB student ambassador



What is MATLAB@KTH?

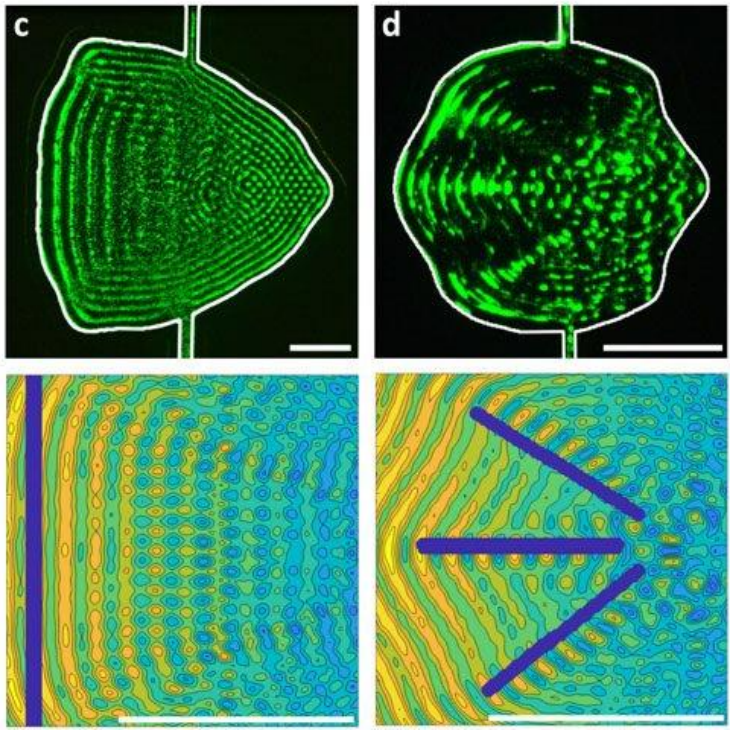
- Code and presentation available on Github: https://github.com/simonthor/kth-matlab-ambassador/tree/master/Seminars/Machine%20Learning%20with%20MATLAB
- Join the email list for future events!
- Facebook group: https://www.facebook.com/groups/MATLAB.KTH
- Instagram: https://www.instagram.com/matlab_kth/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

MATLAB for Artificial Intelligence



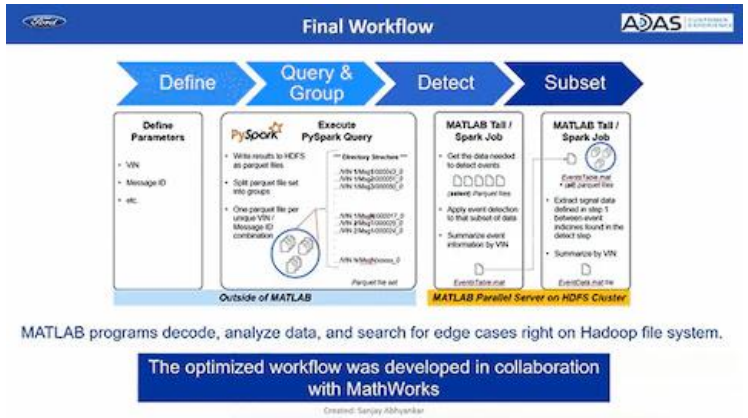
- Machine Learning
- Deep Learning
- Reinforcement Learning
- Predictive Maintenance
- Data Science / Data Analytics
- Signal Processing
- Image Processing
- …and more

Machine Learning Applications with MATLAB

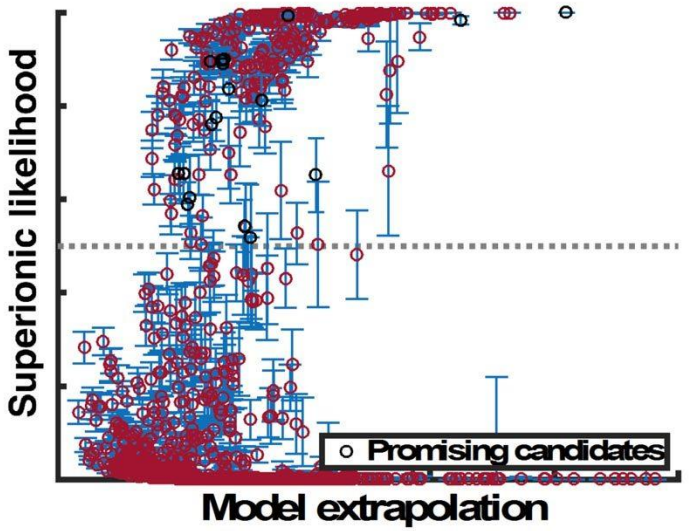


Physics-informed machine learning (MIT)

Deep learning (Airbus)



MATLAB with Apache Spark (Ford)



Battery development (Stanford)

Over-steering detection (BMW)

Machine Learning Workflow

Access and Explore Data

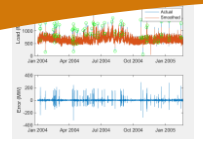
Files

Database

Sensors

Preprocess Data

Working with Messy Data



Data Reduction/ Transformation

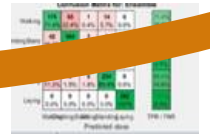
Feature Extraction

Develop Predictive Models

Model Creation e.g. Machine Learning

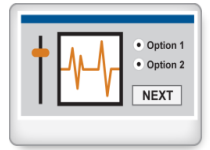
Parameter Optimization

Model Validation



Integrate Analytics with Systems

Desktop Apps

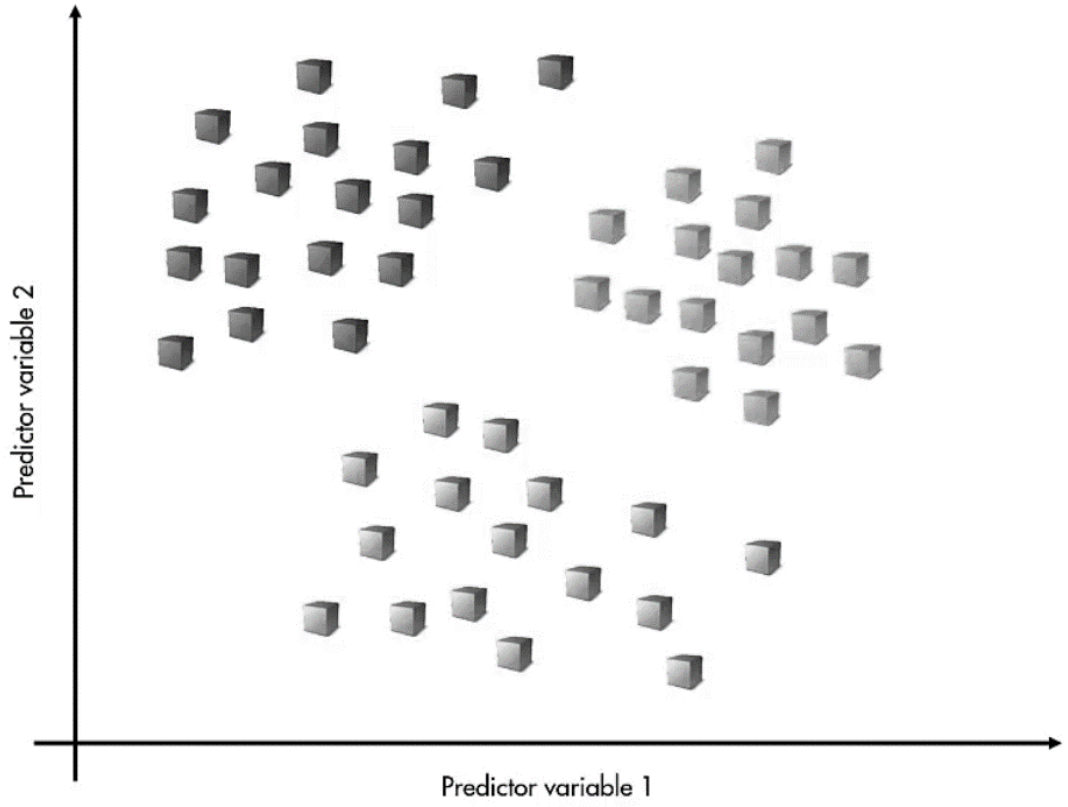


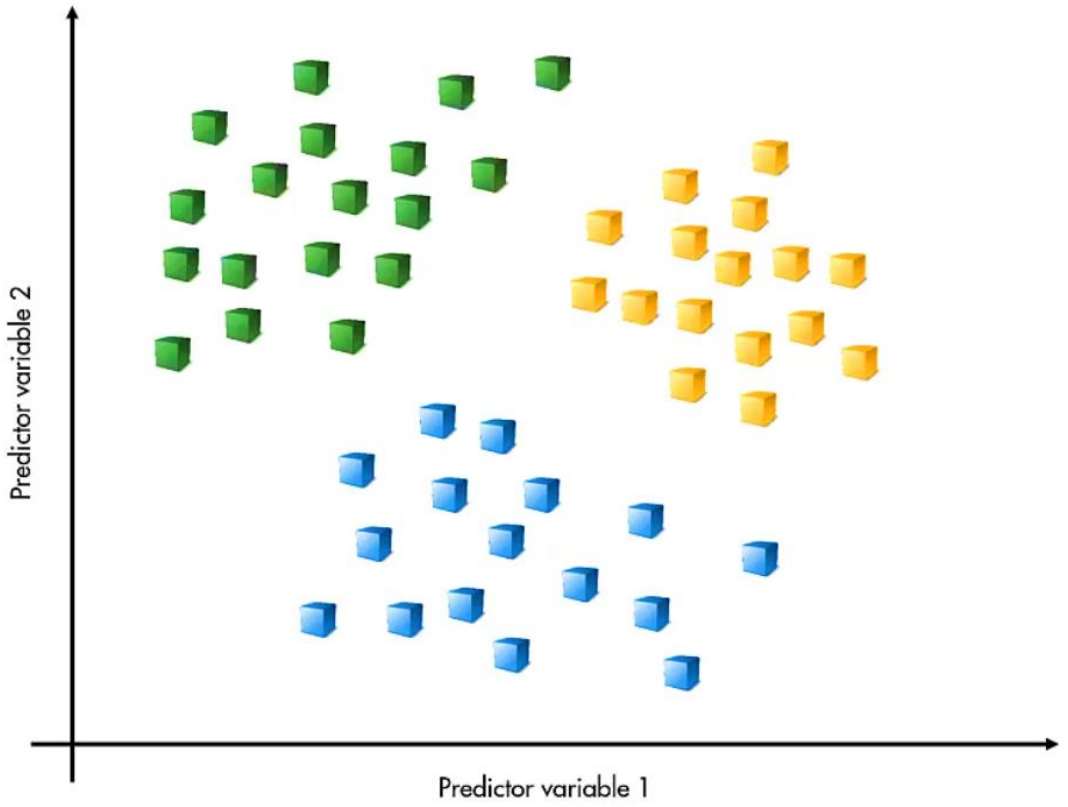
Enterprise Scale Systems

MATLAB Excel .NET .exe C/C++ Java .dll

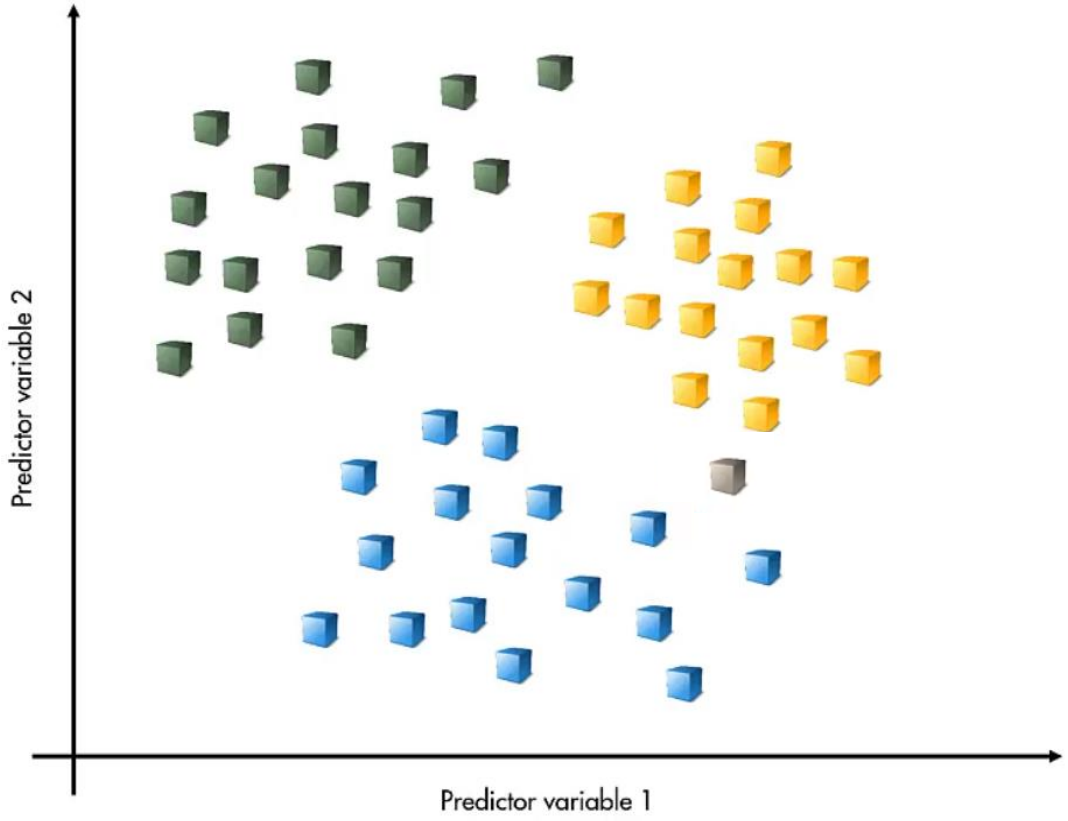
Embedded Devices and Hardware

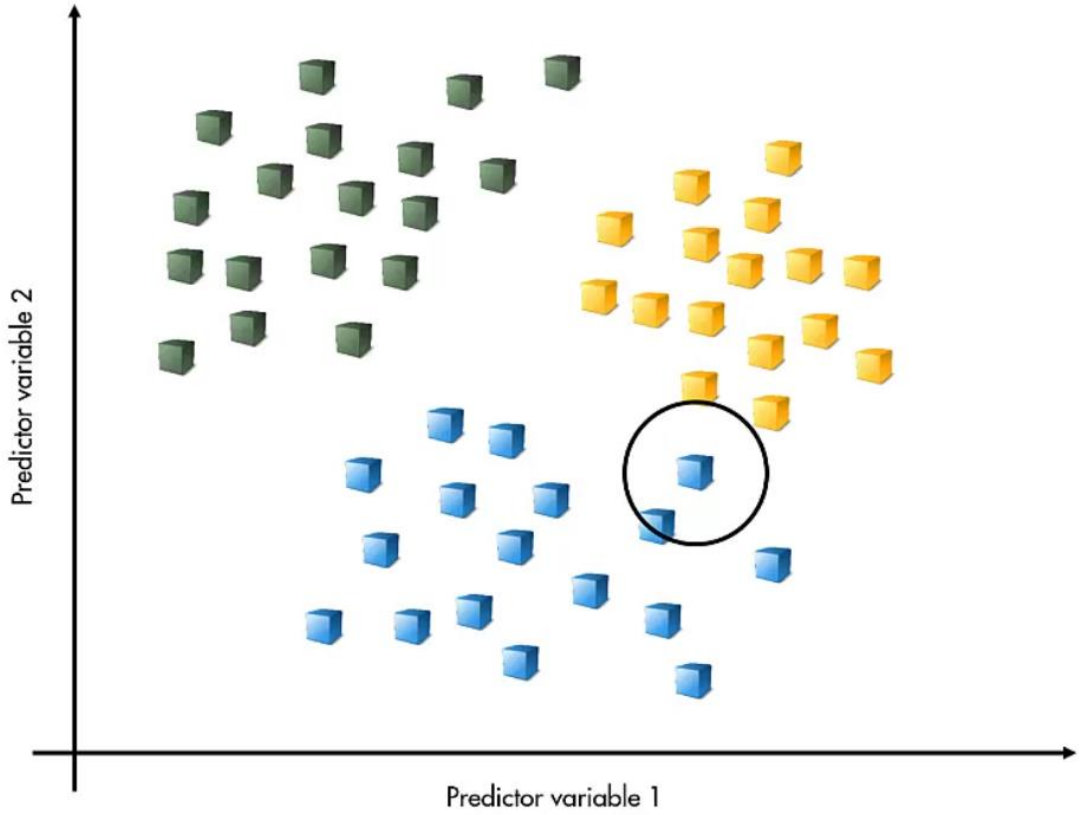
K-Nearest Neighbor Classification



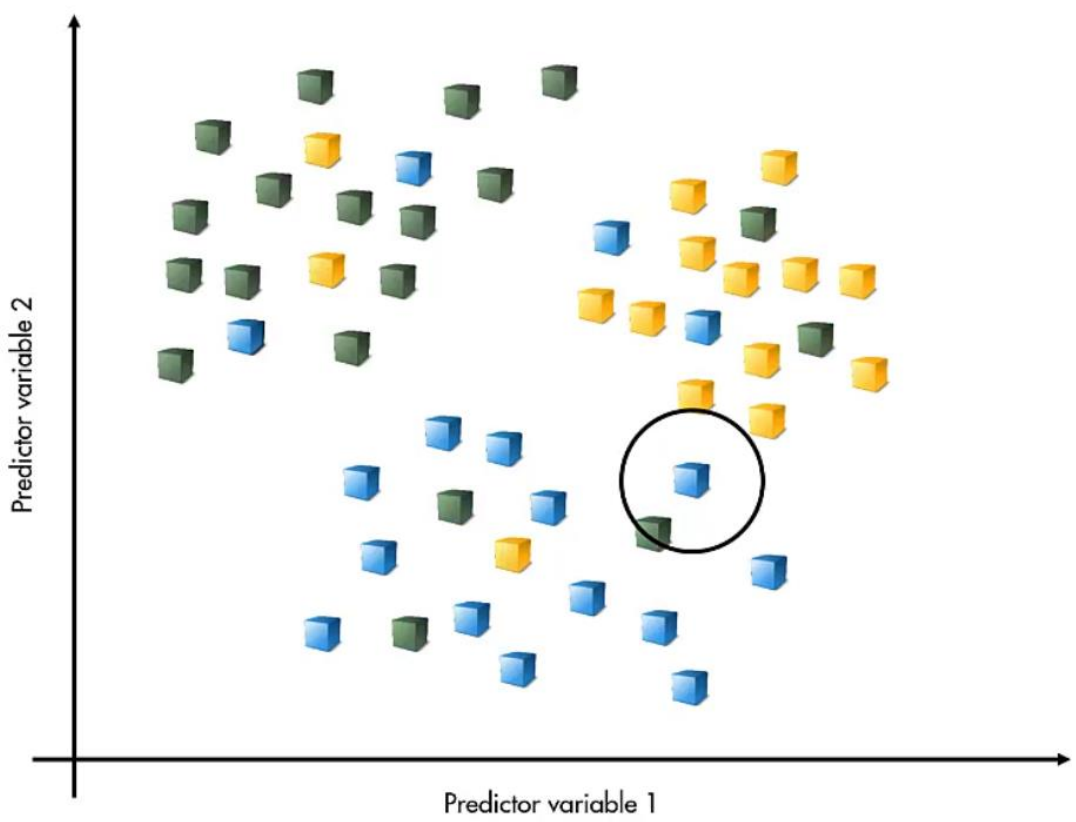


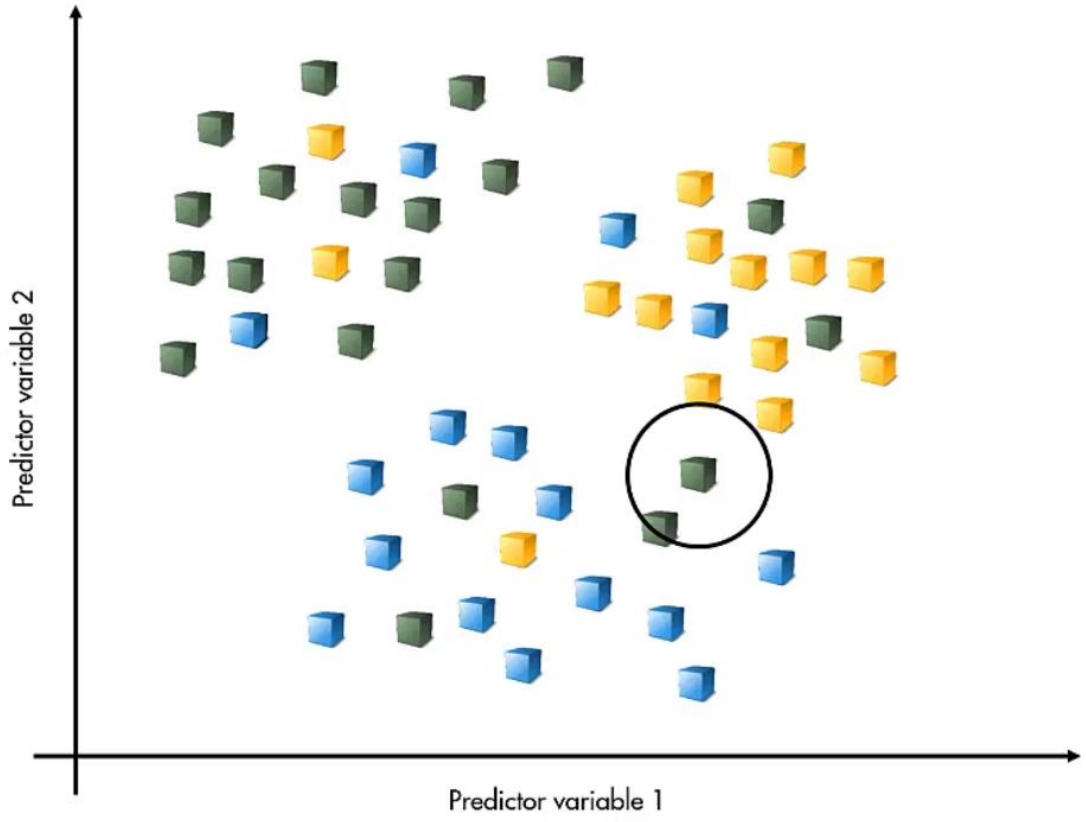
K-Nearest Neighbor Classification



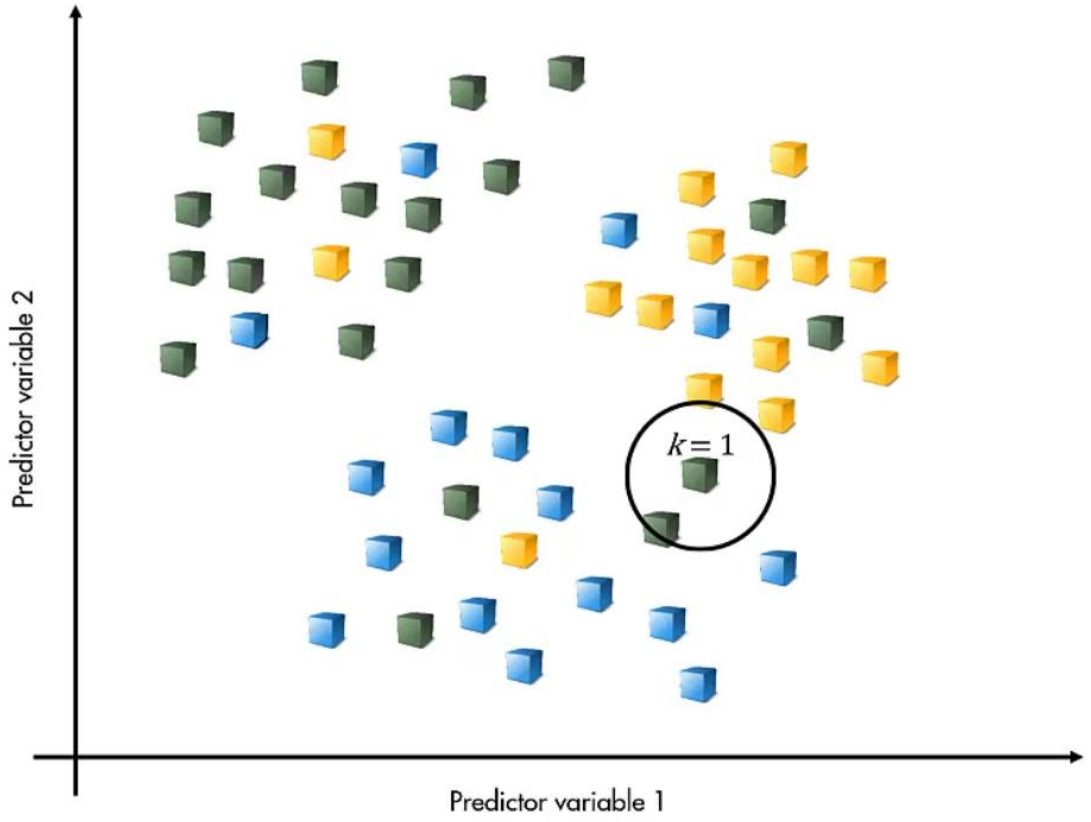


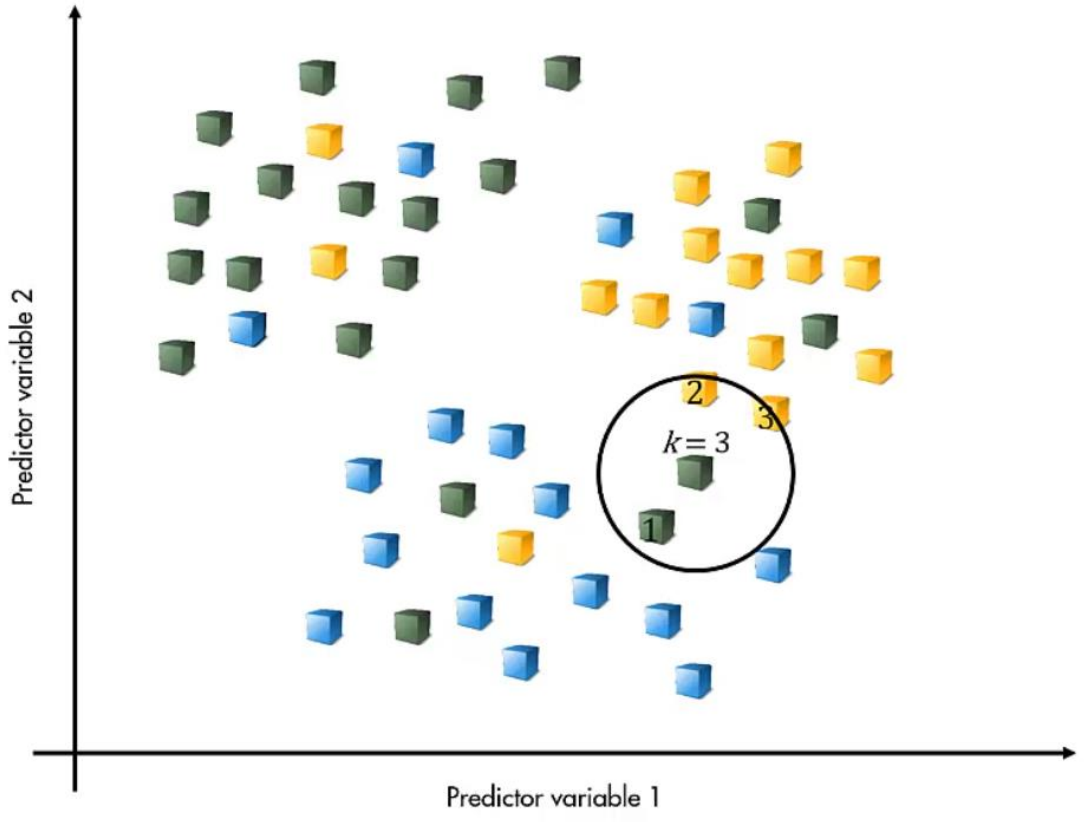
K-Nearest Neighbor Classification



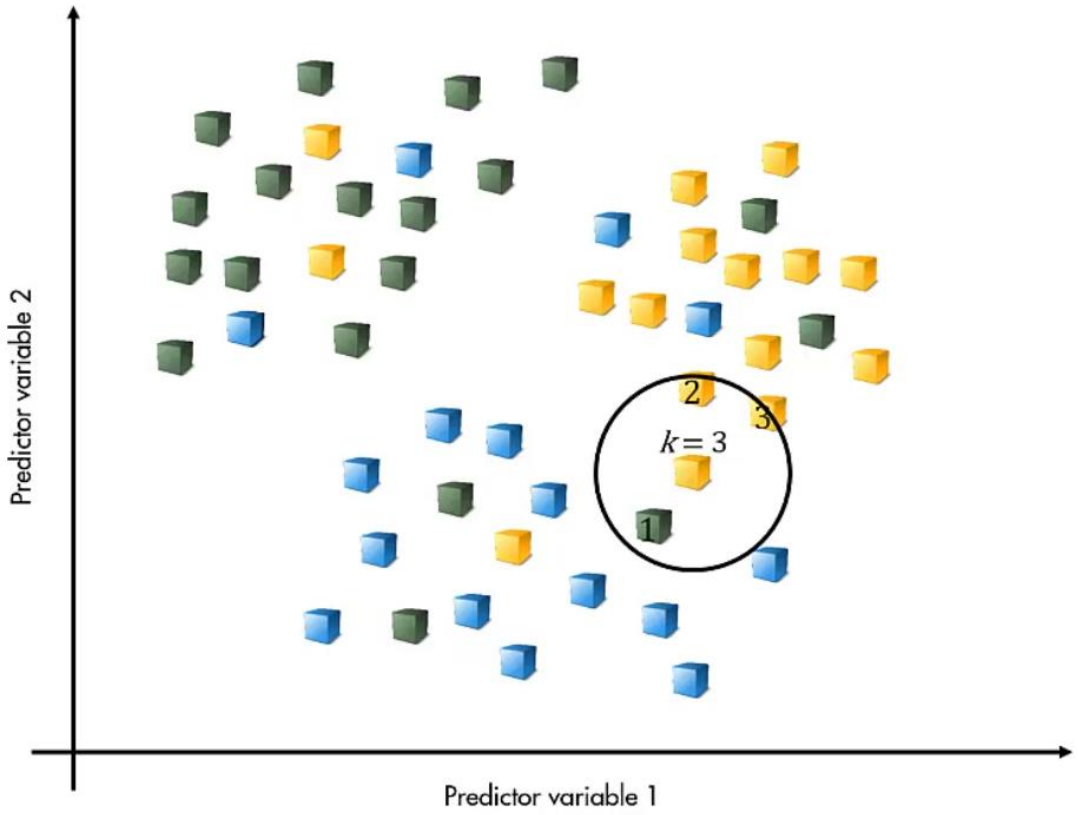


K-Nearest Neighbor Classification



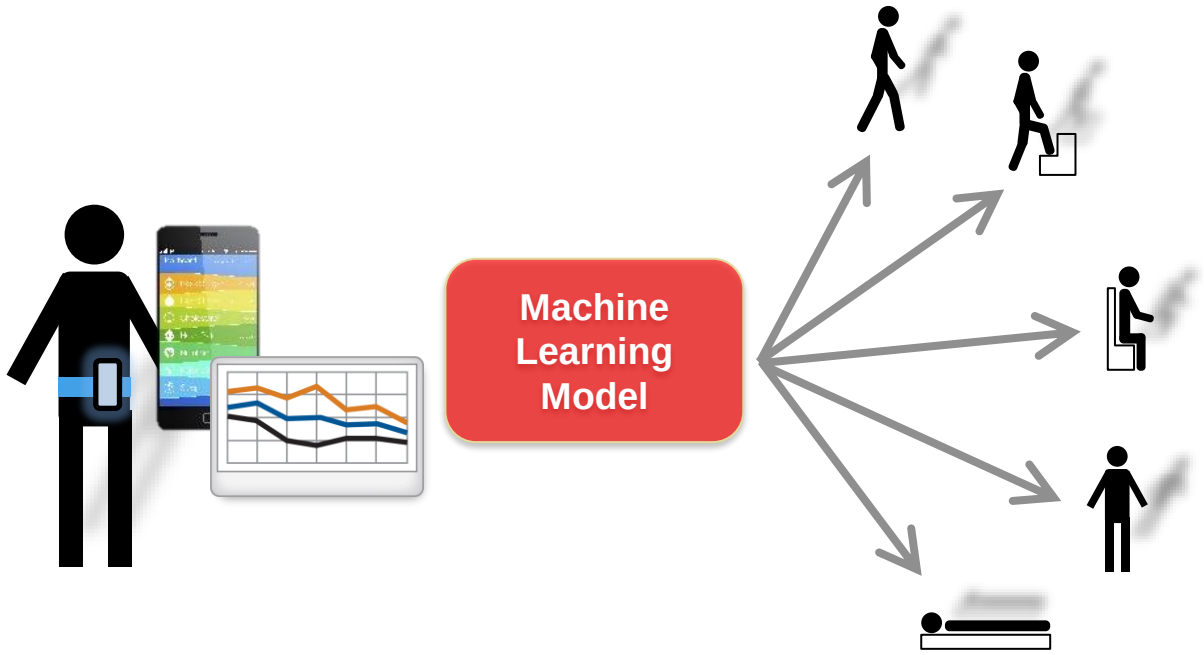


K-Nearest Neighbor Classification



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

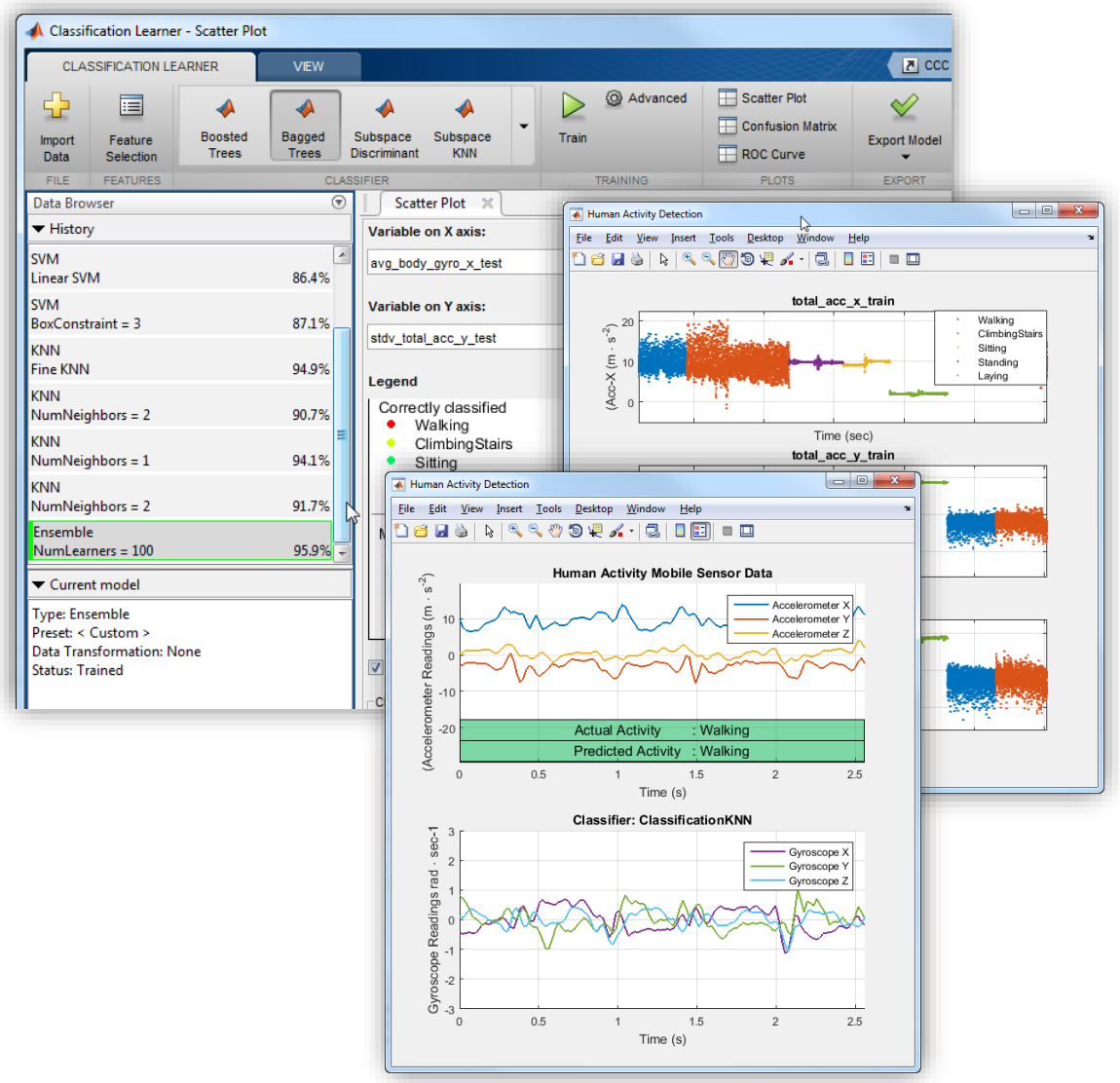
Goal: Train a model to classify human activity from sensor data

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

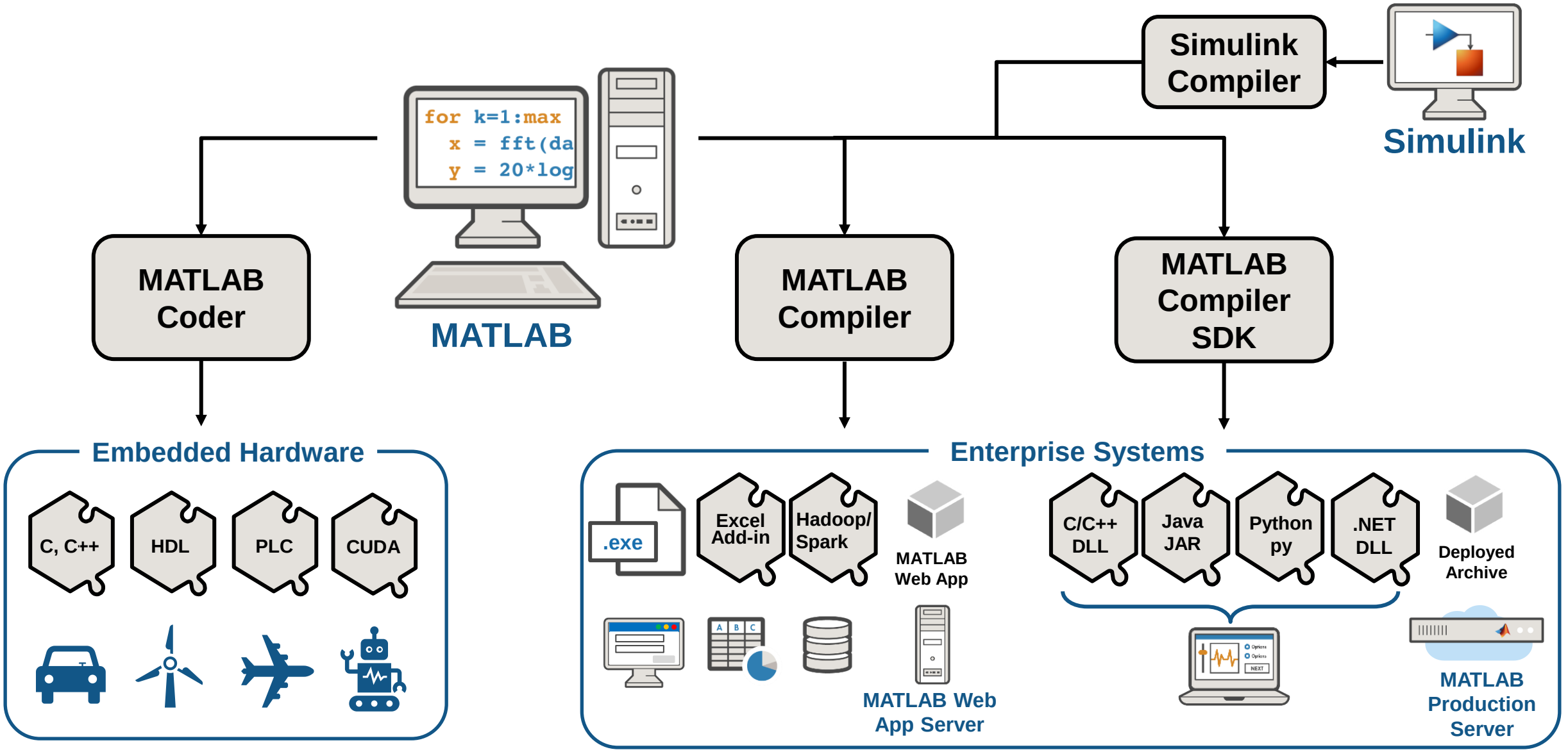
- If you want to follow along:

- Go to this link to access and run the code on MATLAB Online:

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

- Or download the code above and run it on you local MATLAB
  - Requires statistics and machine learning toolbox

Deployment with MATLAB

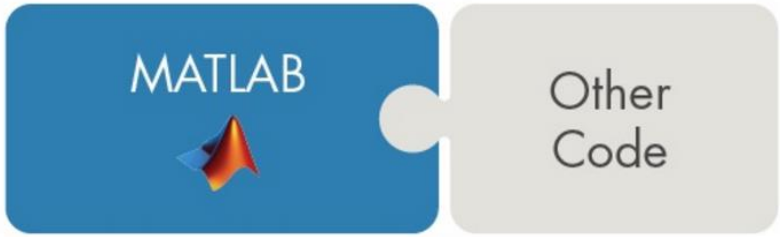


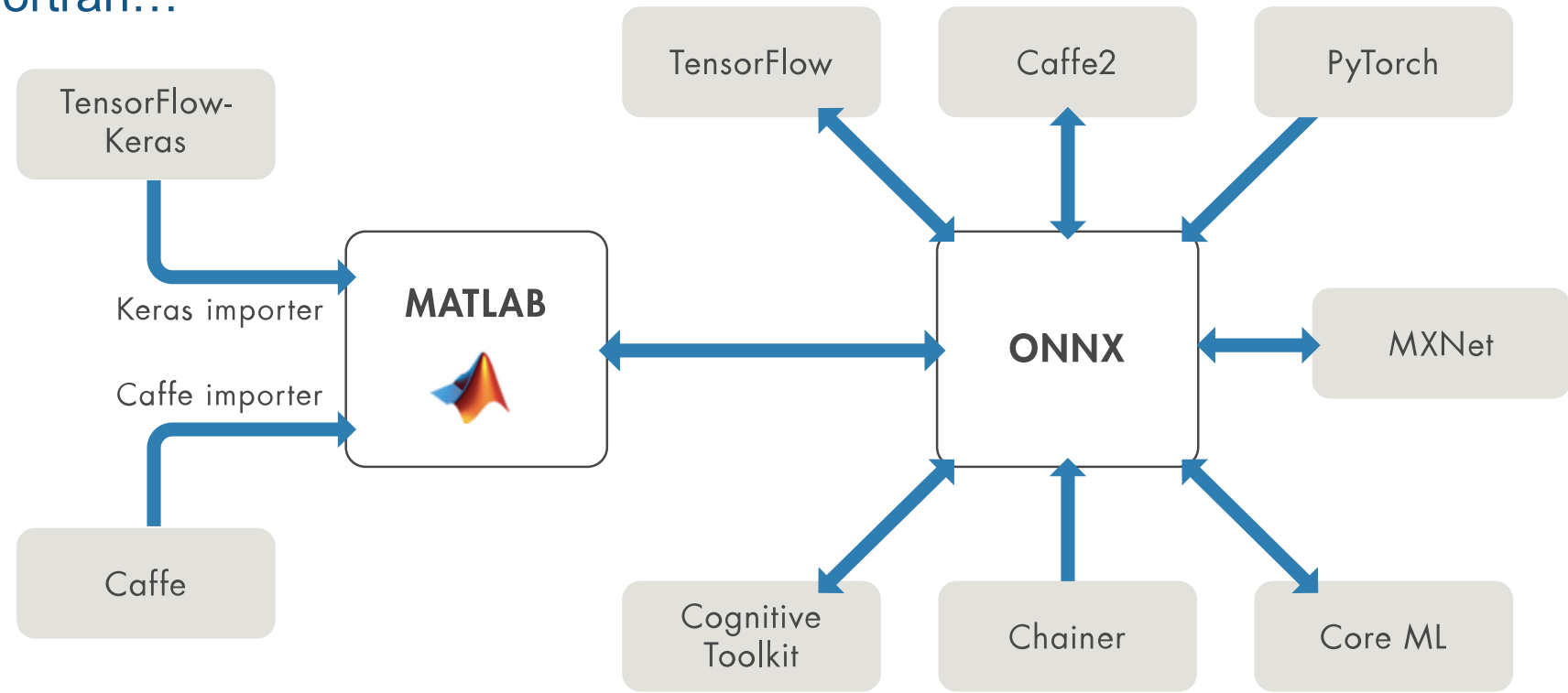
Importing and exporting models

- Import Keras models from Tensorflow directly into MATLAB
- Export and import ONNX models

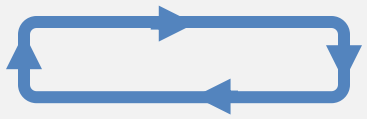
- Interface with other languages
  - Python, C/C++, Java, Fortran…

- 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)
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AI, Machine Learning, and Deep Learning

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40%

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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