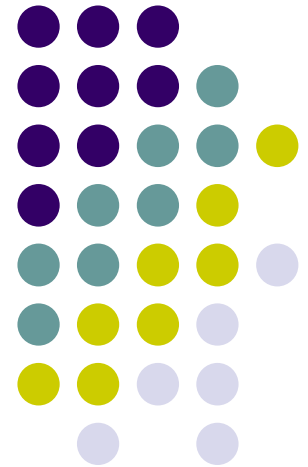


Ubiquitous and Mobile Computing

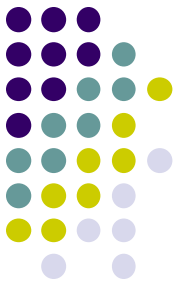
CS 528: *Mobile machine/deep learning support in MATLAB, SMS and Telephony*

Saad Islam, Muzammil Bashir,
Marie Solman, Jishen Xu & Dingda Zhou

*Computer Science Dept.
Worcester Polytechnic Institute (WPI)*



Background



Neural
Network

- 2006

CNN

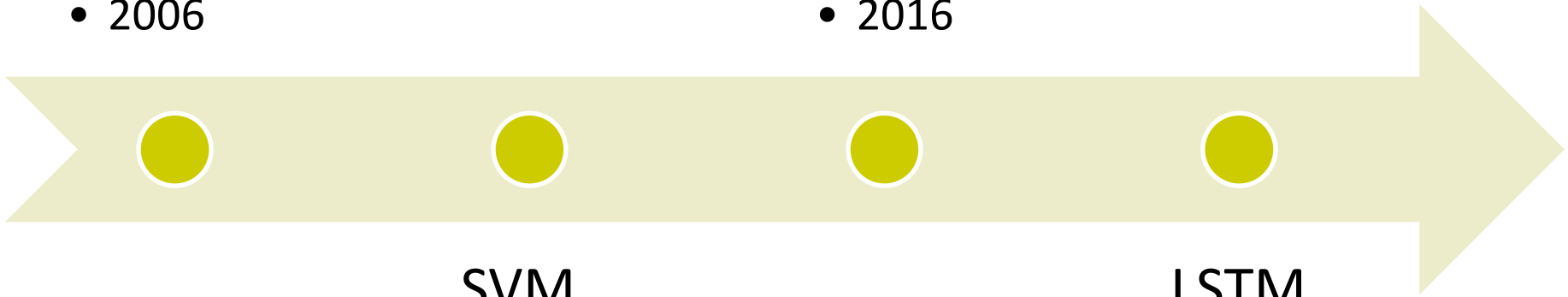
- 2016

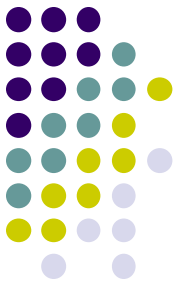
SVM

- 2013

LSTM

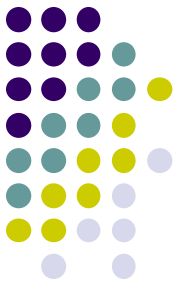
- 2017



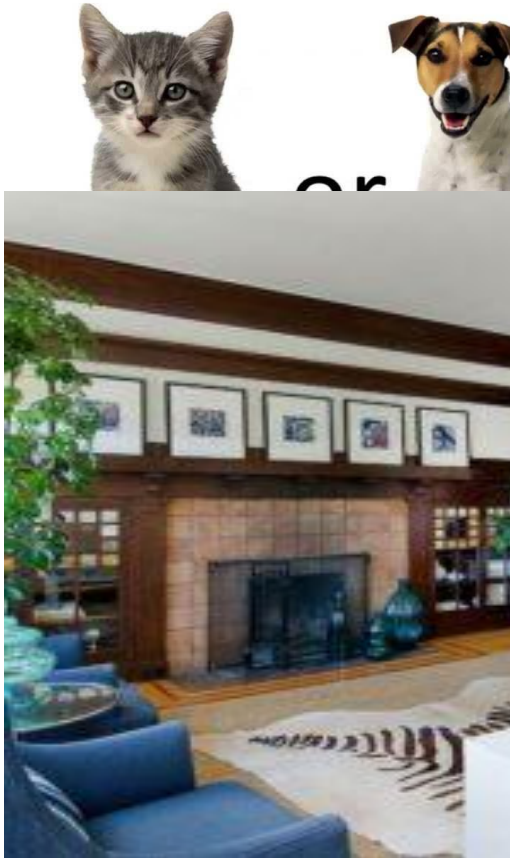


Algorithms in Various Versions

- Logistic regression (Statistics and machine learning toolbox) R2006
- neural network (deeplearning) before 2006
- SVM (Statistics and machine learning toolbox) R2013
- CNN (Computer Vision Toolbox)- R2016
- LSTM (Deep Learning Toolbox) - in R2017



Problems – Image Classification



<https://medium.com/anubhav-shrimal/dogs-vs-cats-image-classification-using-resnet-d2ed7e6db2bb>

<https://www.homedit.com/decorate-with-tall-indoor-plants/>



Problems – Object Detection

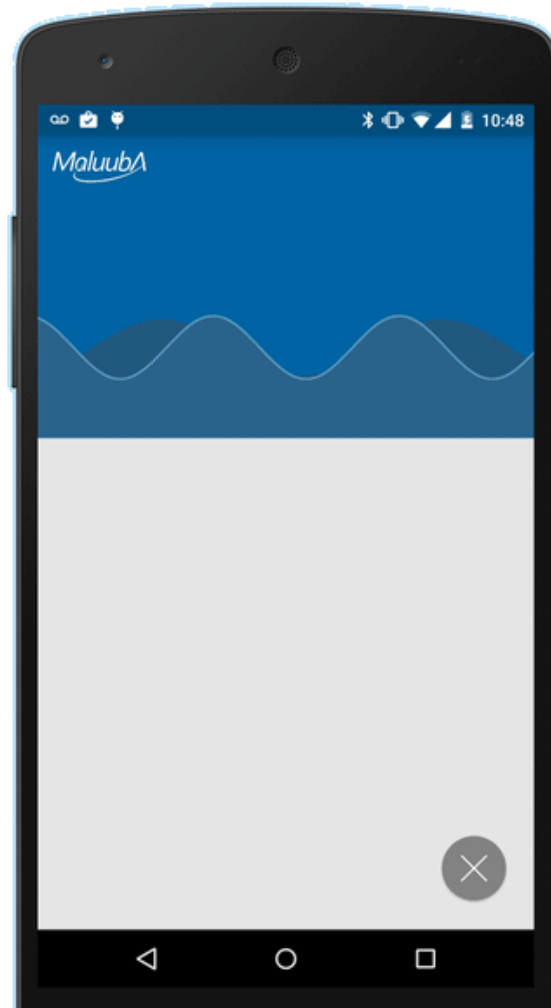
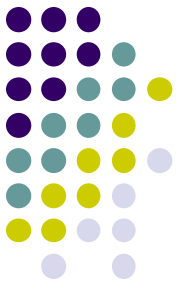
- Clutter score
- Traffic score



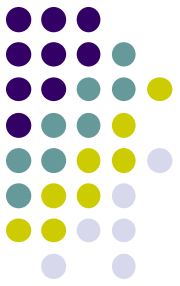
<https://towardsdatascience.com/is-google-tensorflow-object-detection-api-the-easiest-way-to-implement-image-recognition-a8bd1f500ea0>

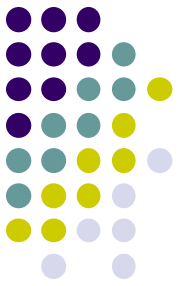
<https://www.transportation.gov/tsi/highway-traffic-safety>

Problems – Speech to Text

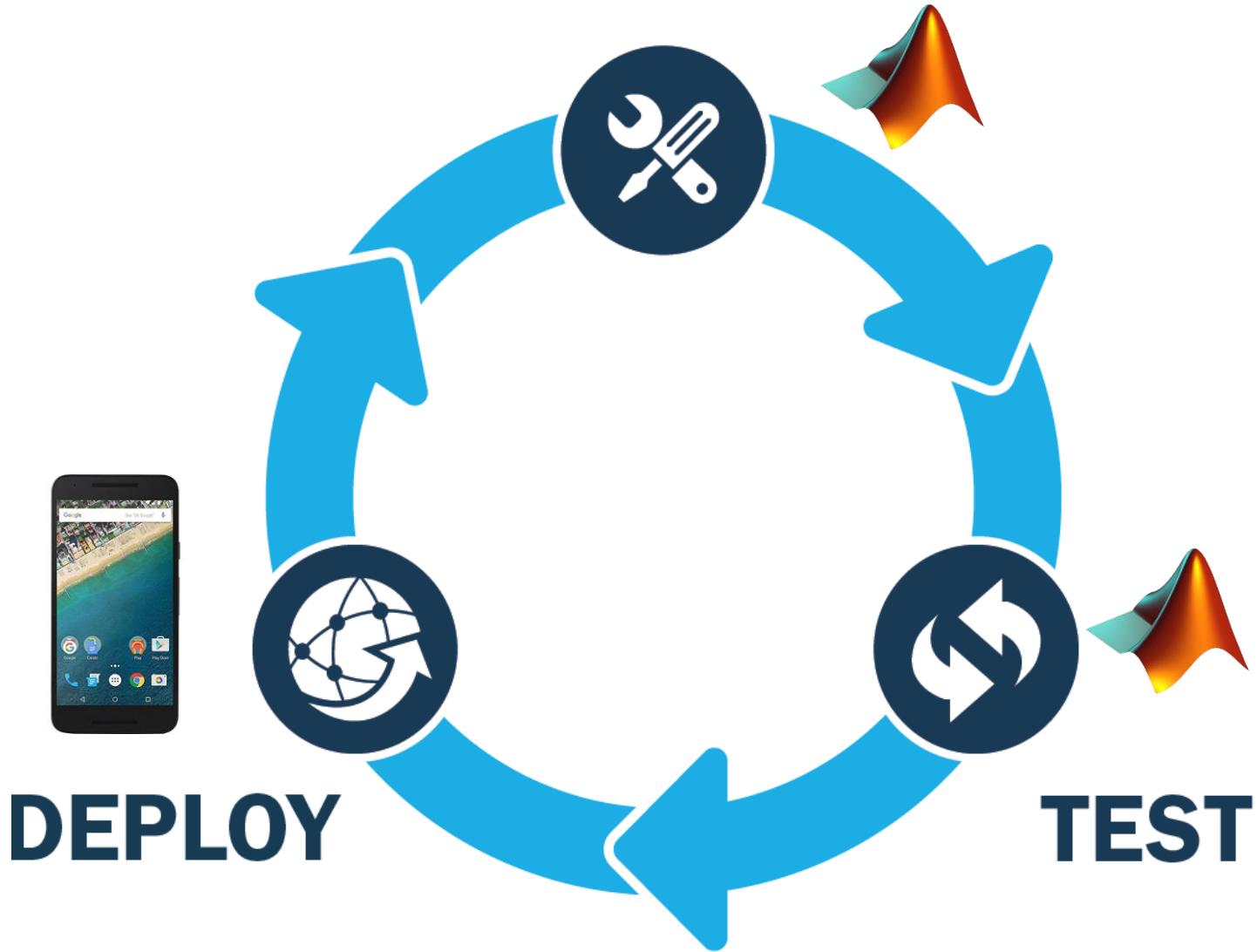


Problems - Translation



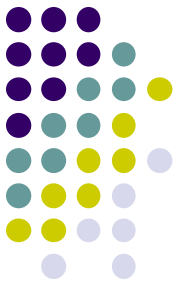


DEVELOP



DEPLOY

TEST

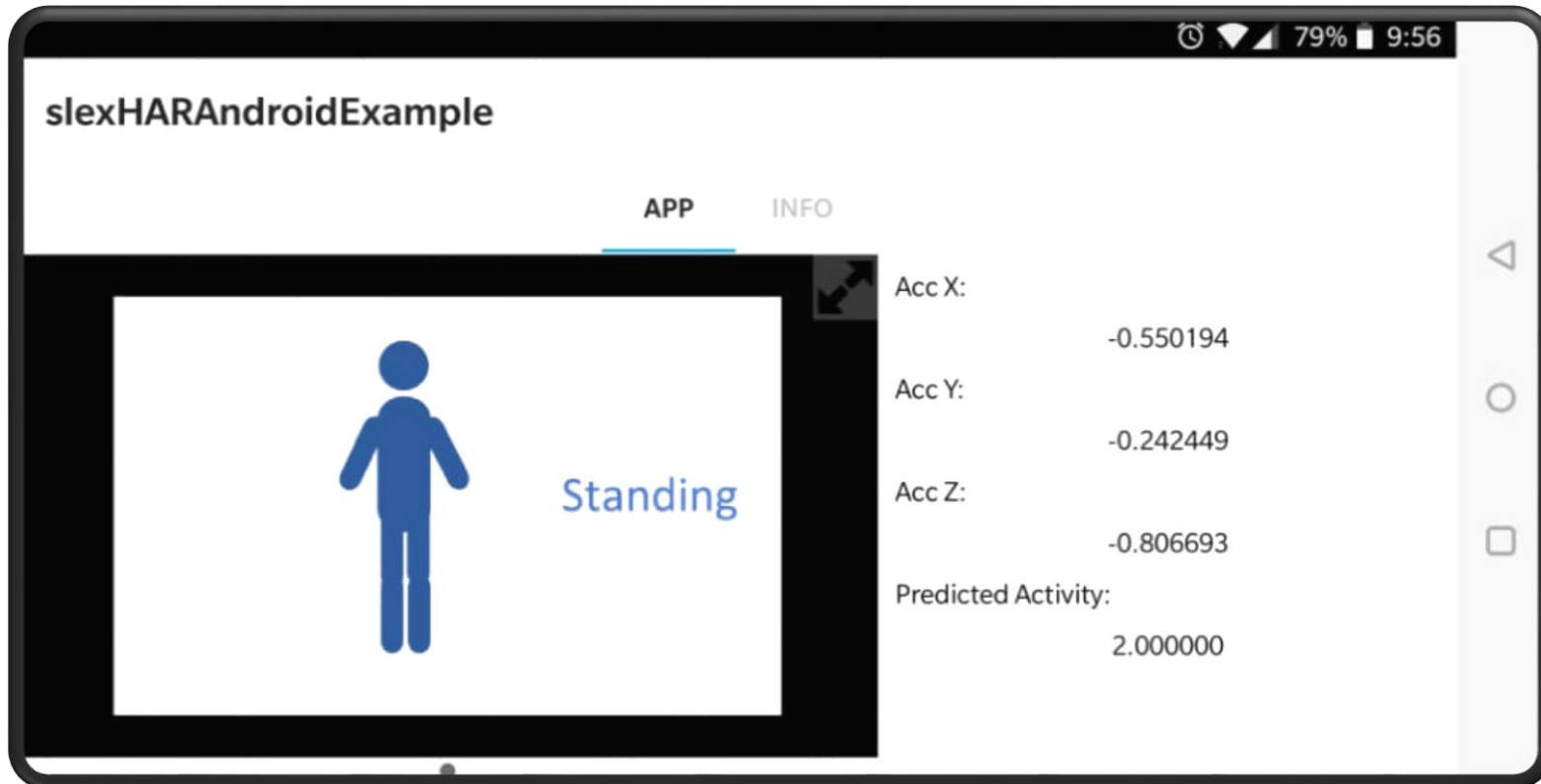
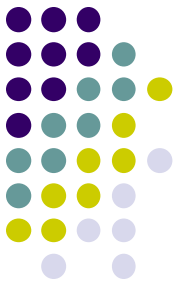


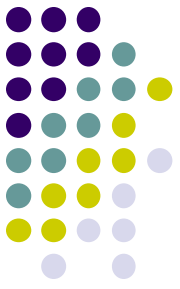
Real world examples

- Library for CNNs
- Oxford Visual Geometry Group

MatConvNet

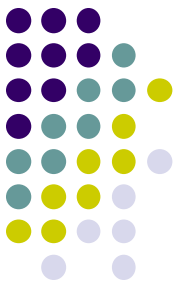
Human Activity Recognition Simulink Model for Smartphone Deployment





Load Sample Data Set

- load humanactivity
- 24,075 observations of five activities
- Sitting, Standing, Walking, Running, and Dancing

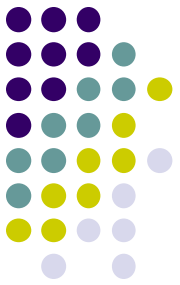


Prepare Data

- `XTrain = feat(trainingInds, :);`
- `YTrain = actid(trainingInds);`

- `XTest = feat(testInds, :);`
- `YTest = actid(testInds);`

- `tTrain = array2table([XTrain YTrain]);`



Load data in Classification Learner

New Session

Data set

Workspace Variable
tTrain 21668x61 table

Response
Activities double 1 .. 5

Predictors

	Name	Type	Range
<input checked="" type="checkbox"/>	TotalAccXMean	double	-0.453039 .. 0.834224
<input checked="" type="checkbox"/>	TotalAccYMean	double	-1.24491 .. 1.66989
<input checked="" type="checkbox"/>	TotalAccZMean	double	-0.989318 .. 0.36021
<input checked="" type="checkbox"/>	BodyAccXRMS	double	0.00136851 .. 0.99214
<input checked="" type="checkbox"/>	BodyAccYRMS	double	0.00244462 .. 2.23241
<input checked="" type="checkbox"/>	BodyAccZRMS	double	0.000647098 .. 1.42422
<input checked="" type="checkbox"/>	BodyAccXCovZeroValue	double	0 .. 31.4989
<input checked="" type="checkbox"/>	BodyAccXCovFirstPos	double	-2.7 .. 0
<input checked="" type="checkbox"/>	BodyAccXCovFirstValue	double	-0.729147 .. 11.3631
<input checked="" type="checkbox"/>	BodyAccYCovZeroValue	double	0 .. 159.477
<input checked="" type="checkbox"/>	BodyAccYCovFirstPos	double	-2.7 .. 0
<input checked="" type="checkbox"/>	BodyAccYCovFirstValue	double	-4.00791 .. 48.9248
<input checked="" type="checkbox"/>	BodyAccZCovZeroValue	double	0 .. 64.9086

Add All Remove All

[How to prepare data](#)

Validation

Cross-Validation
Protects against overfitting by partitioning the data set into folds and estimating accuracy on each fold.

Cross-validation folds: 5 folds

Holdout Validation
Recommended for large data sets.

Percent held out: 25%

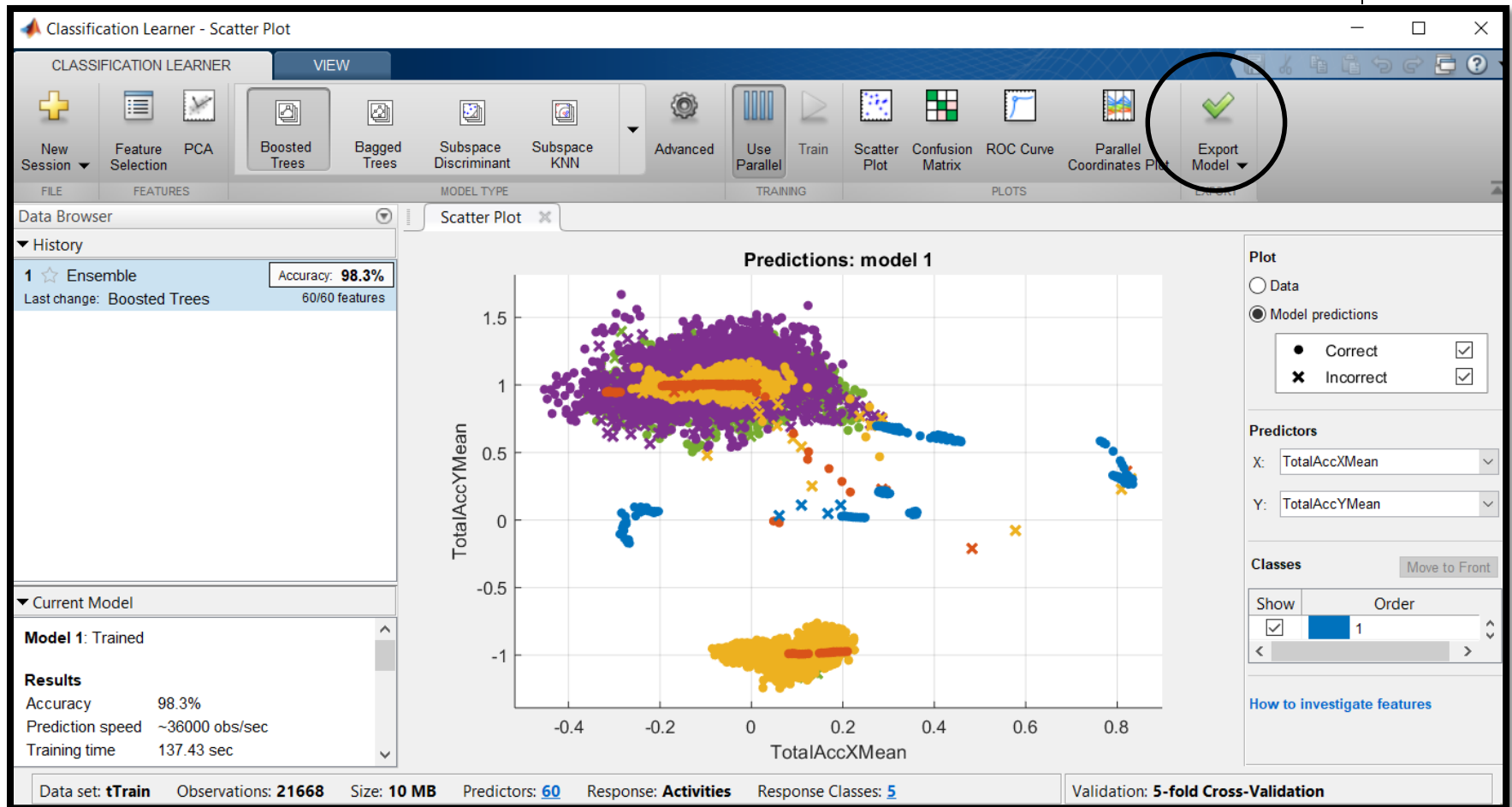
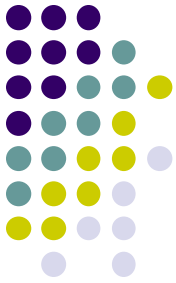
No Validation
No protection against overfitting.

[Read about validation](#)

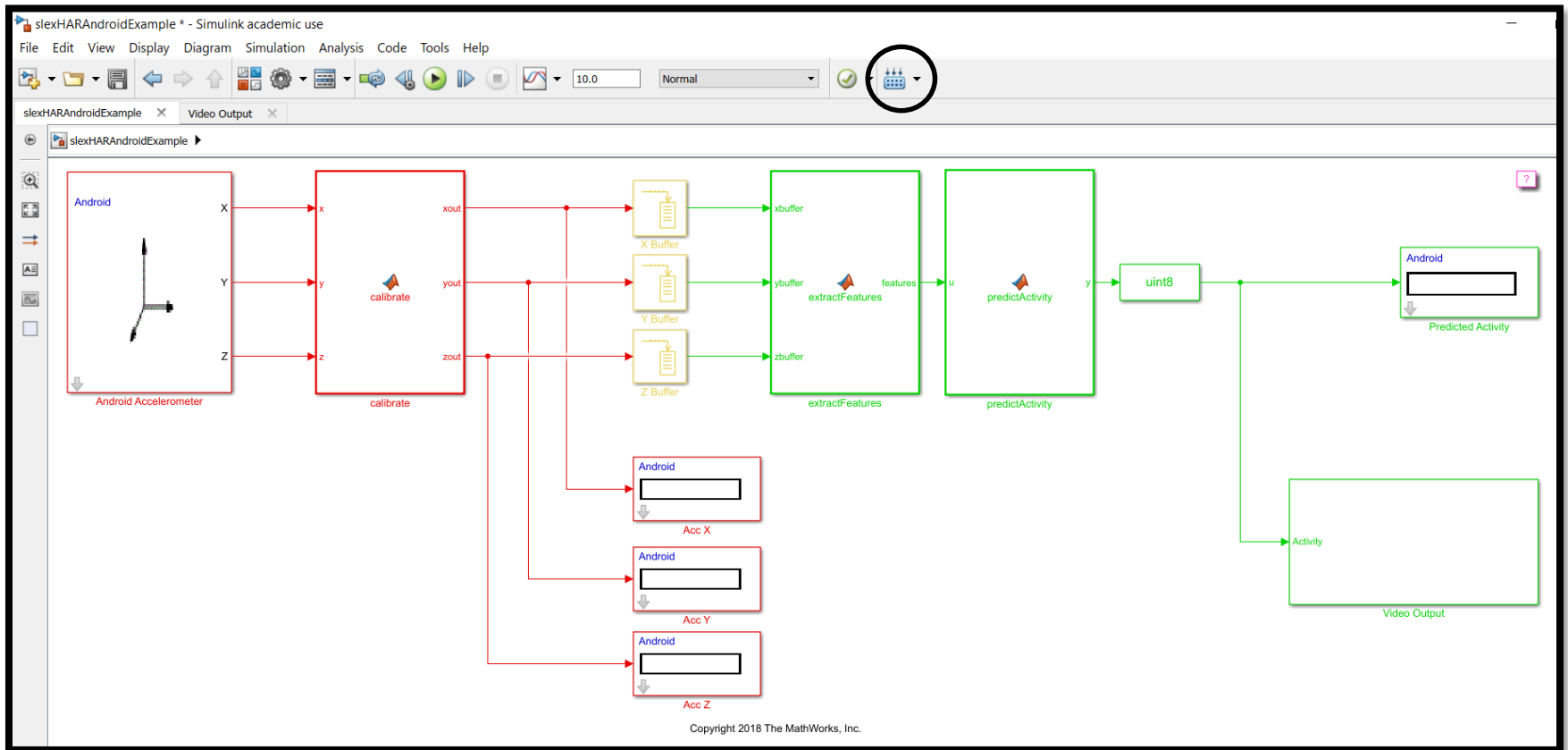
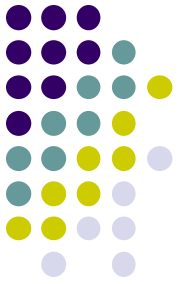
Response variable is numeric. Distinct values will be interpreted as class labels.

Start Session Cancel

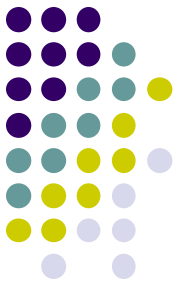
Train Model



Deploy to Hardware



Simulink Support for Android



The screenshot displays the Simulink Library Browser interface. The search bar at the top contains the text 'android'. The main area is titled 'Simulink Support Package for Android Devices/Sensors'. On the left, a tree view shows the following categories:

- Robust Control Toolbox
- > Simscape
- > Simulink 3D Animation
- > Simulink Coder
- > Simulink Control Design
- > Simulink Design Optimization
- > Simulink Desktop Real-Time
- > Simulink Extras
- Simulink Requirements
- ▼ Simulink Support Package for Android Devices
 - Advanced
 - Audio & Video
 - Communication
 - Sensors**
 - User Interface
- Stateflow
- > System Identification Toolbox
- Recently Used

The main display area shows nine sensor blocks arranged in a 3x3 grid, each with an 'Android' label and an icon:

- Accelerometer**: Icon of a 3D coordinate system with X, Y, and Z axes.
- Ambient Temperature Sensor**: Icon of a thermometer.
- Gyroscope**: Icon of a gyroscope with X, Y, and Z axes.
- Humidity Sensor**: Icon of a water droplet.
- Light Sensor**: Icon of a sun.
- Location Sensor**: Icon of a satellite, with output ports labeled Lat, Lon, and Alt.
- Magnetometer**: Icon of a horseshoe magnet.
- Orientation**: Icon of a 3D coordinate system with rotation arrows.
- Pressure Sensor**: Icon of a pressure gauge.