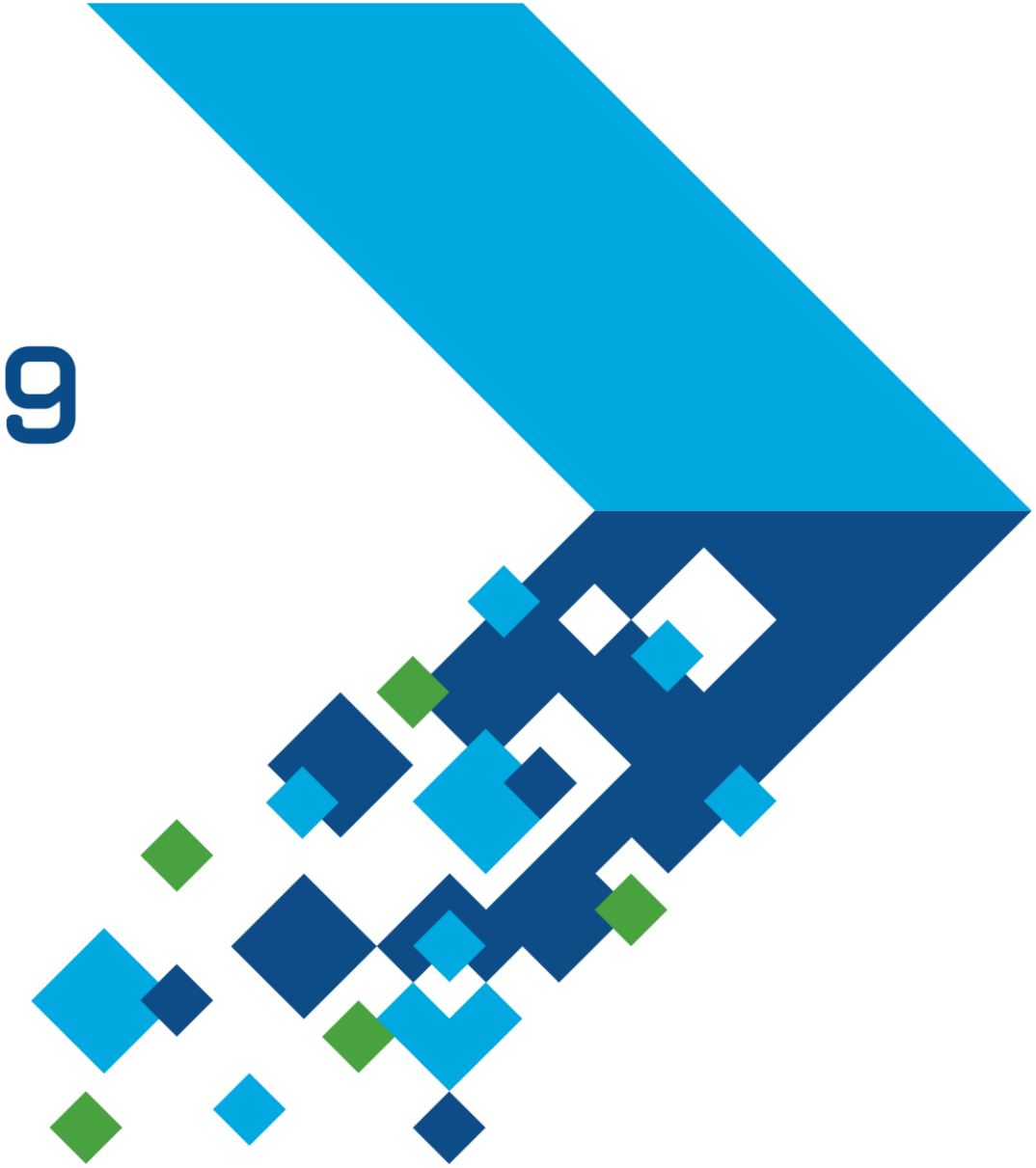
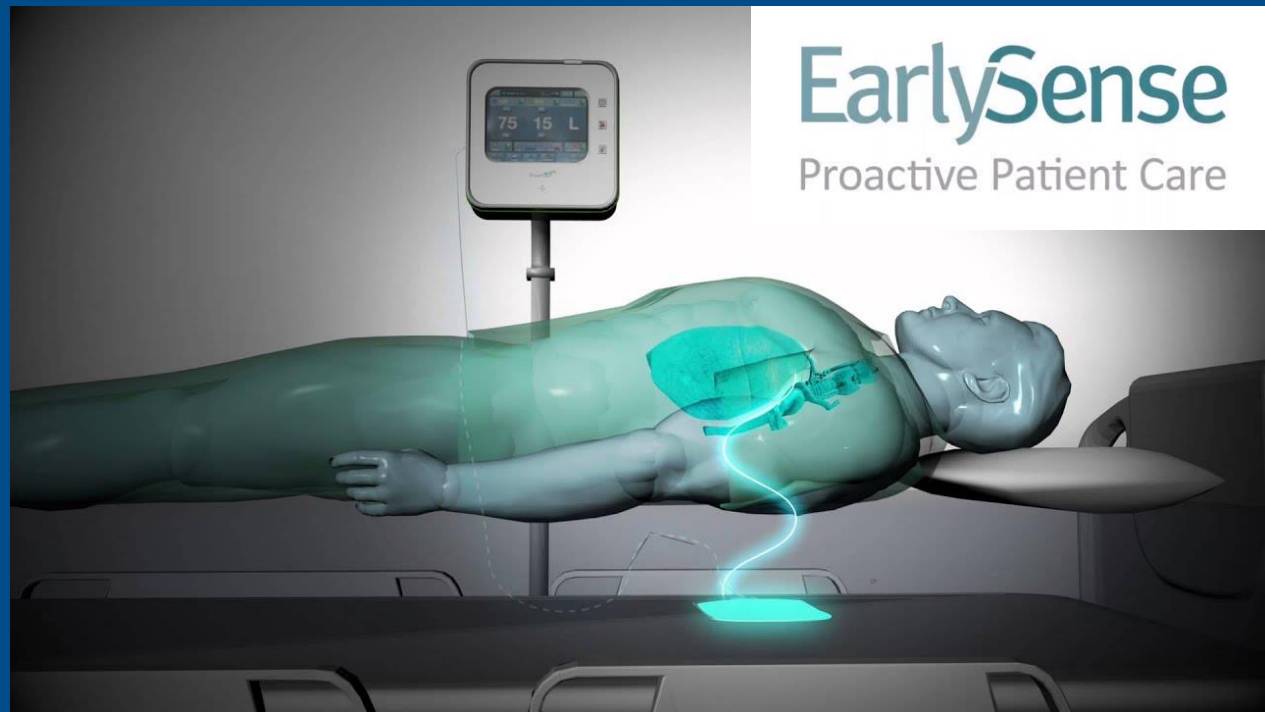
MATLAB EXPO 2019

What's New in MATLAB and Simulink

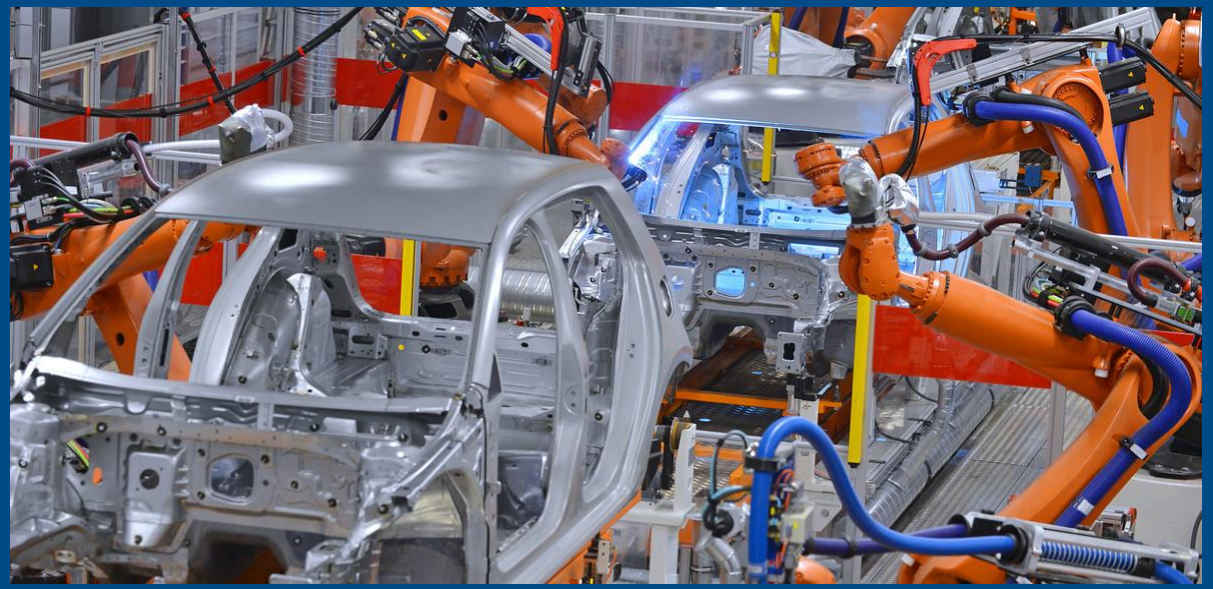


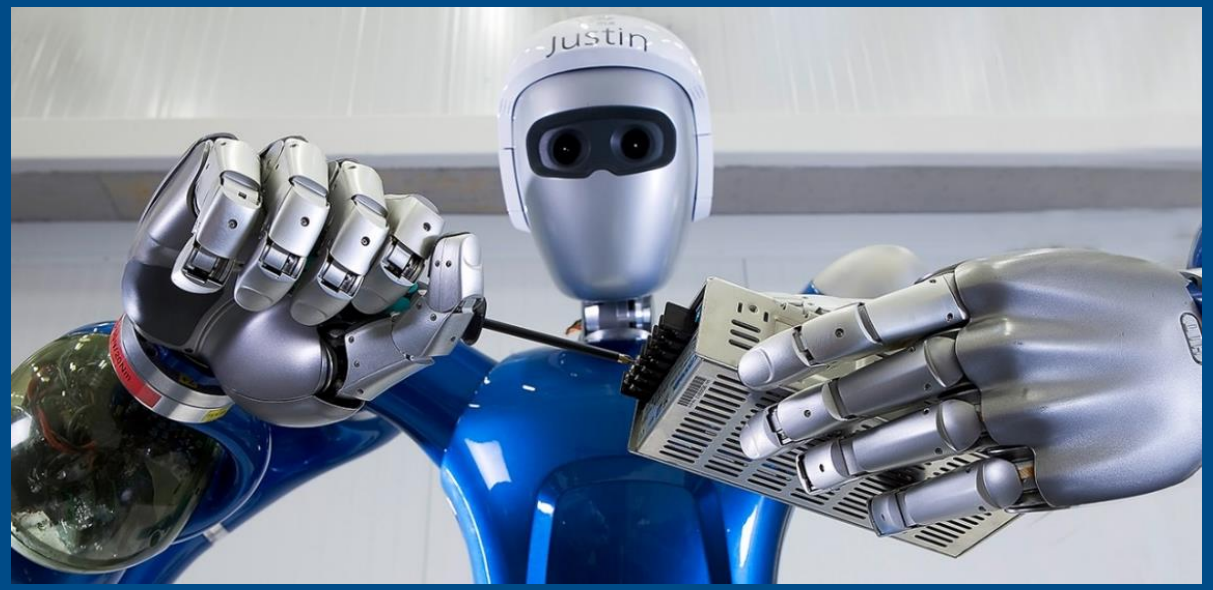
Prashant.Rao@mathworks.in
@_prashantrao_
prashantrao


VOYAGE


75 15 L
EarlySense
Proactive Patient Care

Algorithms in Everything



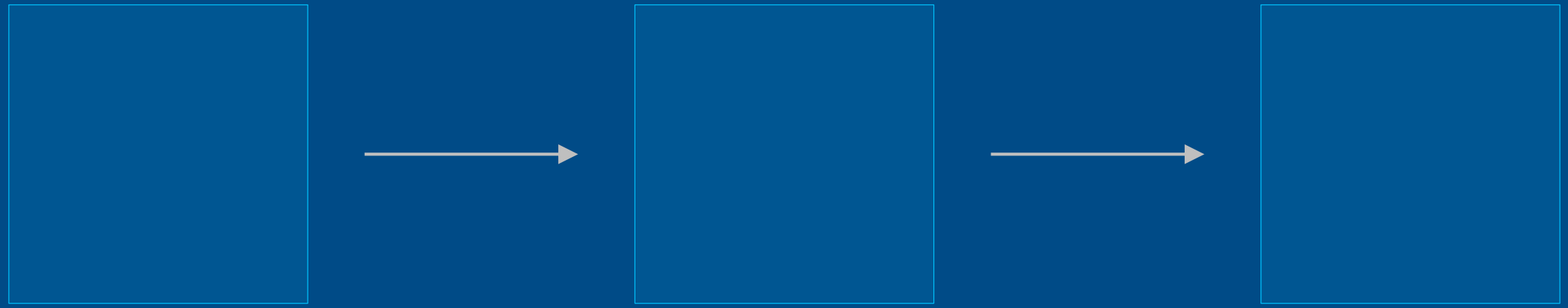


Using MATLAB & Simulink to Build Algorithms in Everything

Simplifying your work…

…often at higher levels of abstraction.

Using MATLAB & Simulink to Build Algorithms in Everything



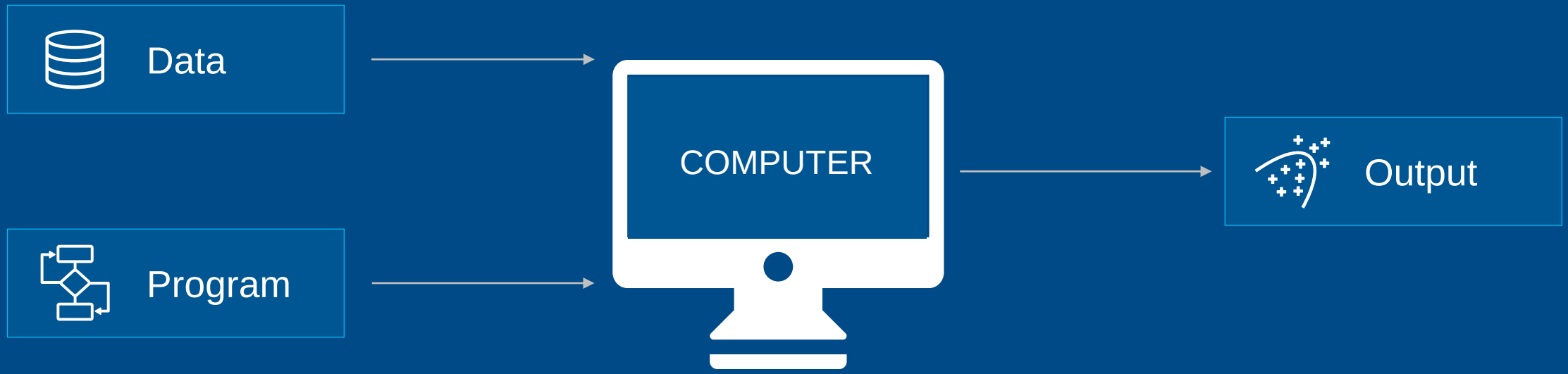
MATLAB&SIMULINK®

Artificial Intelligence

The capability of a machine to
match or exceed intelligent human behavior by
training a machine
to learn the desired behavior

There are two ways to get a computer to do what you want

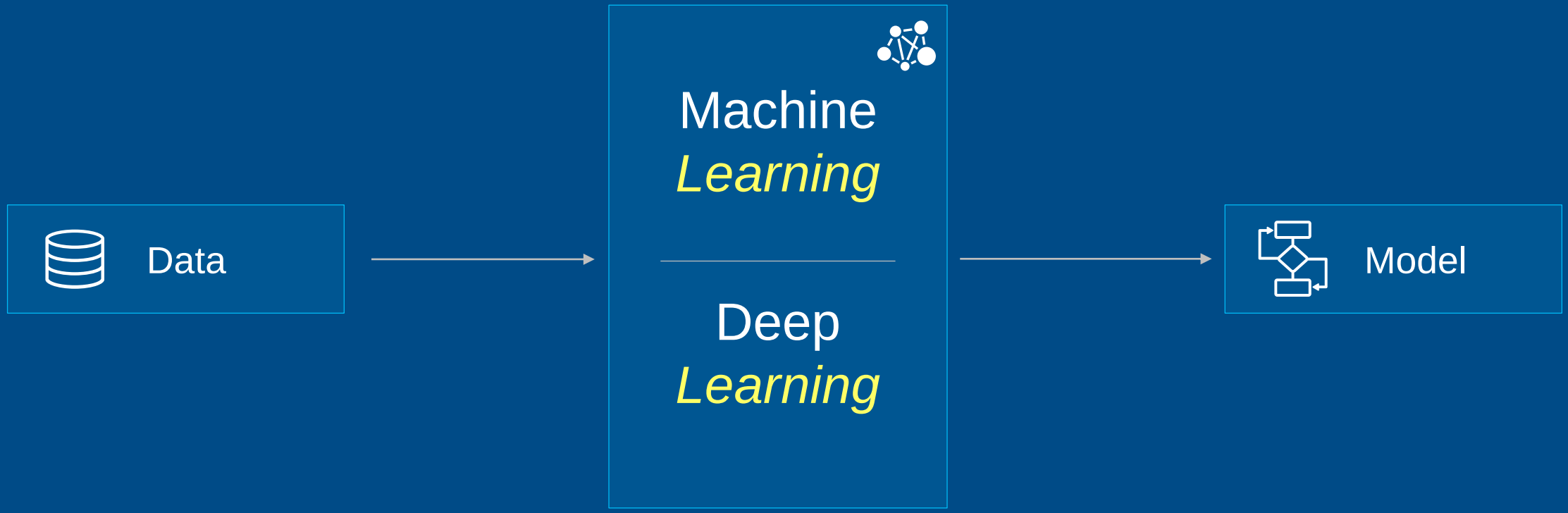
Traditional Programming



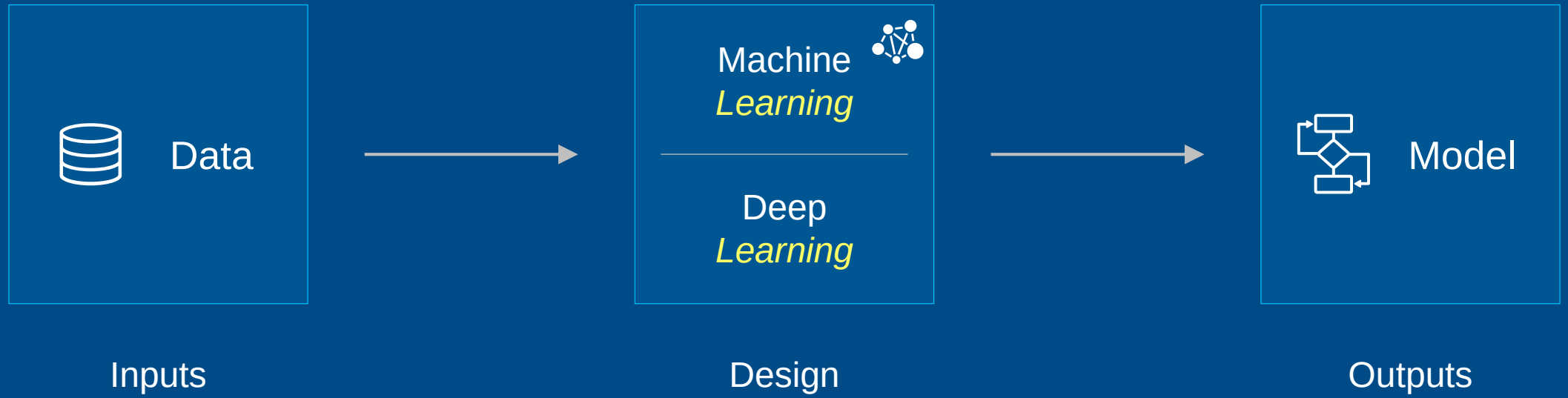
There are two ways to get a computer to do what you want

Machine Learning

Artificial Intelligence



Using MATLAB and Simulink to Build Deep Learning Models



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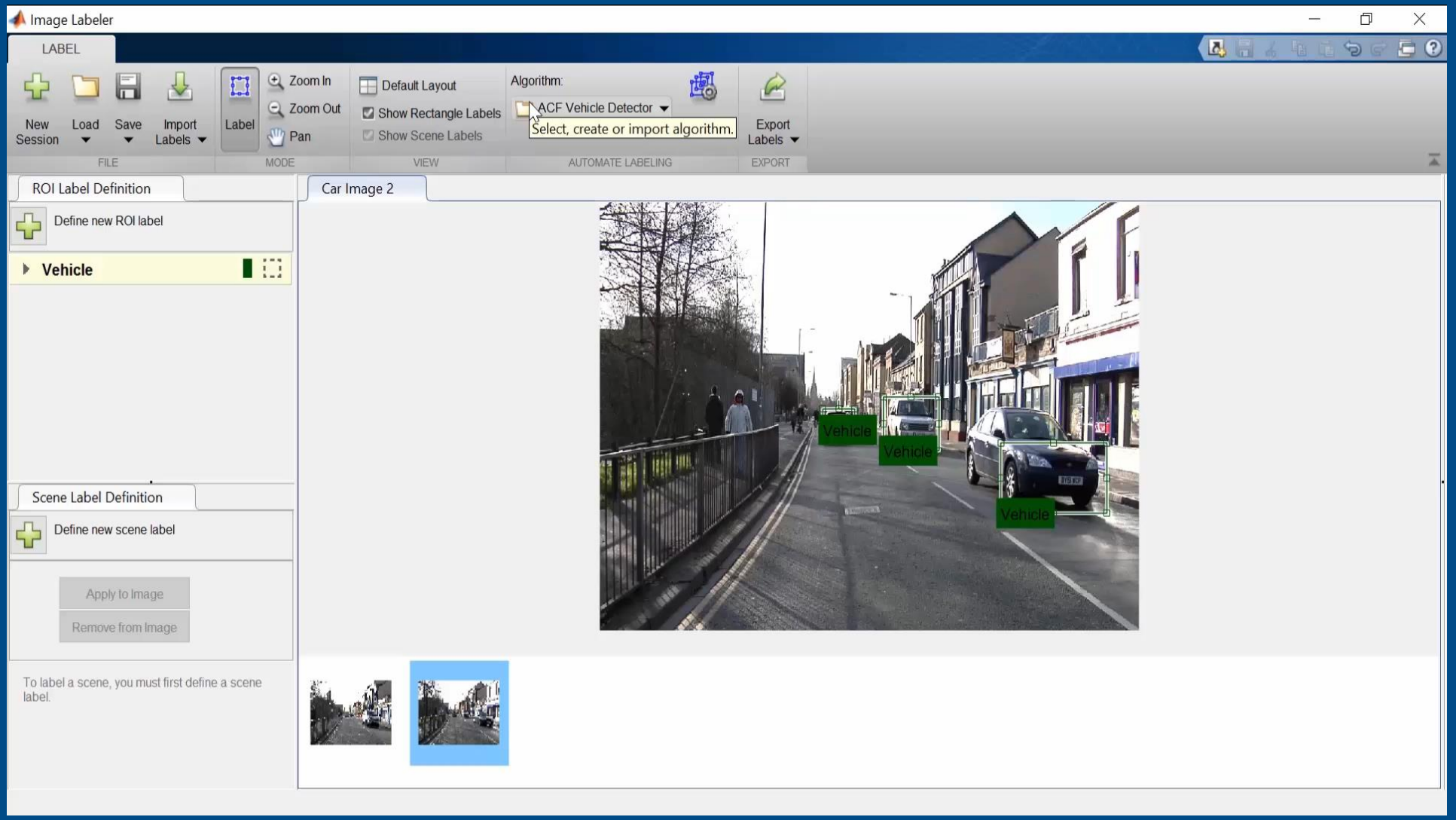
Using Apps for Ground Truth Labeling

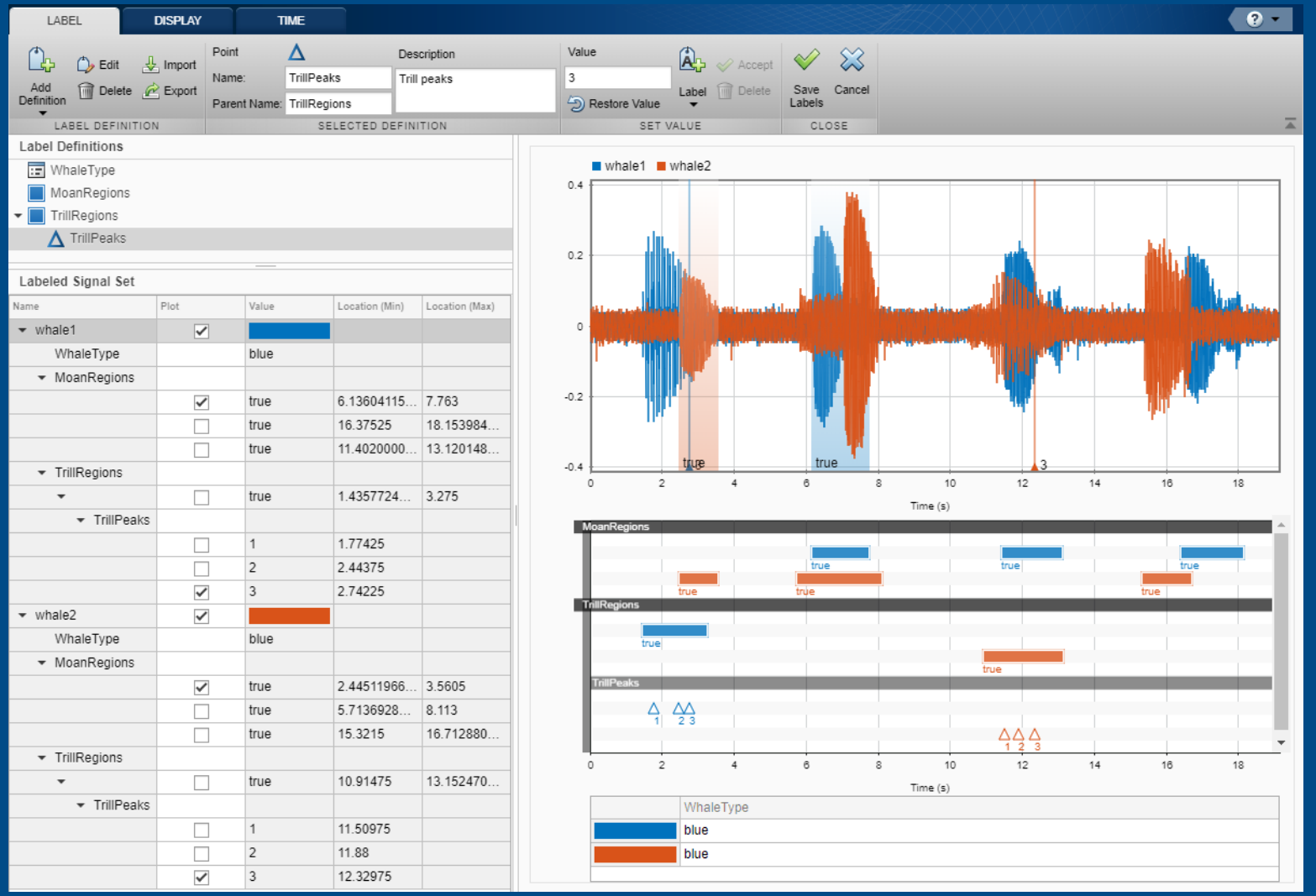
Image and Video Data



Computer Vision Toolbox

Using Apps for Ground Truth Labeling

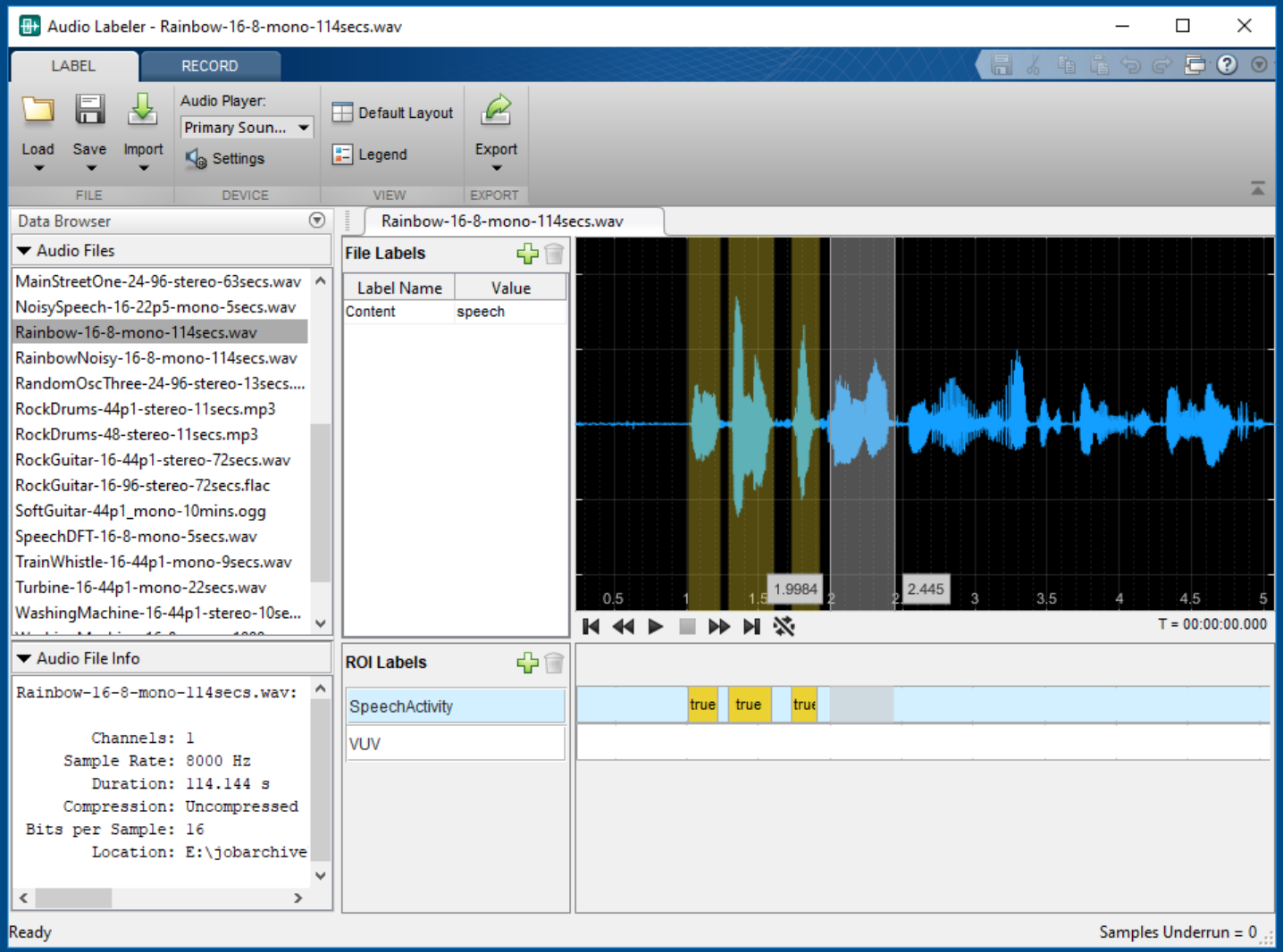
Signal Data



Signal Processing Toolbox

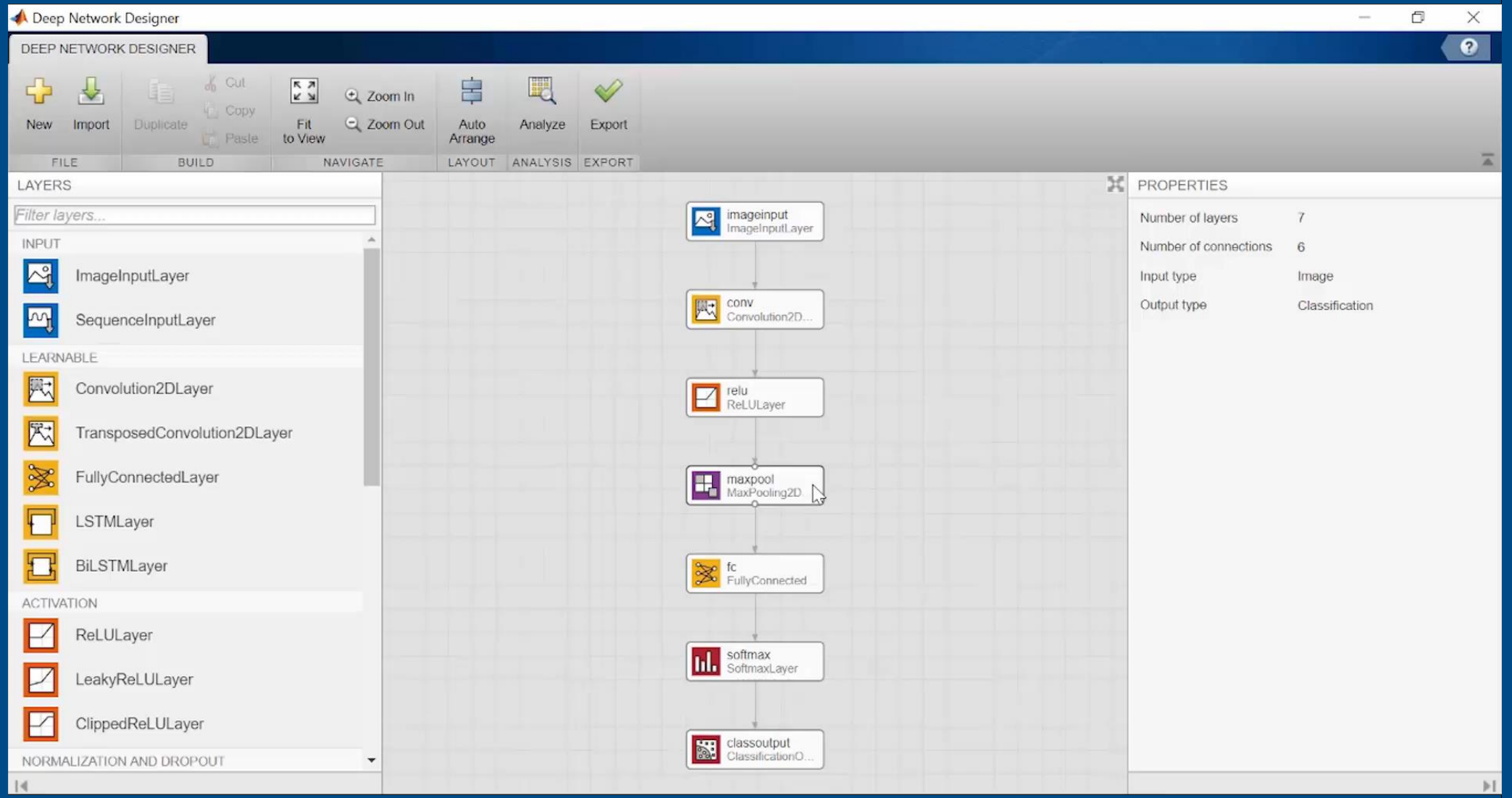
Using Apps for Ground Truth Labeling

Audio Data



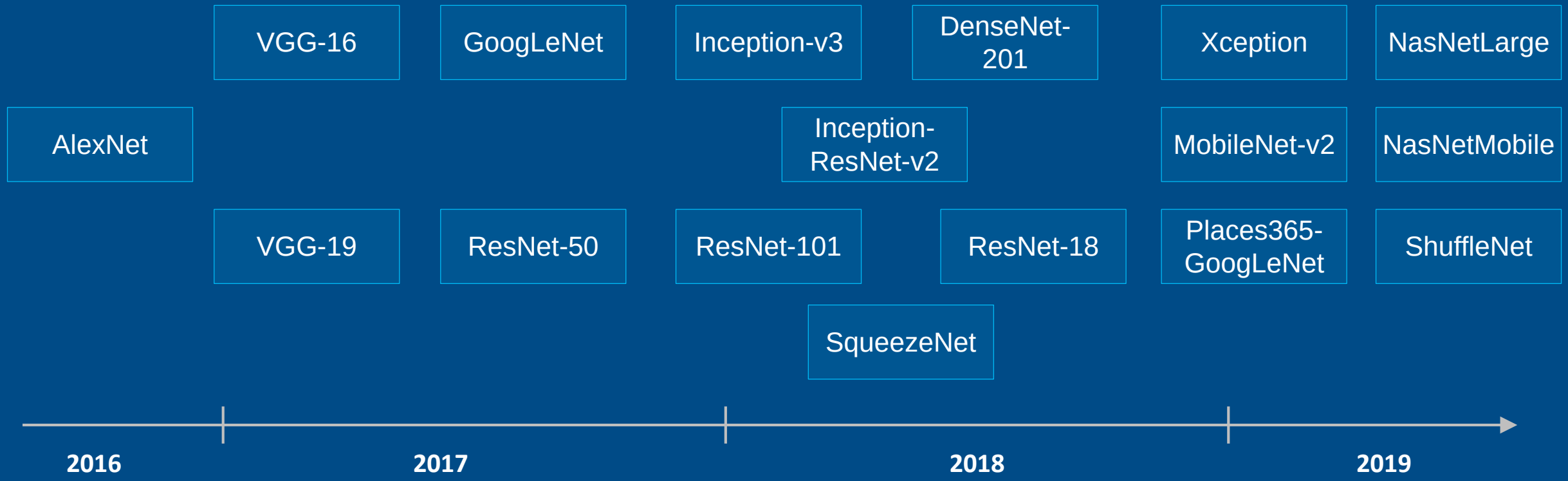
Audio Toolbox

Using Apps for Designing Deep Learning Networks

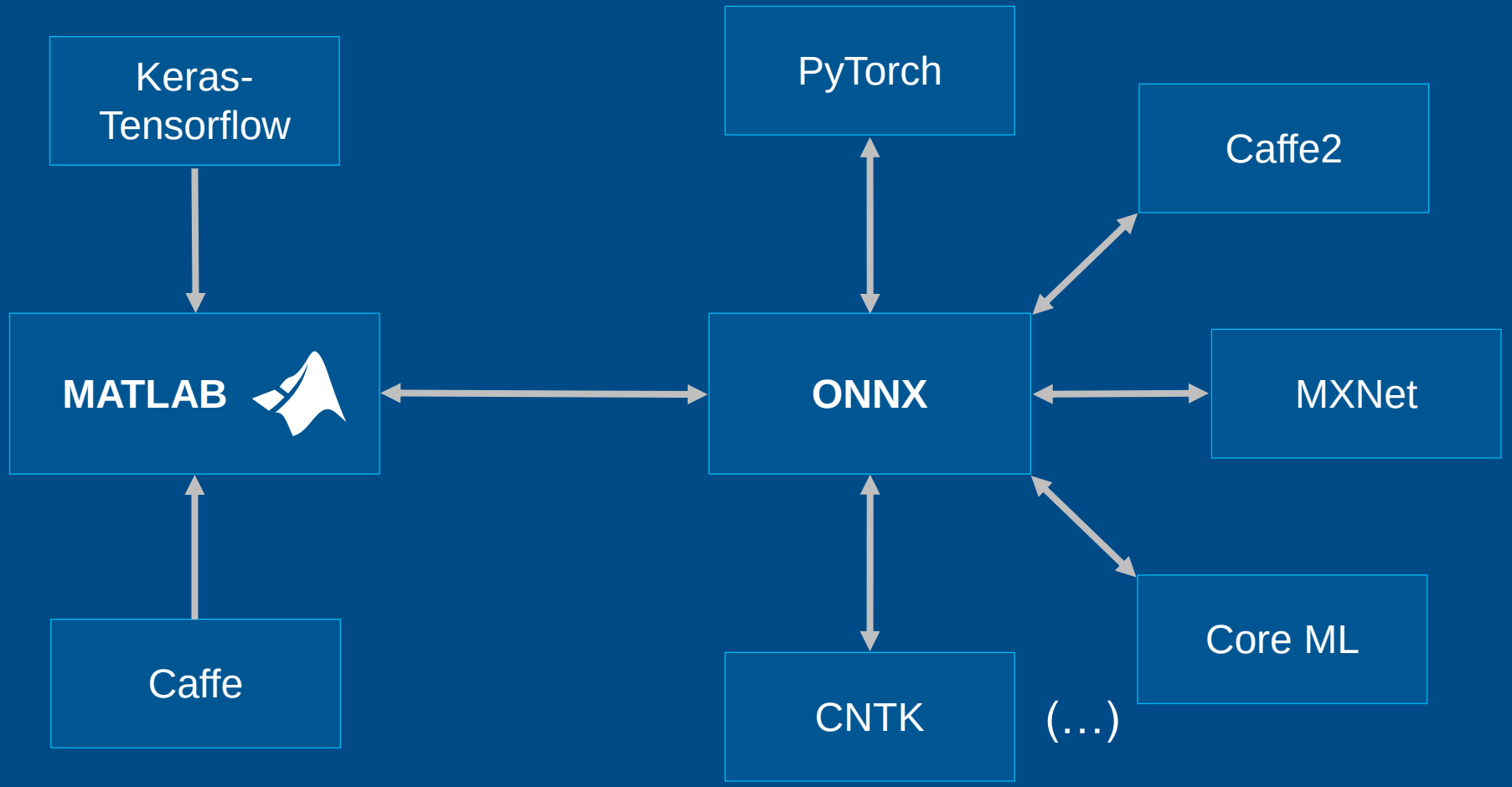


Deep Learning Toolbox

Using Transfer Learning with Pre-trained Models



Using Models from Other Frameworks



Deploying Deep Learning Applications

Deep Learning Application

Coder Products

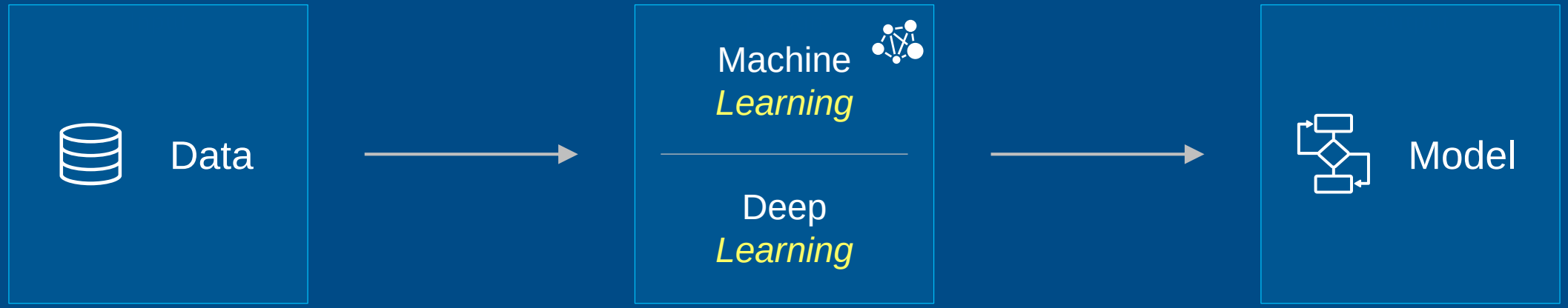
Intel MKL-DNN Library

NVIDIA TensorRT & cuDNN Libraries

ARM Compute Library

MATLAB Coder
GPU Coder

Using MATLAB and Simulink for Reinforcement Learning



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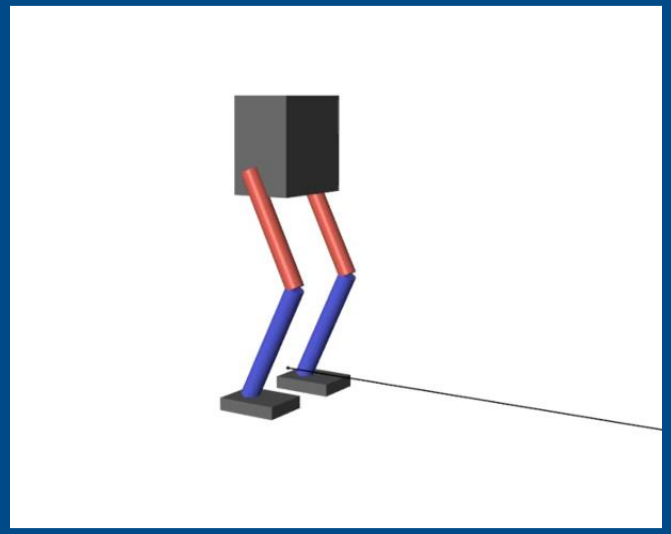
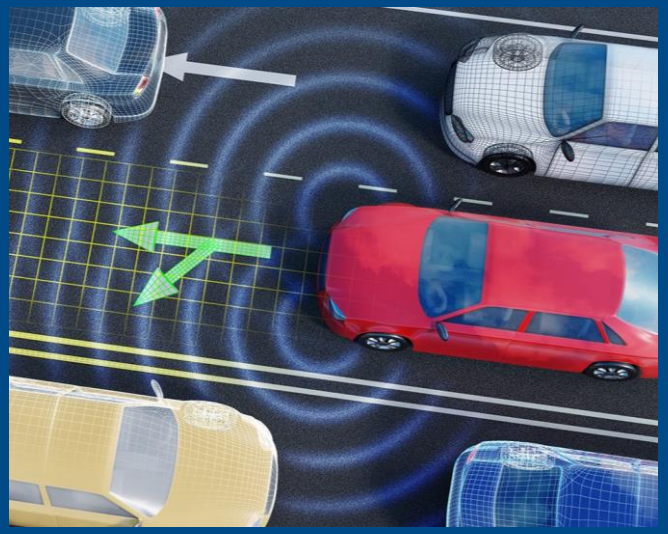
Reinforcement Learning Toolbox

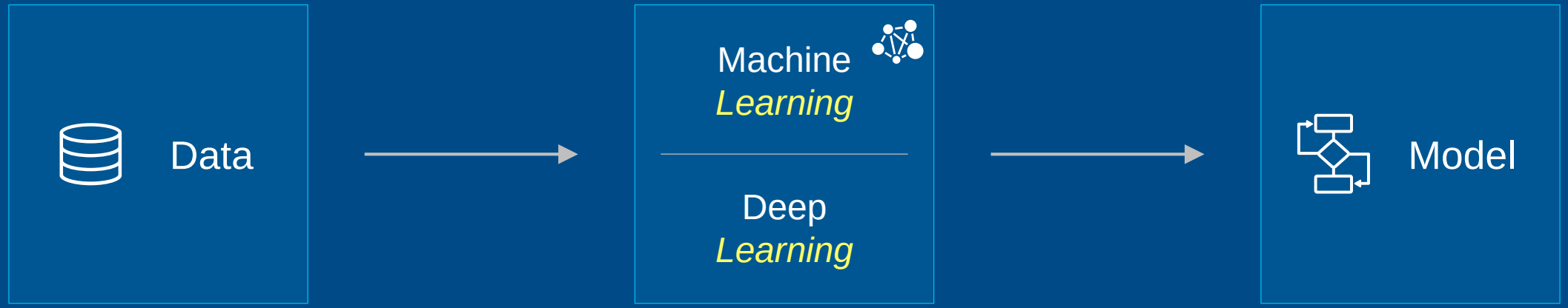
Using MATLAB and Simulink for Reinforcement Learning





Reinforcement Learning Toolbox

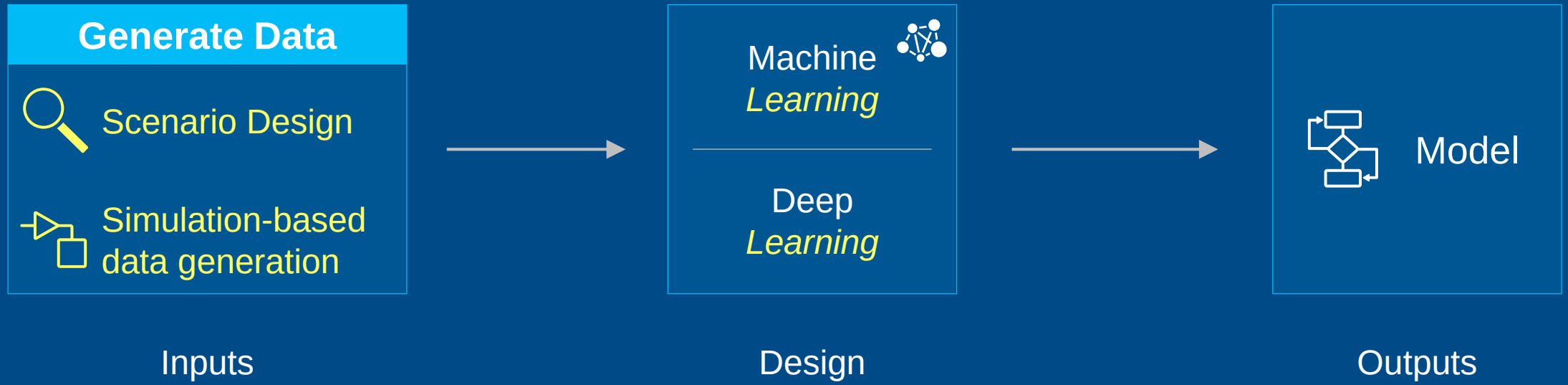
Using MATLAB and Simulink for Reinforcement Learning



MATLAB&SIMULINK®

Reinforcement Learning Toolbox

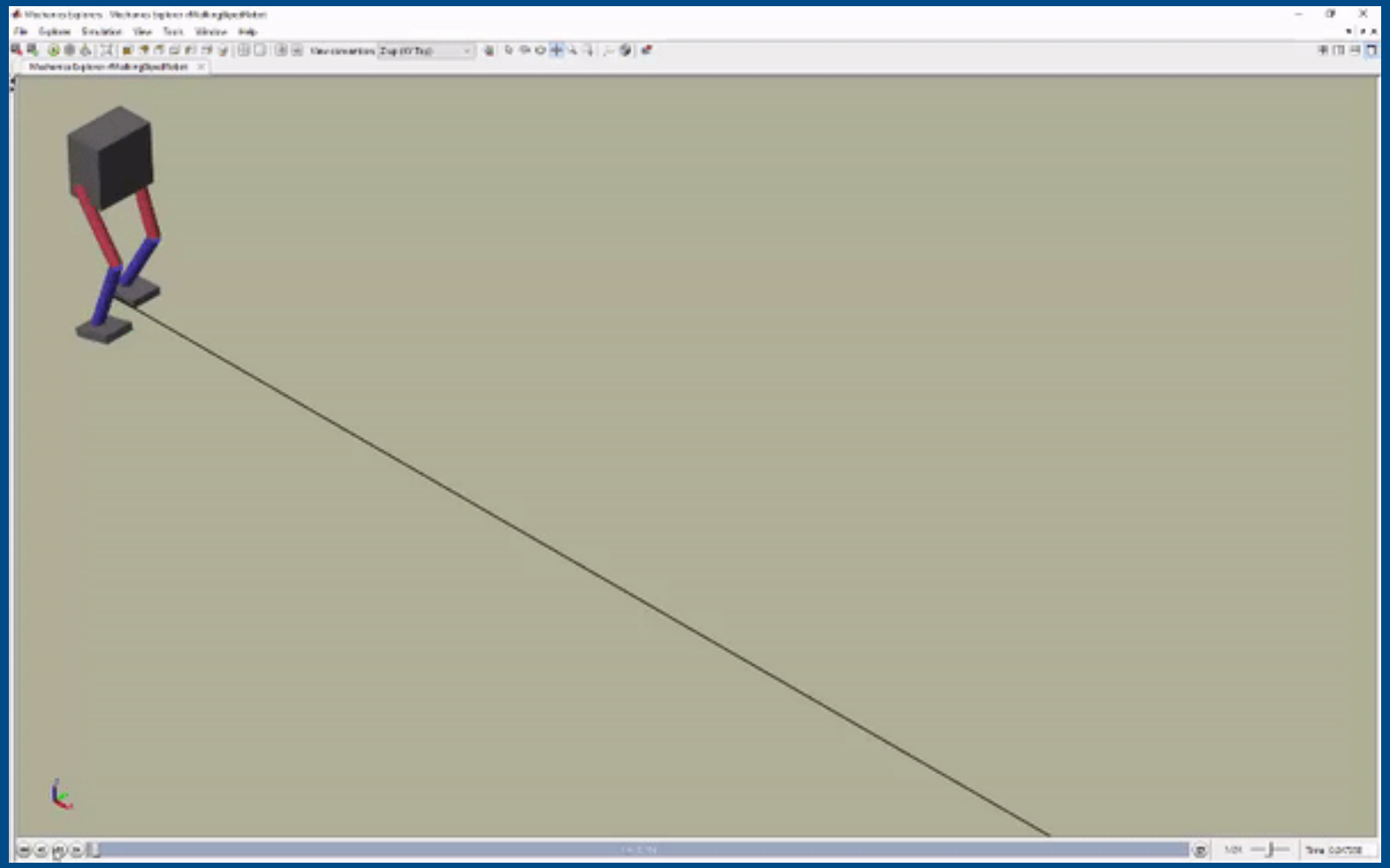
Using MATLAB and Simulink for Reinforcement Learning



MATLAB&SIMULINK®

Simulink
Reinforcement Learning Toolbox

Using MATLAB and Simulink for Reinforcement Learning



Reinforcement Learning Toolbox

Using MATLAB and Simulink for Reinforcement Learning

Generate Data

Scenario Desig

Simulation-bas
data generatior

Inputs

Model

Outputs

Find out more:
Deep Learning and Reinforcement Learning Workflows in A.I.

Avi Nehemiah
Deep Learning & Autonomous Systems Track

MATLAB&SIMULINK

Using MATLAB & Simulink to Build Algorithms in Everything

Inputs

Design

Outputs

MATLAB&SIMULINK®

Working with Text Data

Vehicle_Repairs.csv

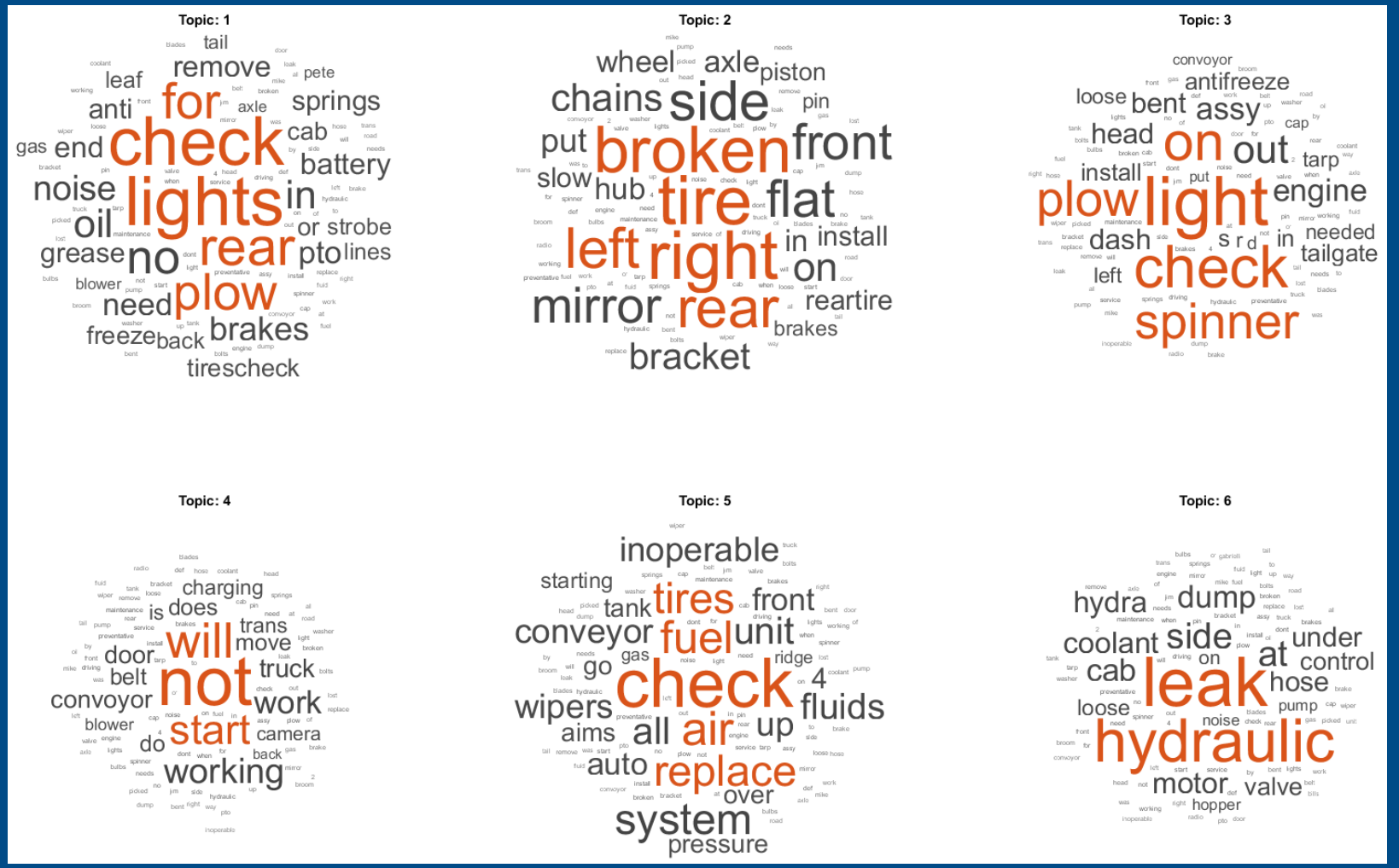
```
Dept,JobDate,jobno,Vehicleid,UnitNo,Reason,Notes,CostParts,CostLabor,CostTotal
1020,01/06/2015 12:00:00 AM,14073,118743,14,04    DRIVER'S REPORT,"PM SERVICE, CHECK TURN SIGNAL, CLUNKING NOISE WHEN DRIVING",493.85,0,493.85
1020,01/14/2015 12:00:00 AM,14232,230973,13,08    PM SERVICE             ***,"SERVICEROB,EXT,5604",38.869999999999997,0,38.869999999999997
2111,01/02/2015 12:00:00 AM,14006,1243,116,04    DRIVER'S REPORT,NEED 4 PLOW PINS,45,0,45
2111,01/02/2015 12:00:00 AM,14140,B39109      ,178,04    DRIVER'S REPORT,INSTALL SPINNER ASSY,0,0,0
2111,01/03/2015 12:00:00 AM,14163,574950,215,13    SNOW BREAKDOWN,DONT START,0,0,0
2111,01/05/2015 12:00:00 AM,14169,A00413      ,283,04    DRIVER'S REPORT,DOG BONE PIN BROKEN,20,0,20
2111,01/06/2015 12:00:00 AM,14000,766153,248,08    PM SERVICE             ***,"NEED SERVICE, CHECK BRAKES",387.17,0,387.17
2111,01/06/2015 12:00:00 AM,14155,525670,232,04    DRIVER'S REPORT,HYD CAP CHECK ENGINE LIGHT ON,12.95,0,12.95
2111,01/06/2015 12:00:00 AM,14157,621909,213,40    NEGLIGENCE,TARP VALVE STICKINGRIGHT SIDE MIRROR BRACKET BROKEN,50.02,0,50.02
2111,01/06/2015 12:00:00 AM,14164,1226,117,13    SNOW BREAKDOWN,HANDLES IN CAB LOOSE,0,0,0
2111,01/06/2015 12:00:00 AM,14165,525999,114,04    DRIVER'S REPORT,NO PLOW LIGHTS,0,0,0
2111,01/06/2015 12:00:00 AM,14172,B34632      ,276,10    ROADCALL,WILL NOT START,0,0,0
2111,01/06/2015 12:00:00 AM,14174,1469,122,10    ROADCALL,WILL NOT START,0,0,0
2111,01/06/2015 12:00:00 AM,14175,68932,147,10    ROADCALL,WILL NOT START,0,0,0
2111,01/06/2015 12:00:00 AM,14176,68933,148,10    ROADCALL,WILL NOT START,0,0,0
2111,01/06/2015 12:00:00 AM,14177,621907,208,10    ROADCALL,WILL NOT START,0,0,0
2111,01/06/2015 12:00:00 AM,14181,337657,218,04    DRIVER'S REPORT,CONVEORY NOT WORKING,0,0,0
2111,01/06/2015 12:00:00 AM,14182,D-1920      ,164,10    ROADCALL,DONT START,0,0,0
2111,01/06/2015 12:00:00 AM,14183,525998,217,10    ROADCALL,DONT START,0,0,0
2111,01/06/2015 12:00:00 AM,14184,526000,225,10    ROADCALL,DONT START,0,0,0
2111,01/06/2015 12:00:00 AM,14185,621921,214,04    DRIVER'S REPORT,CONVORY NOT WORKING,0,0,0
2111,01/07/2015 12:00:00 AM,14188,O01469      ,201,04    DRIVER'S REPORT,needs def/jim f,0,0,0
2111,01/07/2015 12:00:00 AM,14190,337656,219,04    DRIVER'S REPORT,NEEDS FLOOR MATTS,65.069999999999993,0,65.069999999999993
2111,01/07/2015 12:00:00 AM,14191,B34632      ,276,10    ROADCALL,DONT START,0,0,0
2111,01/07/2015 12:00:00 AM,14196,1222,118,04    DRIVER'S REPORT,HARDWARE FOR REAR SPRINGS,14.32,0,14.32
2111,01/07/2015 12:00:00 AM,14199,52565,626,04    DRIVER'S REPORT,WASHER FLUIDDEF,28.88,0,28.88
2111,01/09/2015 12:00:00 AM,14107,1467,121,08    PM SERVICE             ***,"REMOVE & REPLACE REAR SPRINGS, CHECK COOLANT TUBESPM SERVIVE",4697.55,0,
```


Working with Text Data


```
t = readtable(filename,'TextType','string');
disp(t(1:20,6:7))
```

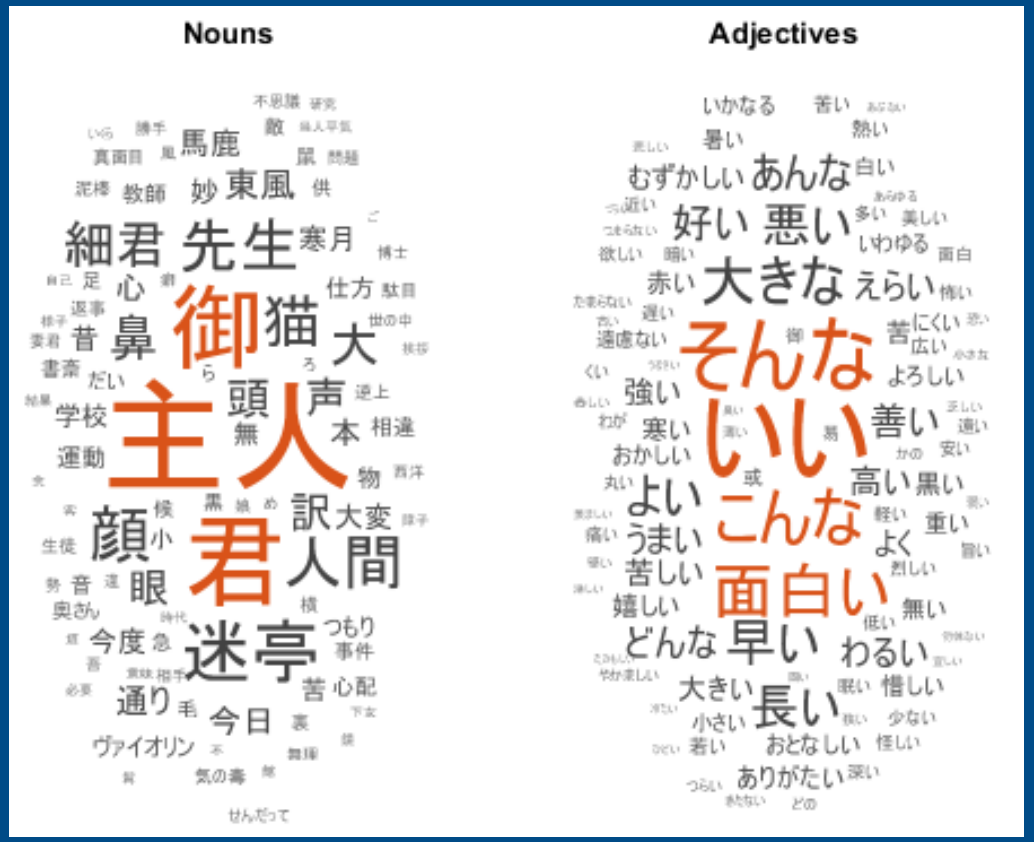
Reason	Notes
"04 DRIVER'S REPORT"	"PM SERVICE, CHECK TURN SIGNAL, CLUNKING NOISE WHEN DRIVING"
"08 PM SERVICE ***"	"SERVICEROB,EXT,5604"
"04 DRIVER'S REPORT"	"NEED 4 PLOW PINS"
"04 DRIVER'S REPORT"	"INSTALL SPINNER ASSY"
"13 SNOW BREAKDOWN"	"DONT START"
"04 DRIVER'S REPORT"	"DOG BONE PIN BROKEN"
"08 PM SERVICE ***"	"NEED SERVICE, CHECK BRAKES"
"04 DRIVER'S REPORT"	"HYD CAP CHECK ENGINE LIGHT ON"
"40 NEGLIGENCE"	"TARP VALVE STICKINGRIGHT SIDE MIRROR BRACKET BROKEN"
"13 SNOW BREAKDOWN"	"HANDLES IN CAB LOOSE"
"04 DRIVER'S REPORT"	"NO PLOW LIGHTS"
"10 ROADCALL"	"WILL NOT START"
"10 ROADCALL"	"WILL NOT START"
"10 ROADCALL"	"WILL NOT START"
"10 ROADCALL"	"WILL NOT START"
"10 ROADCALL"	"WILL NOT START"
"04 DRIVER'S REPORT"	"CONVEORY NOT WORKING"
"10 ROADCALL"	"DONT START"
"10 ROADCALL"	"DONT START"
"10 ROADCALL"	"DONT START"

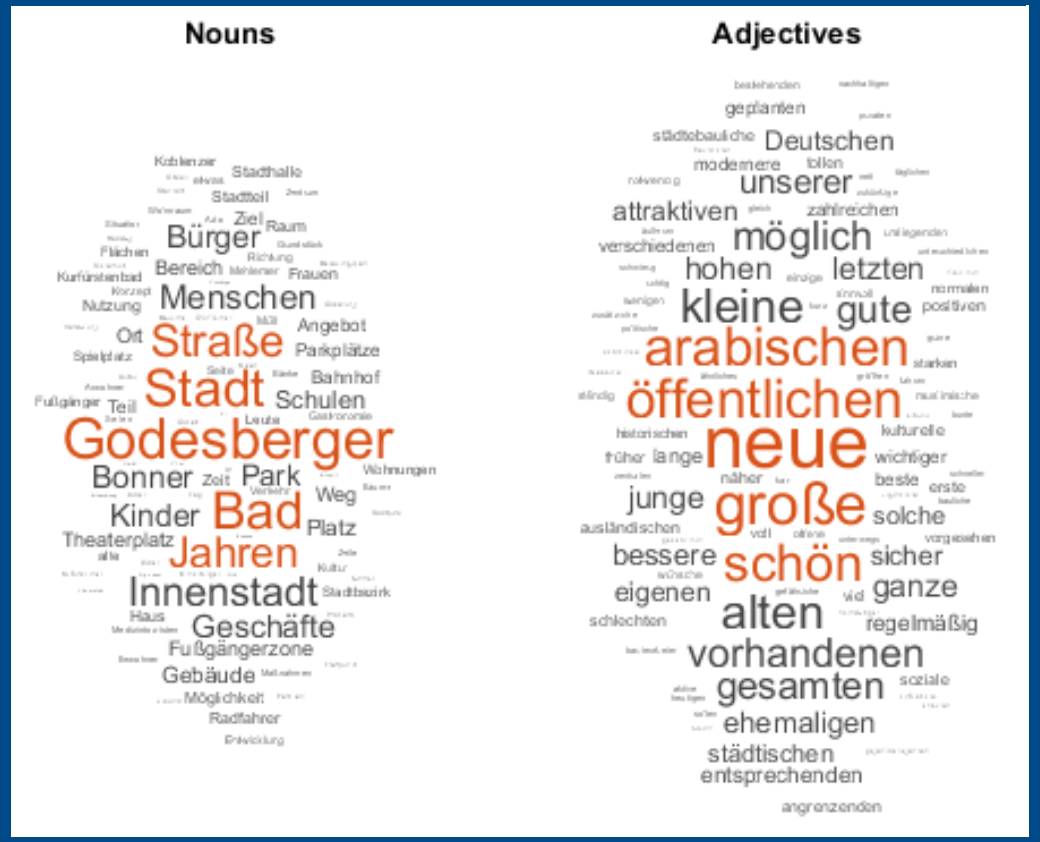
Working with Text Data



Deep Learning Toolbox
Statistics and Machine Learning Toolbox
Text Analytics Toolbox
MATLAB

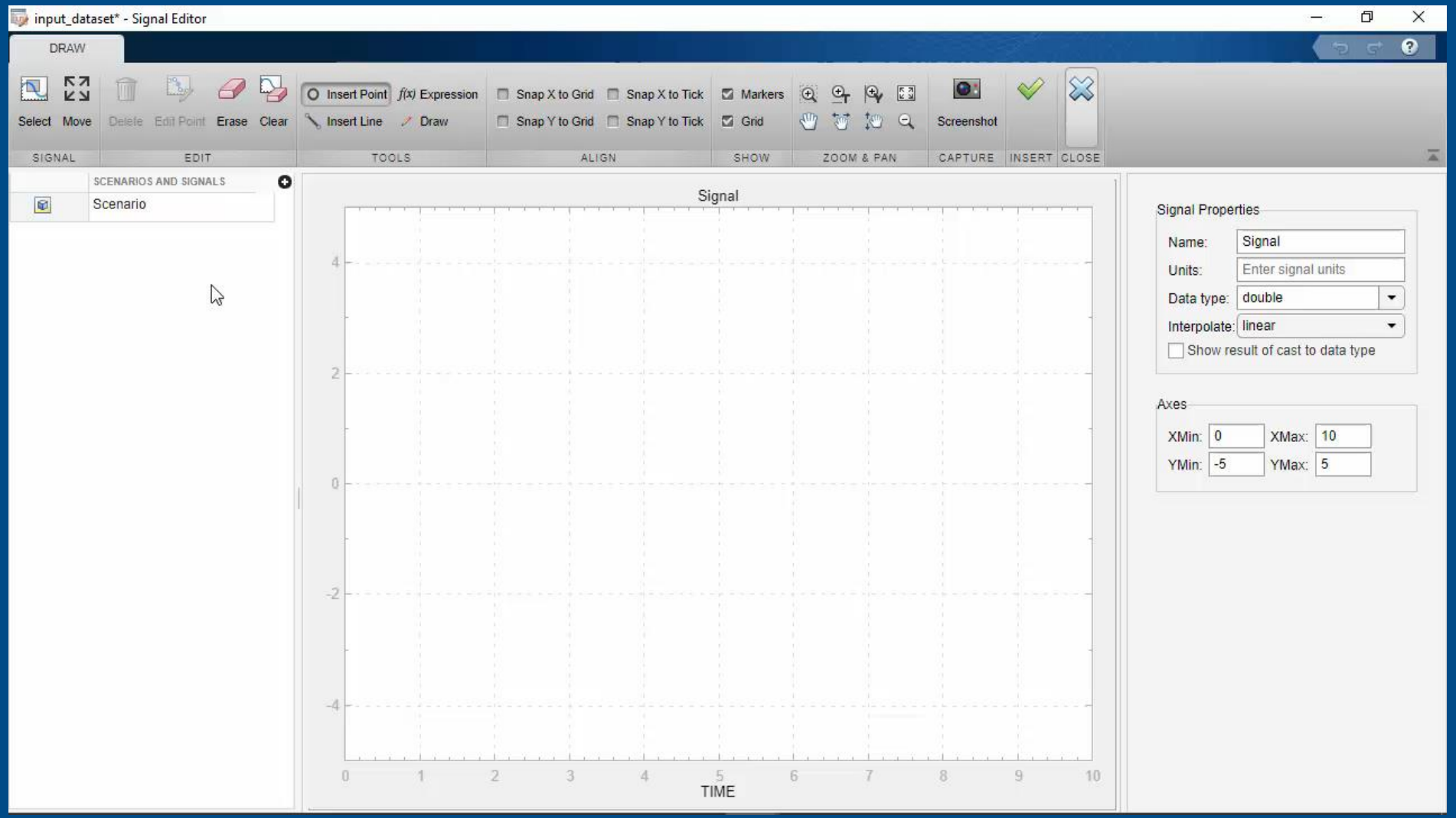
Working with Text Data

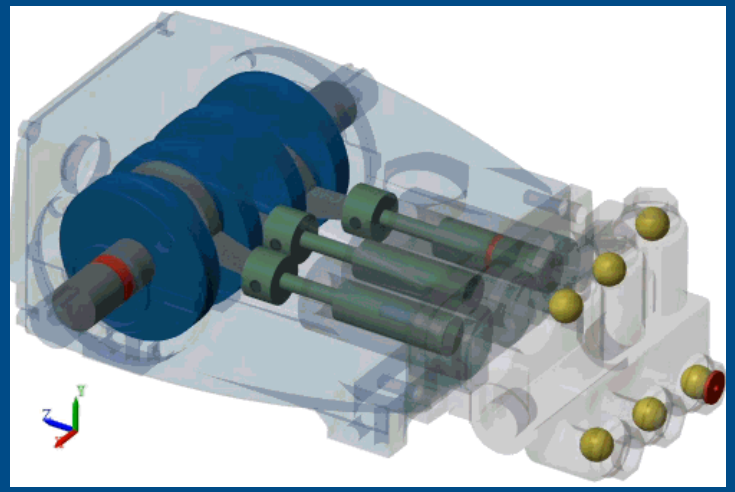


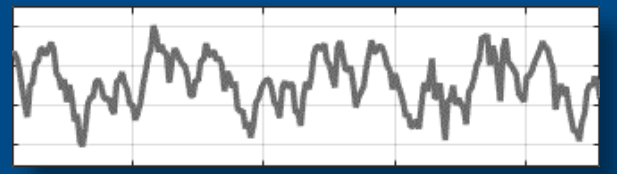


Text Analytics Toolbox
MATLAB

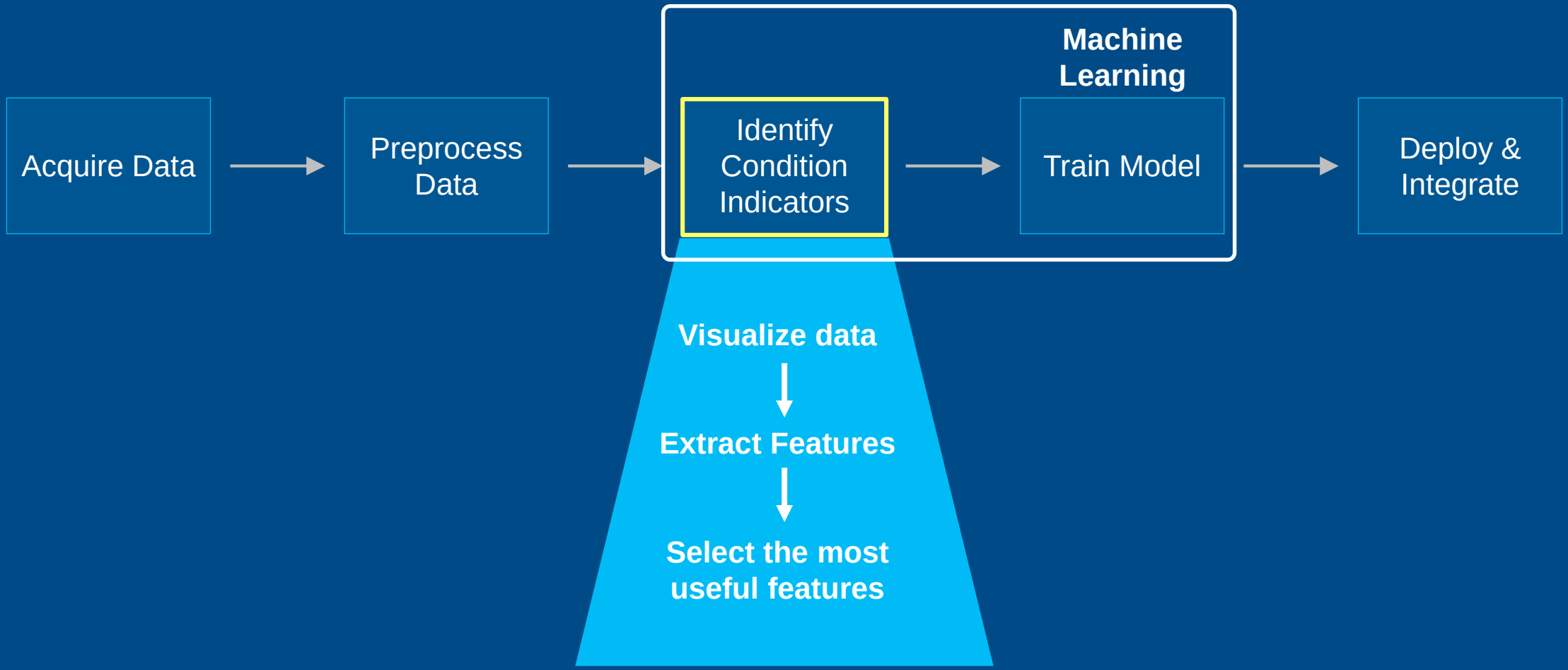
Creating Your Own Data



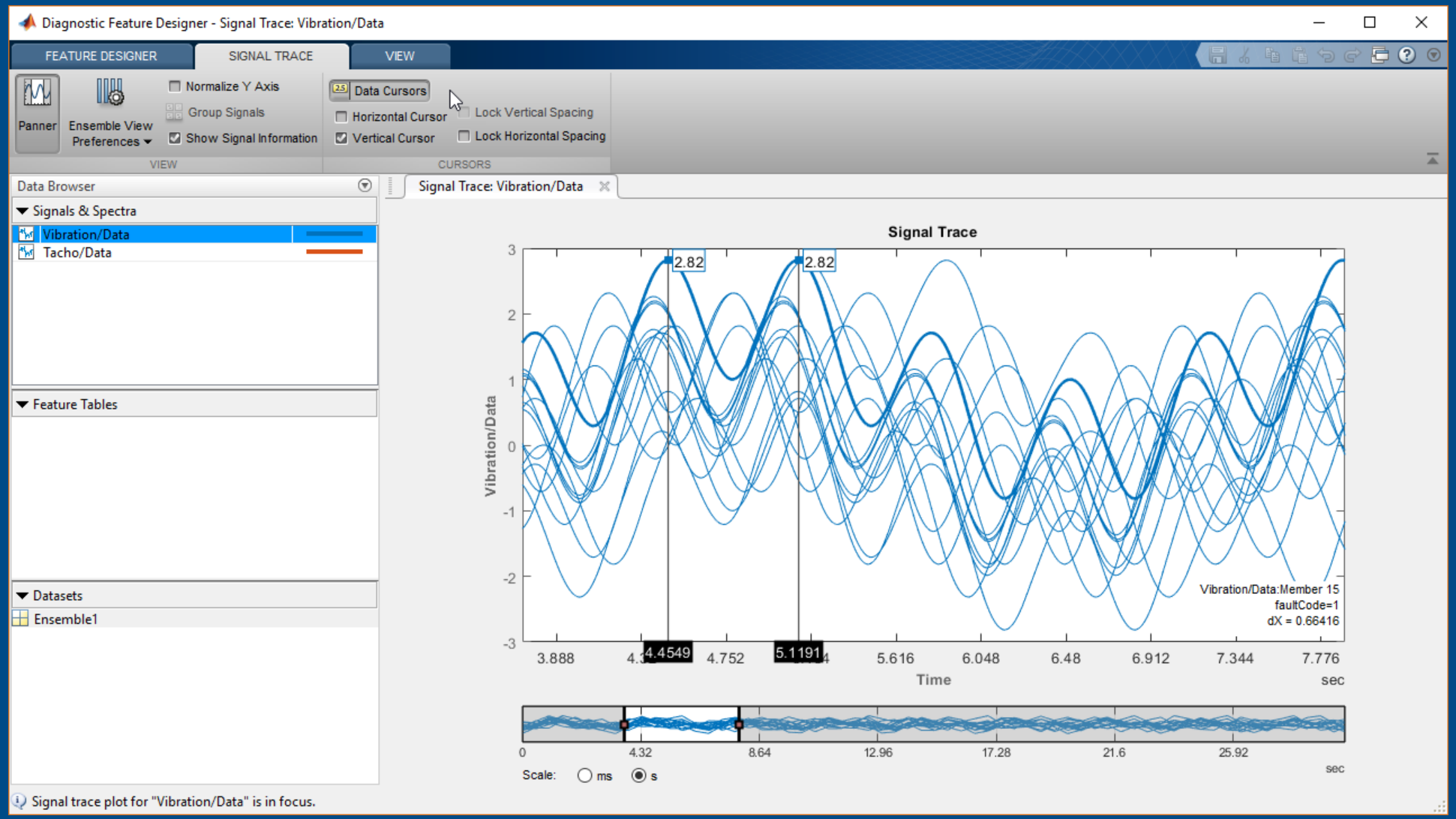




Identifying the Useful Data

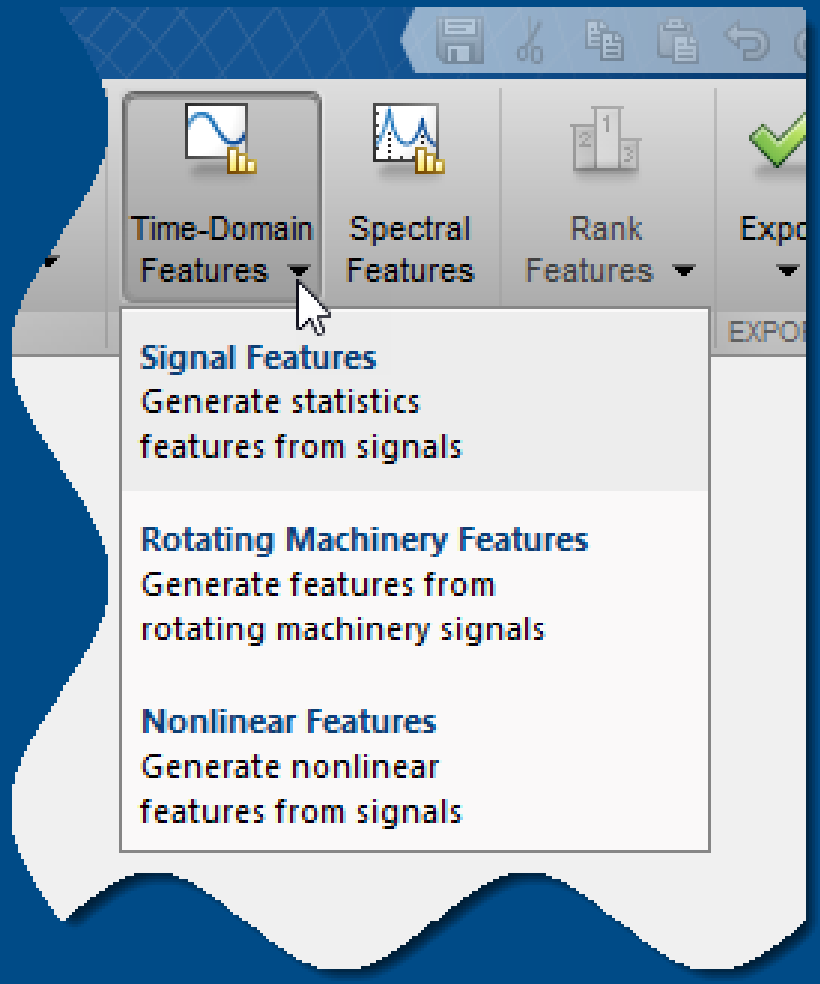


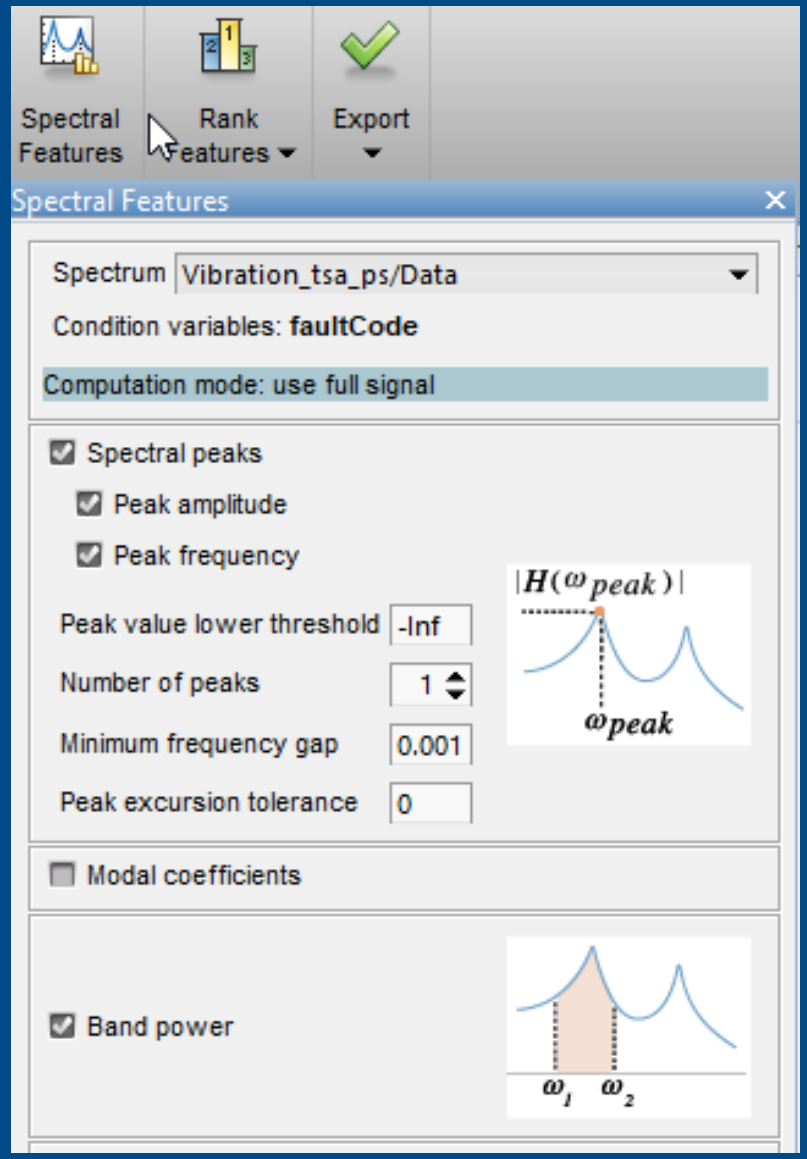
Identifying the Useful Data



Predictive Maintenance Toolbox

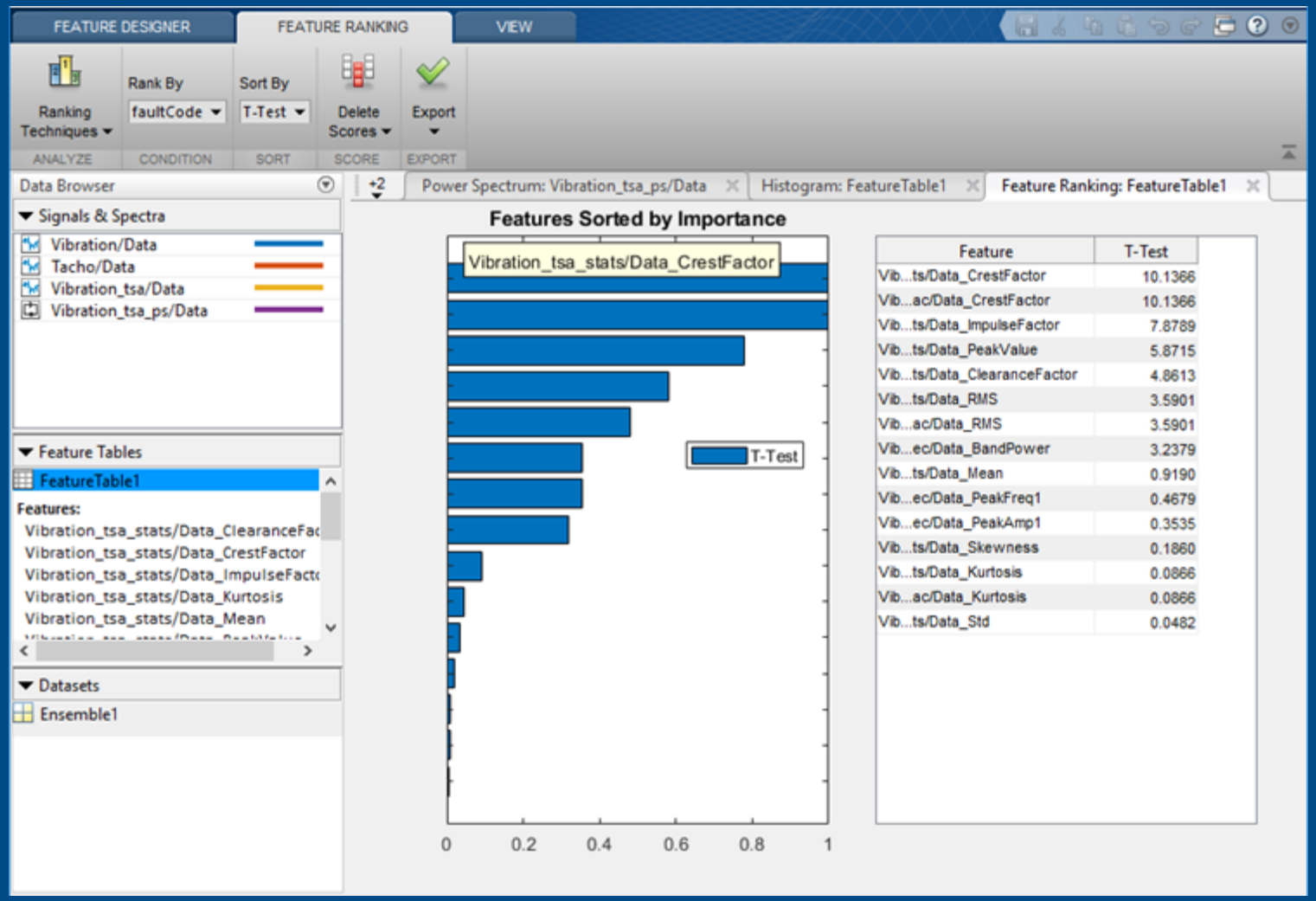
Identifying the Useful Data





Predictive Maintenance Toolbox

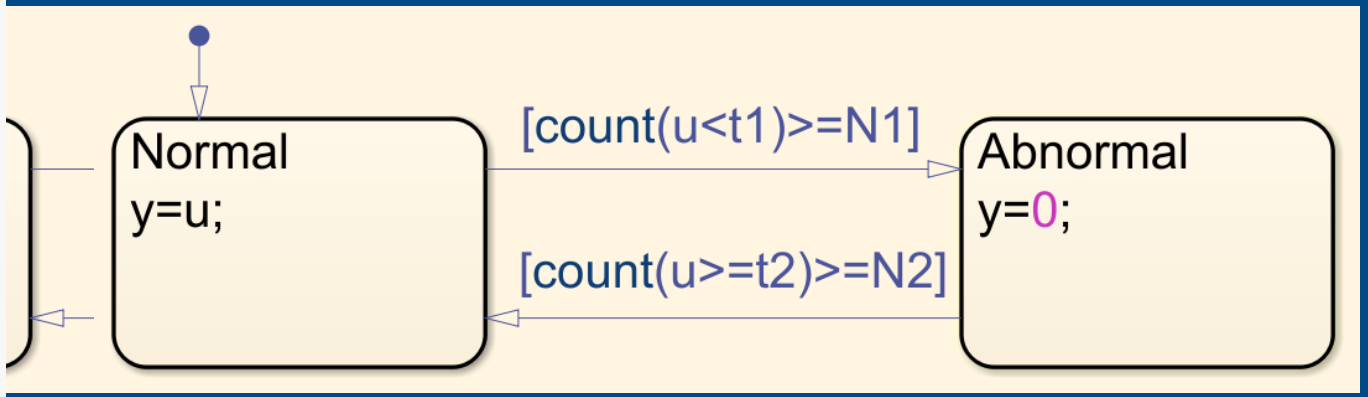
Identifying the Useful Data



Predictive Maintenance Toolbox

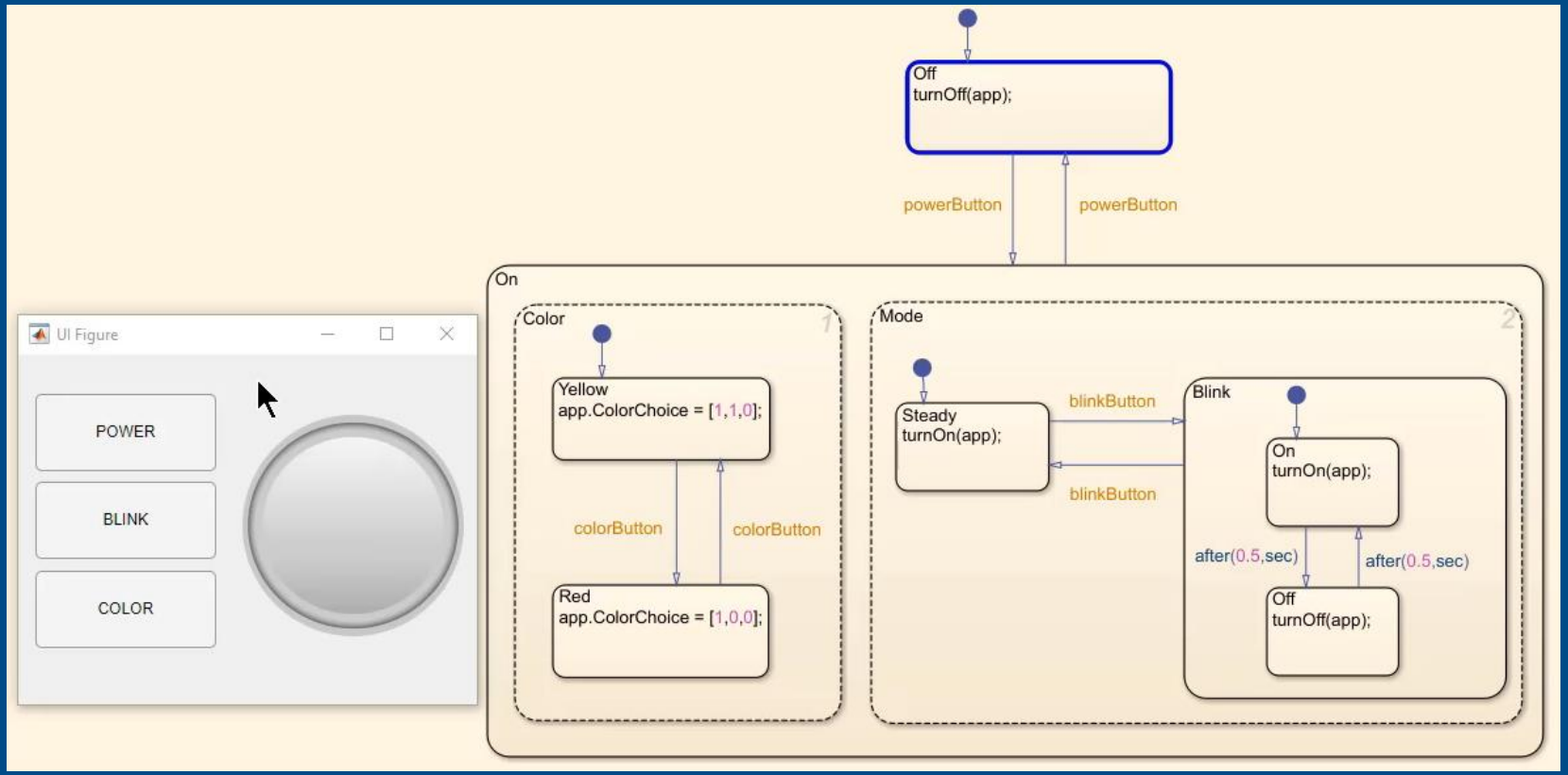
Designing Decision Logic with Stateflow

```
inNormalRegion = true;
counter = 0;
for i=1:length(inData)
    if(inNormalRegion)
        if(inData(i)<t1)
            counter = counter+1;
            if(counter>=N1)
                inNormalRegion = false;
            end
        else
            counter = 0;
        end
     else
        if(inData(i)>=t2)
            counter = counter+1;
            if(counter>=N2)
                inNormalRegion = true;
            end
        else
            counter = 0;
        end
     end
     if(inNormalRegion)
        outData(i) = inData(i);
    else
        outData(i) = 0;
    end
end
```



Stateflow
MATLAB

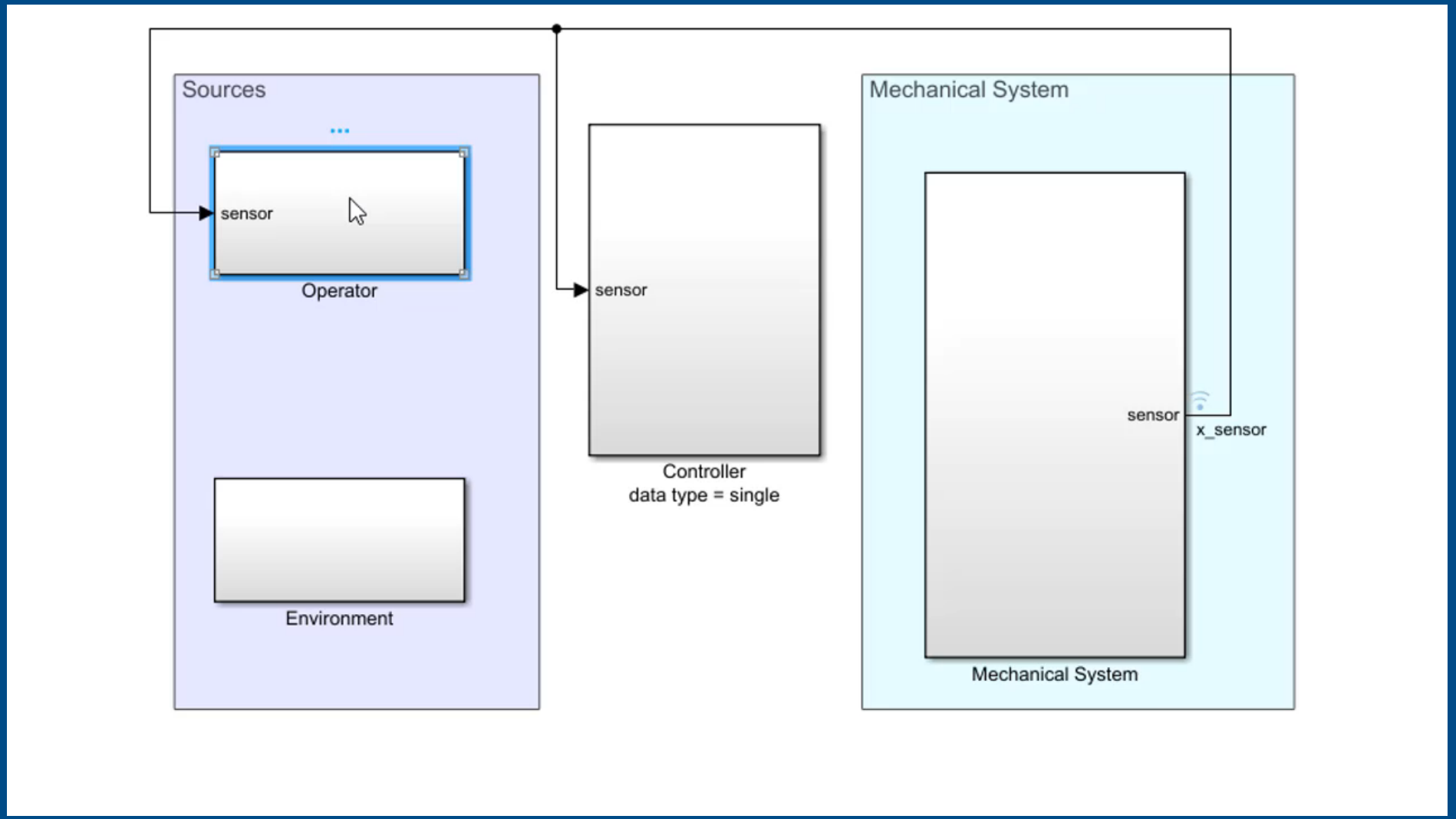
Using Stateflow in MATLAB



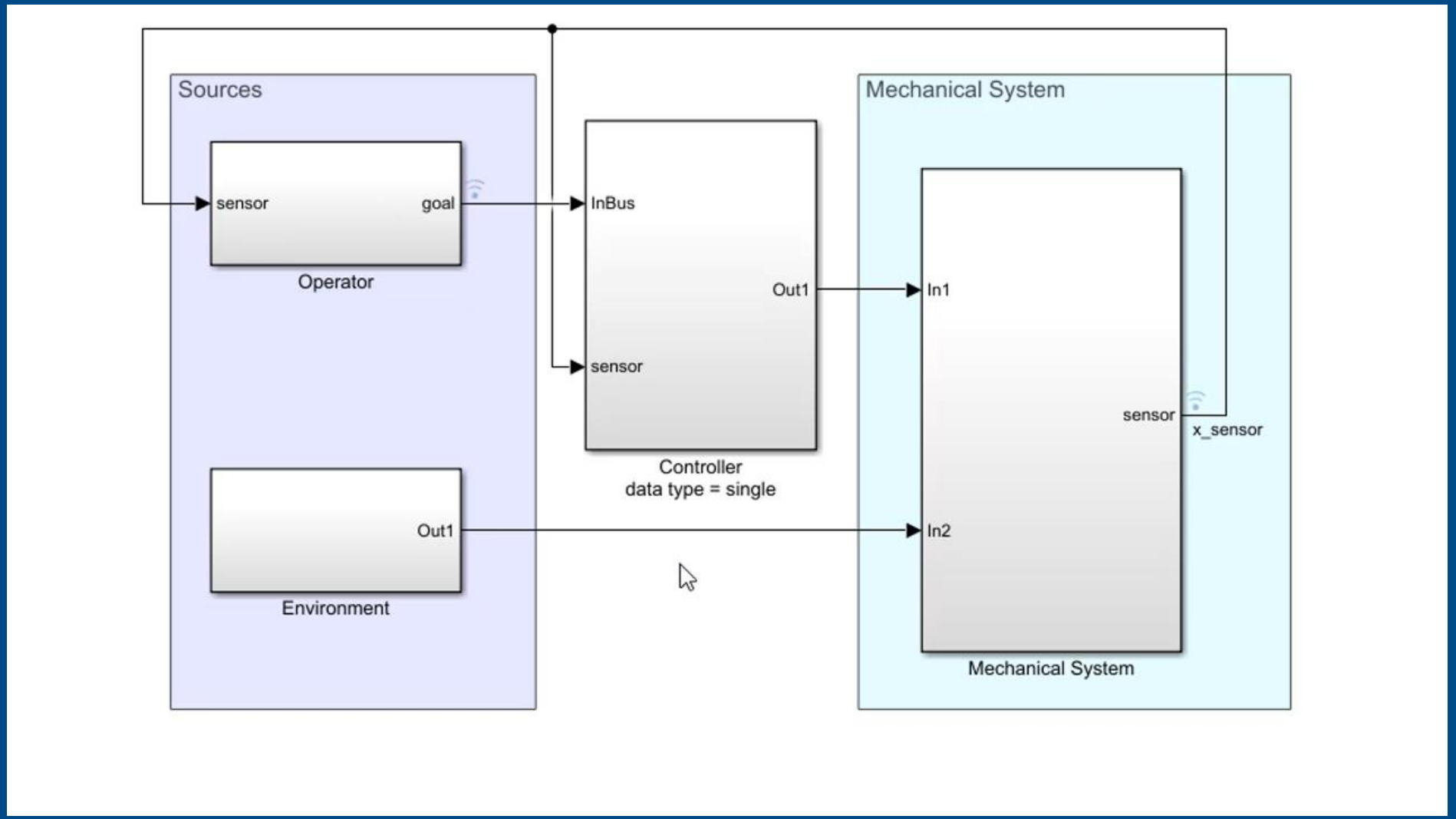

```
% Callbacks that handle component events
methods (Access = private)

    % Code that executes after component creation
    function startupFcn(app)
        app.LanternLogic = BlinkLanternLogic('app',app);
    end

    % Button pushed function: POWERButton
    function POWERButtonPushed(app, event)
        app.LanternLogic.powerButton();
    end

    % Button pushed function: COLORButton
    function COLORButtonPushed(app, event)
        app.LanternLogic.colorButton();
    end

    % Close request function: UIFigure
    function UIFigureCloseRequest(app, event)
        delete(app.LanternLogic);
        delete(app);
    end

    % Button pushed function: BLINKButton
    function BLINKButtonPushed(app, event)
        app.LanternLogic.blinkButton();
    end
end
```

Stateflow
MATLAB

Editing at the Speed of Thought

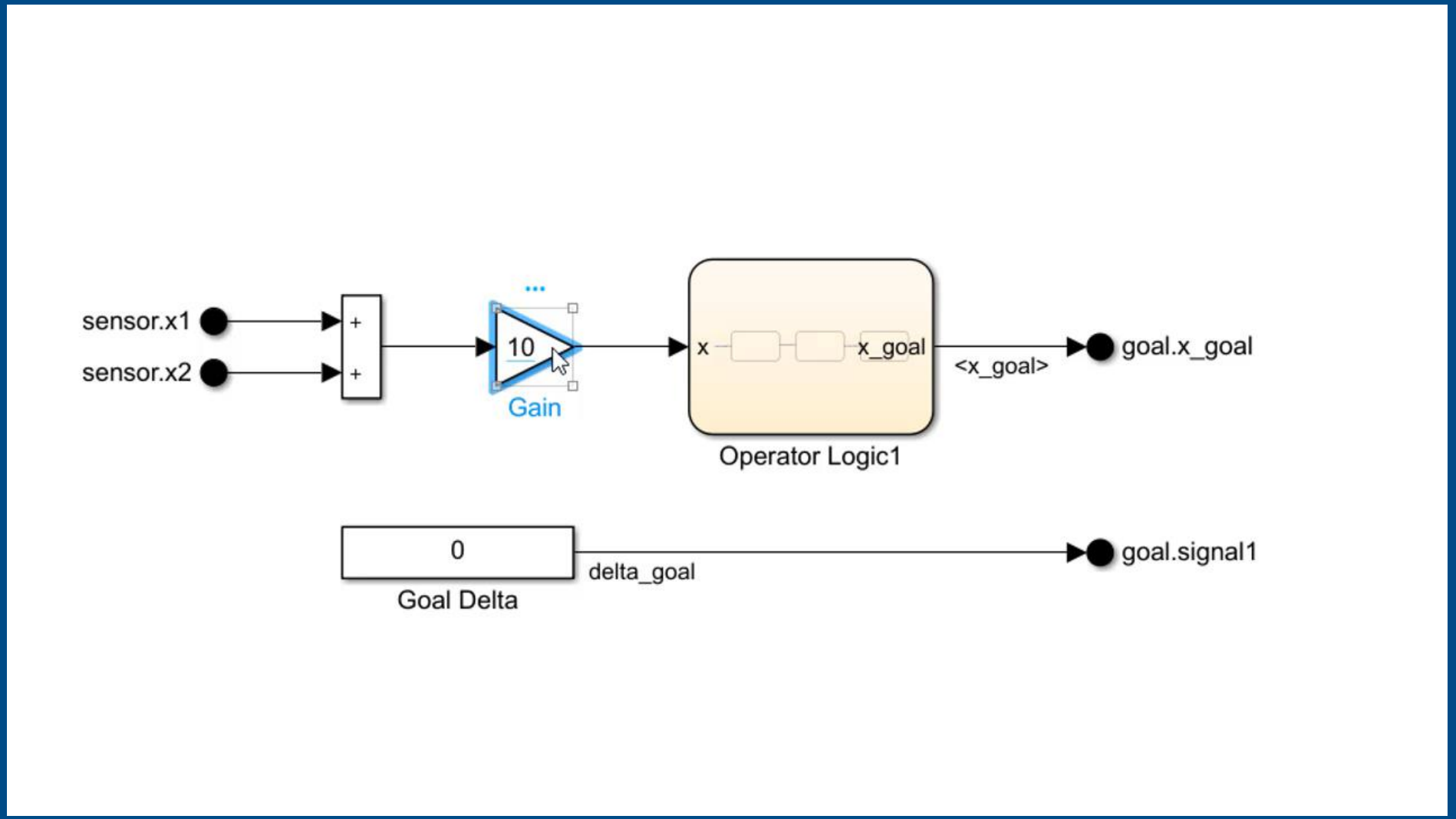


Editing at the Speed of Thought

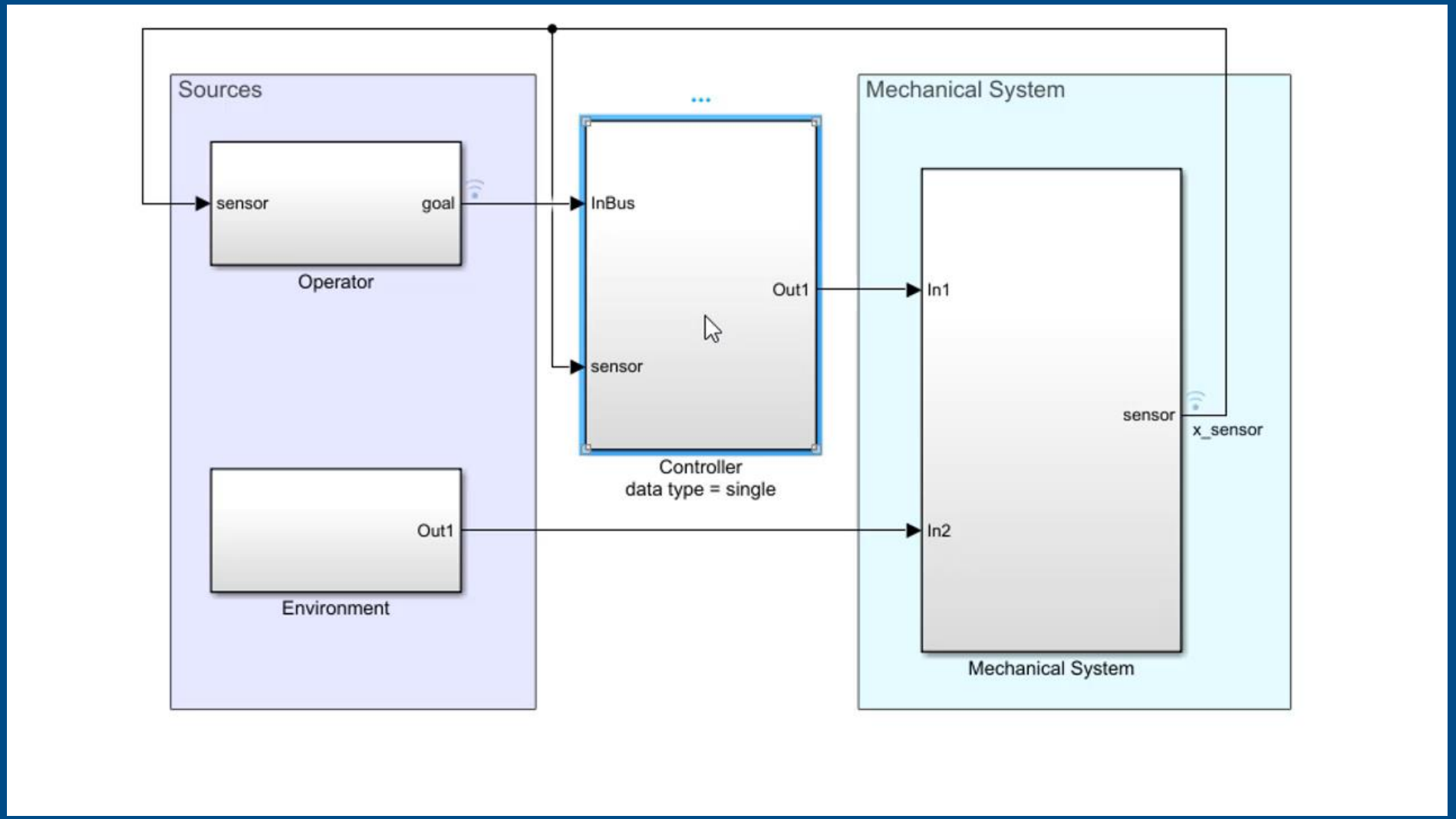


Simulink

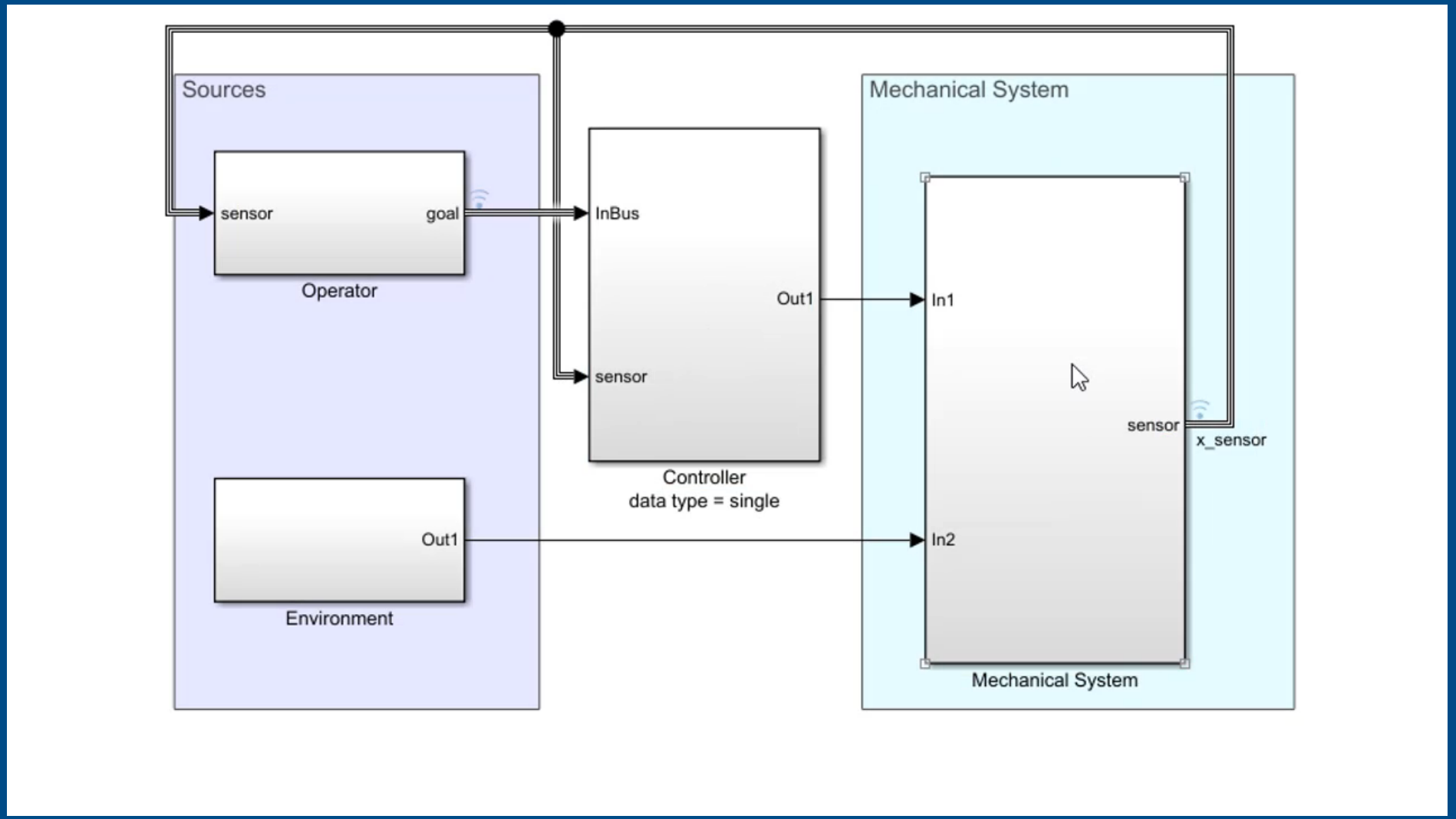
Editing at the Speed of Thought



Editing at the Speed of Thought

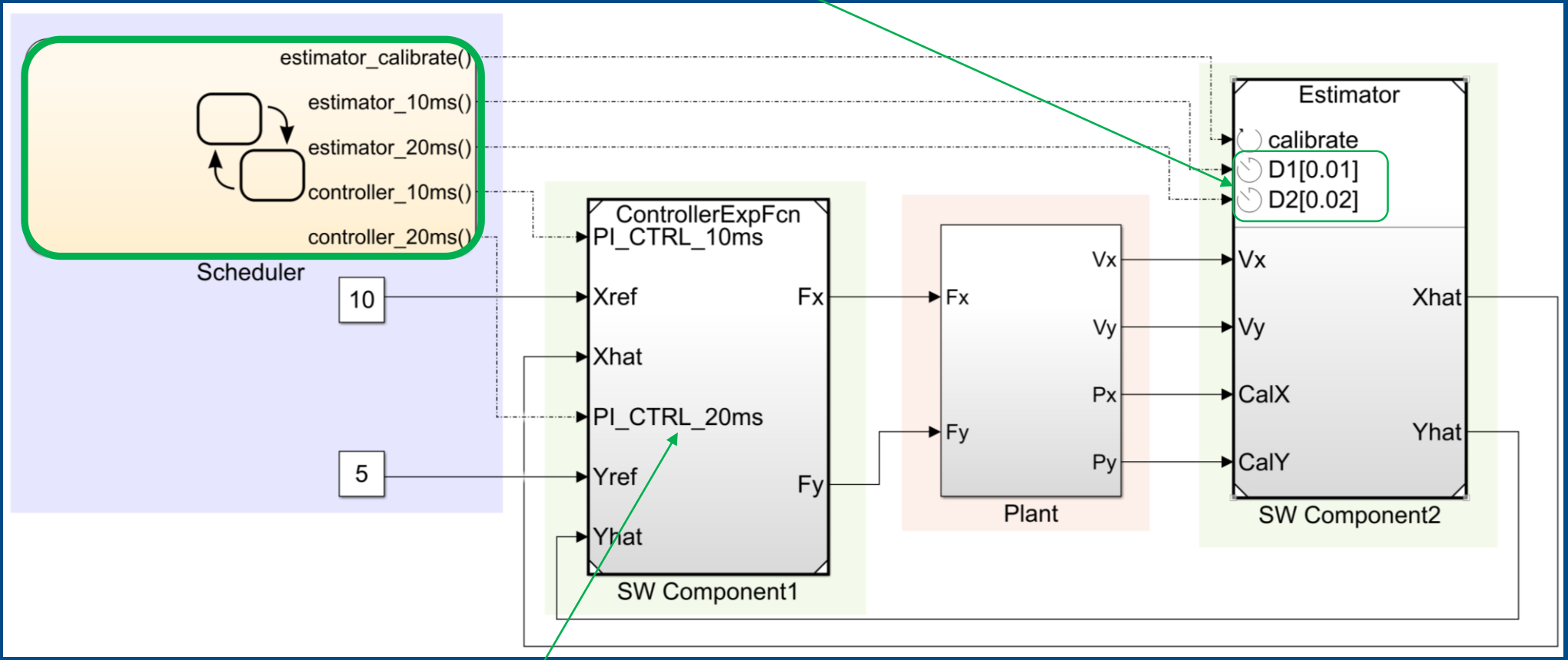


Editing at the Speed of Thought



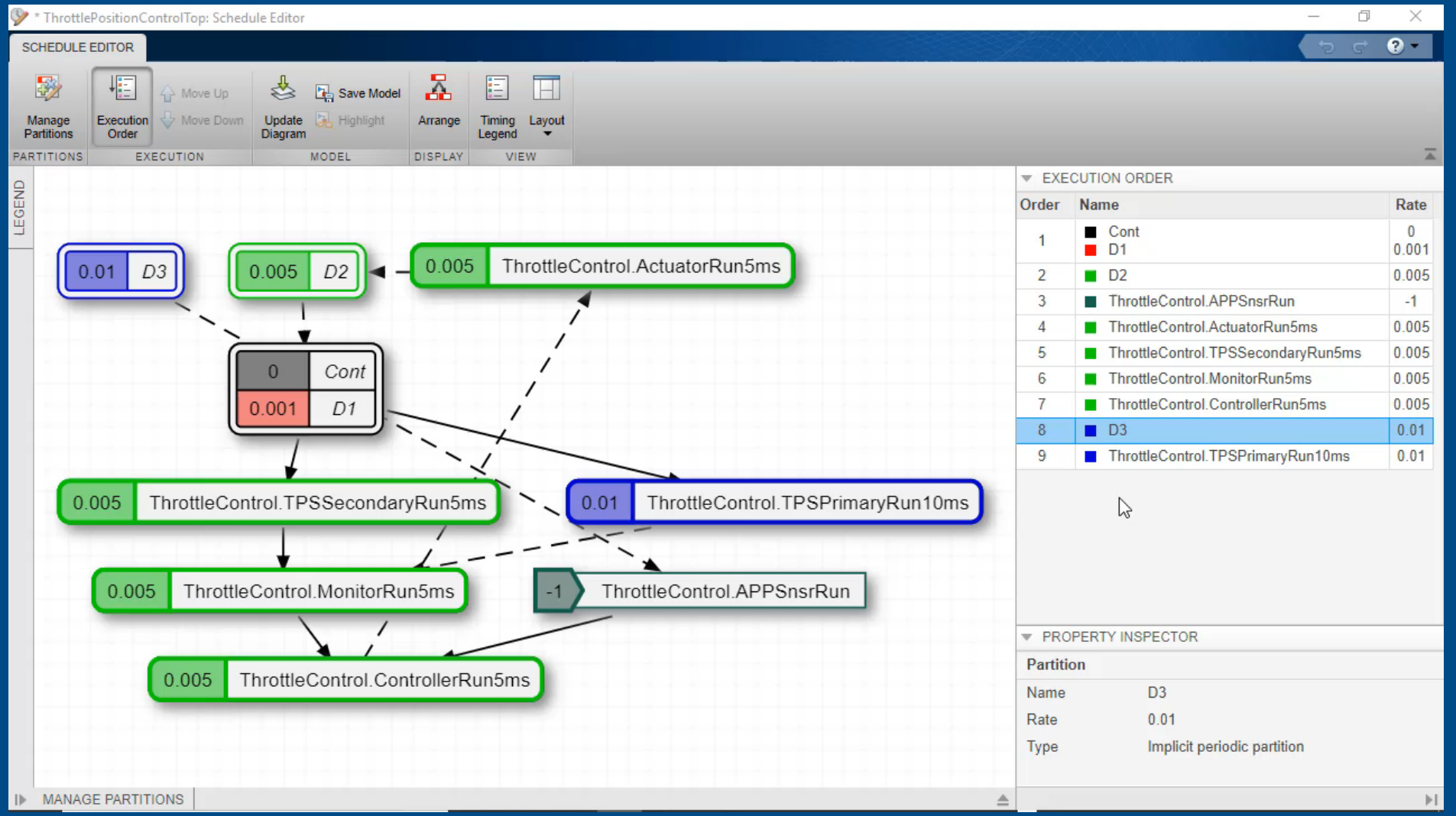
Controlling the Execution of Model Components

Schedulable Rate-Based Model

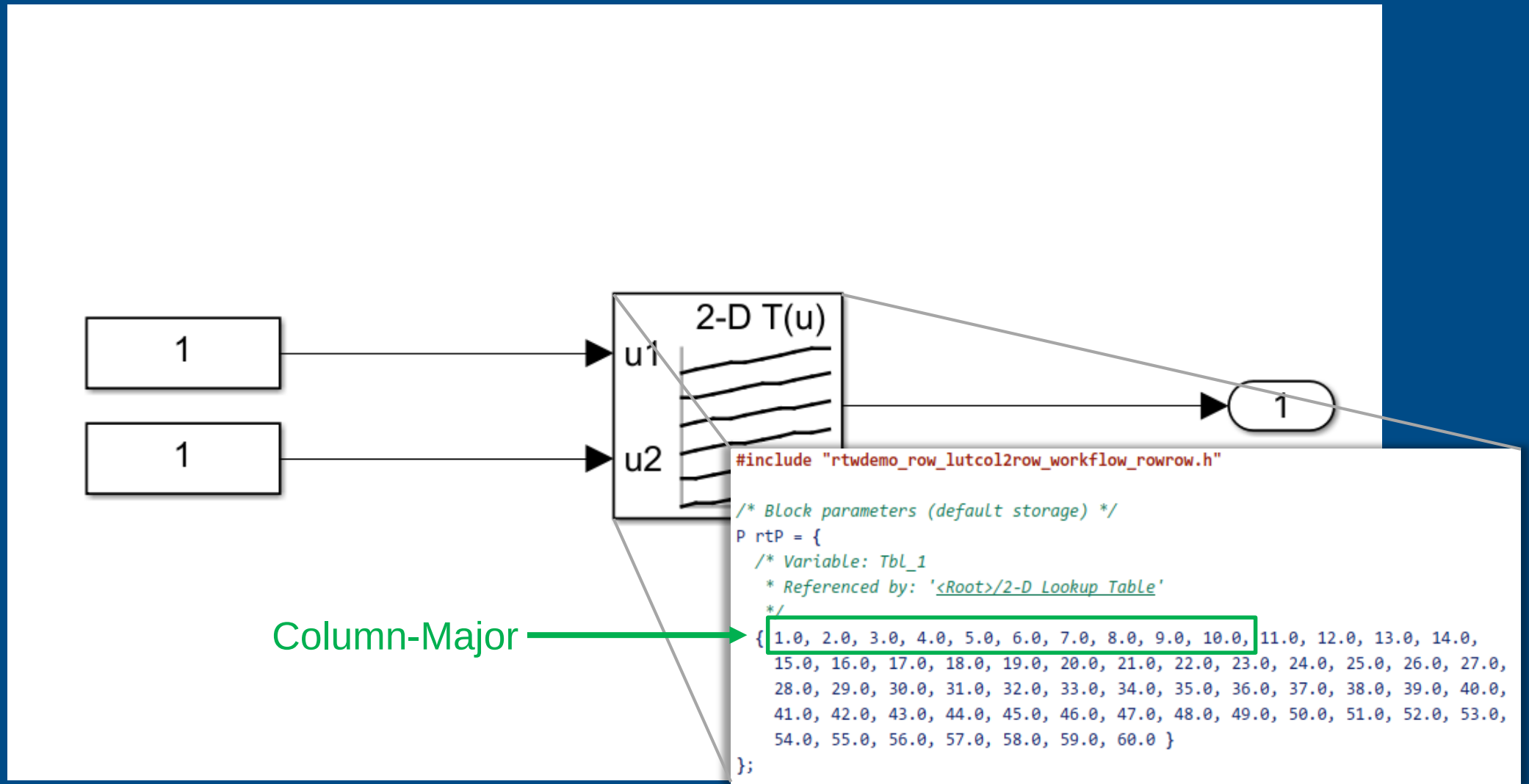


Export Function Model

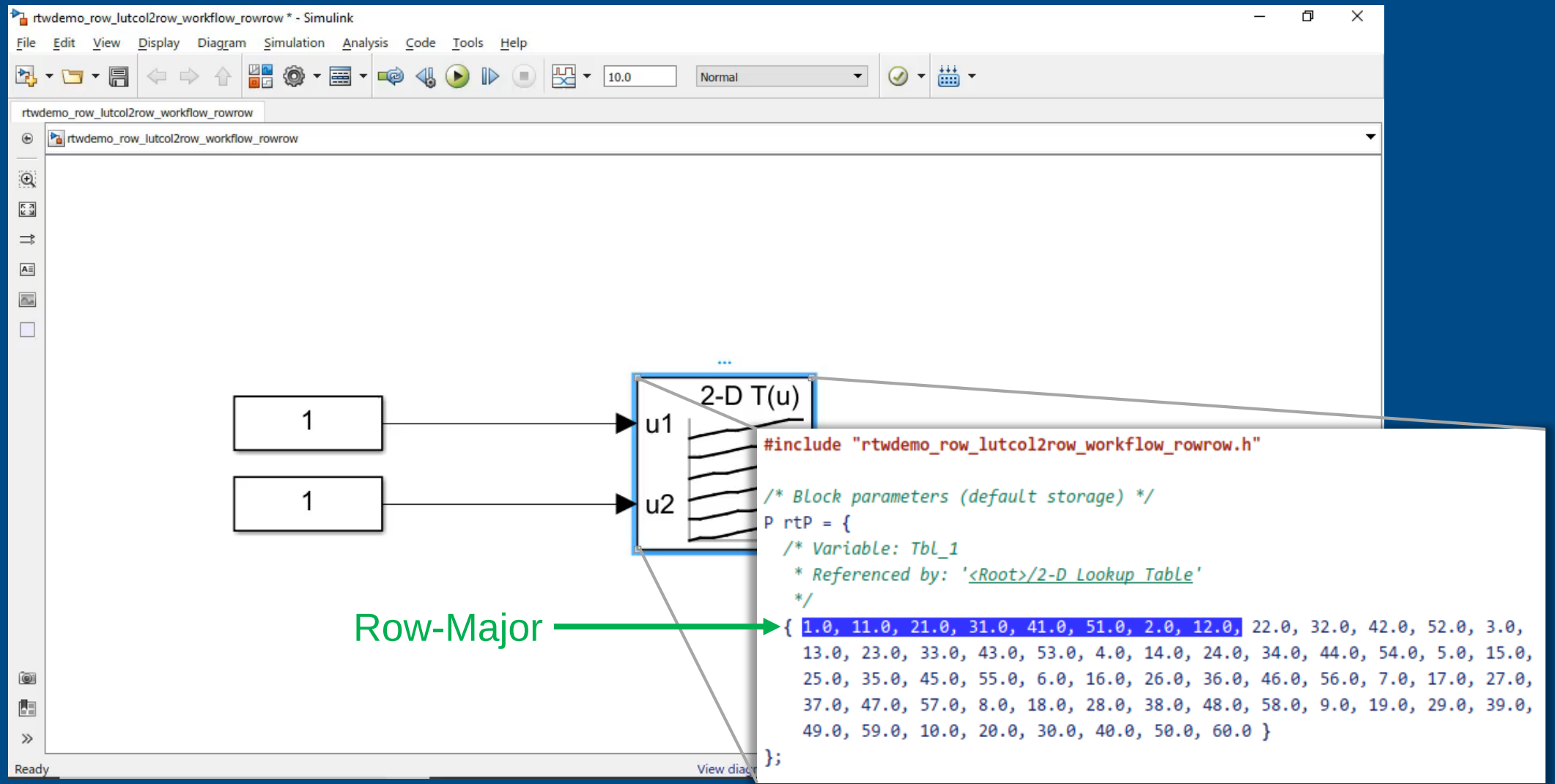
Controlling the Execution of Model Components



Simplifying Integration with External C/C++ Code

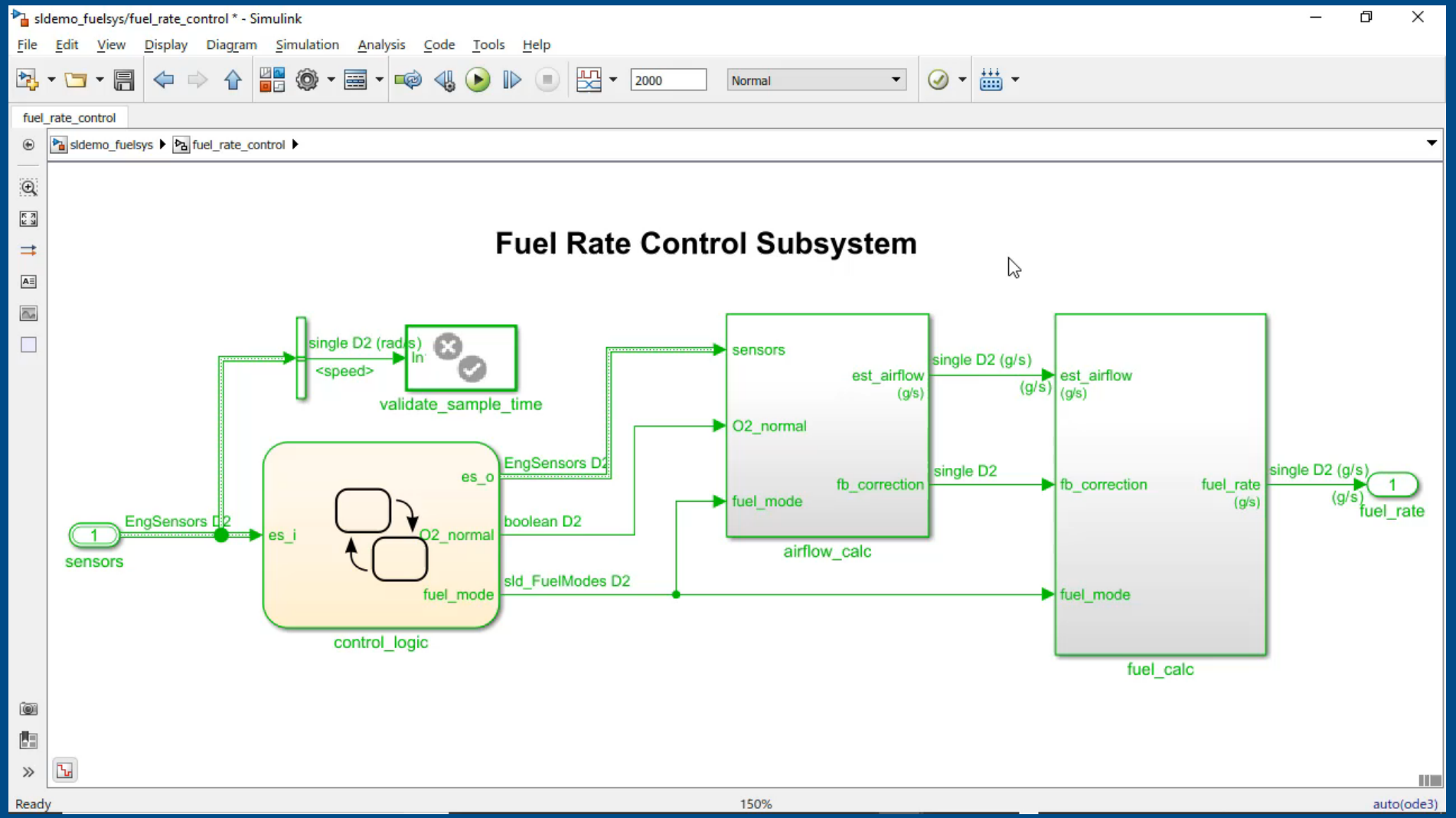


Simplifying Integration with External C/C++ Code



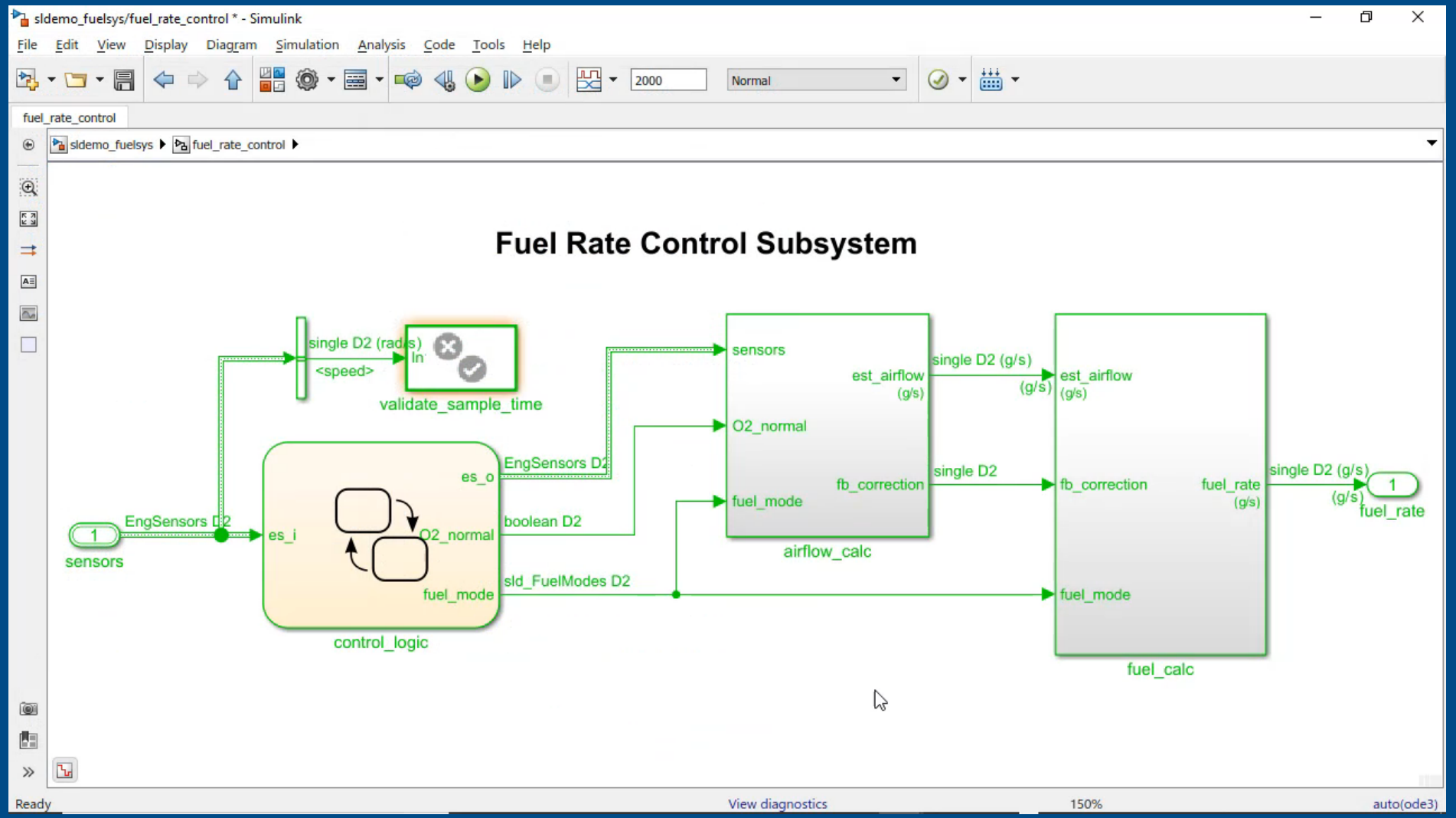
Simulink Coder

Viewing Generated Code Alongside the Model



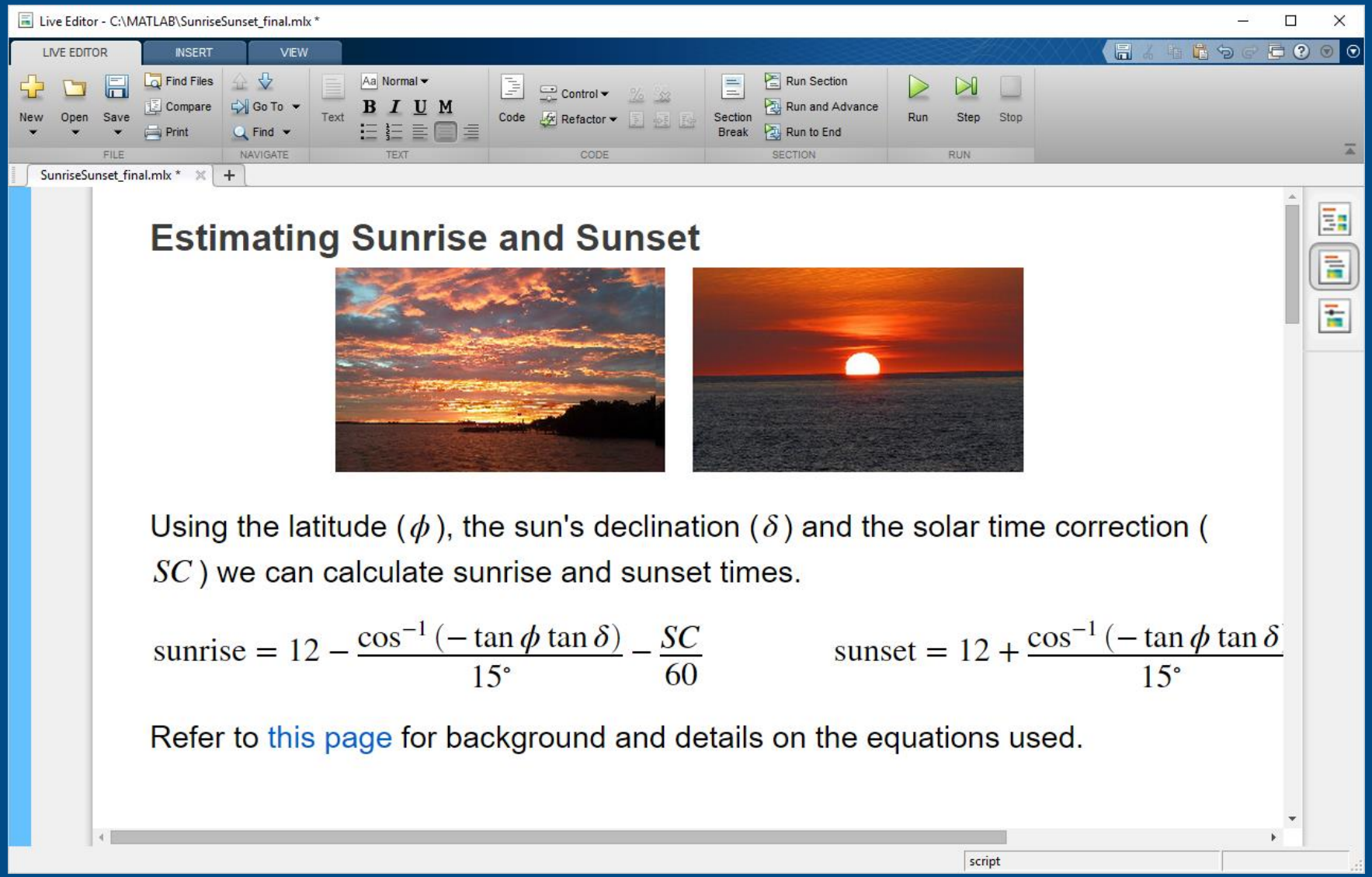
Embedded Coder

Viewing Generated Code Alongside the Model

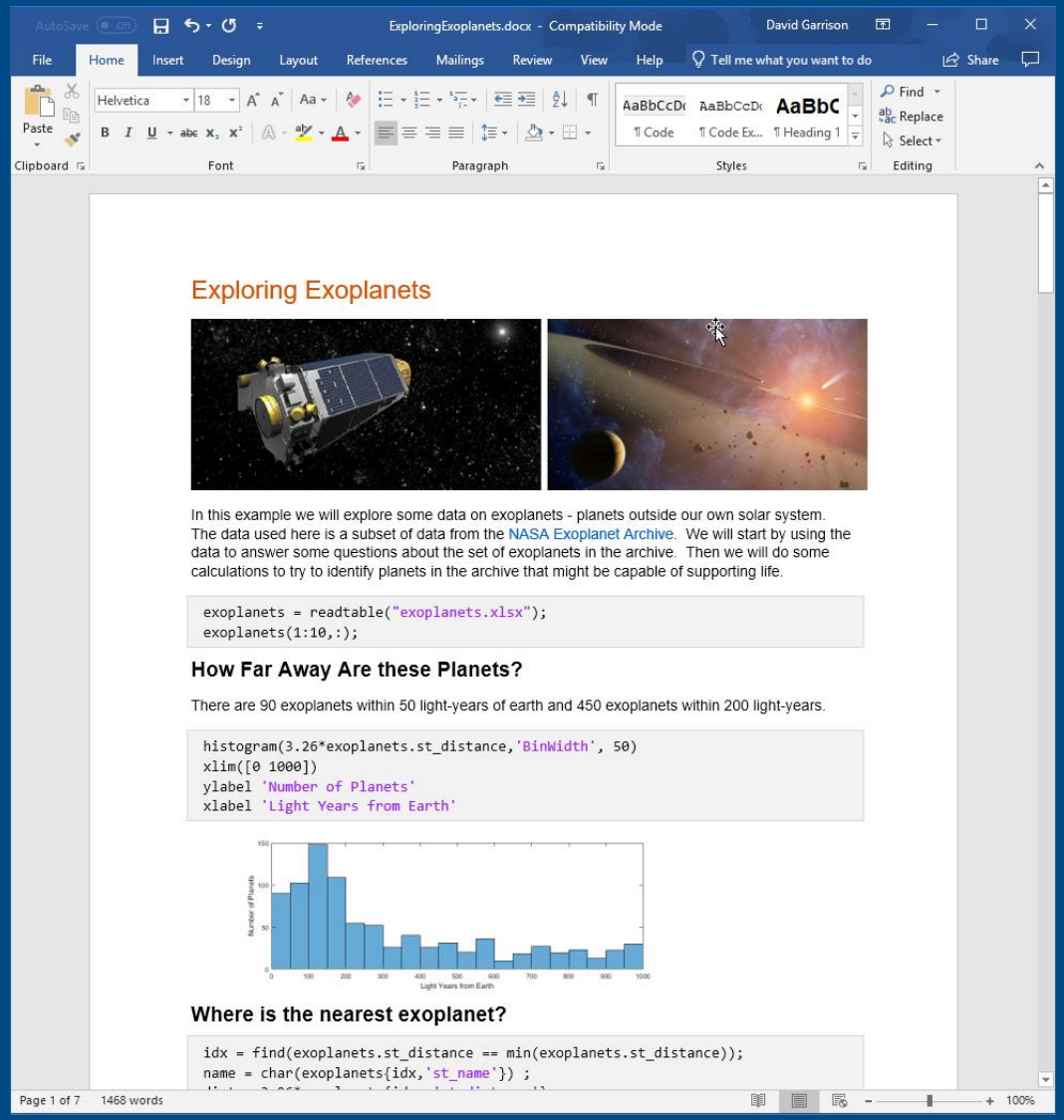


Embedded Coder

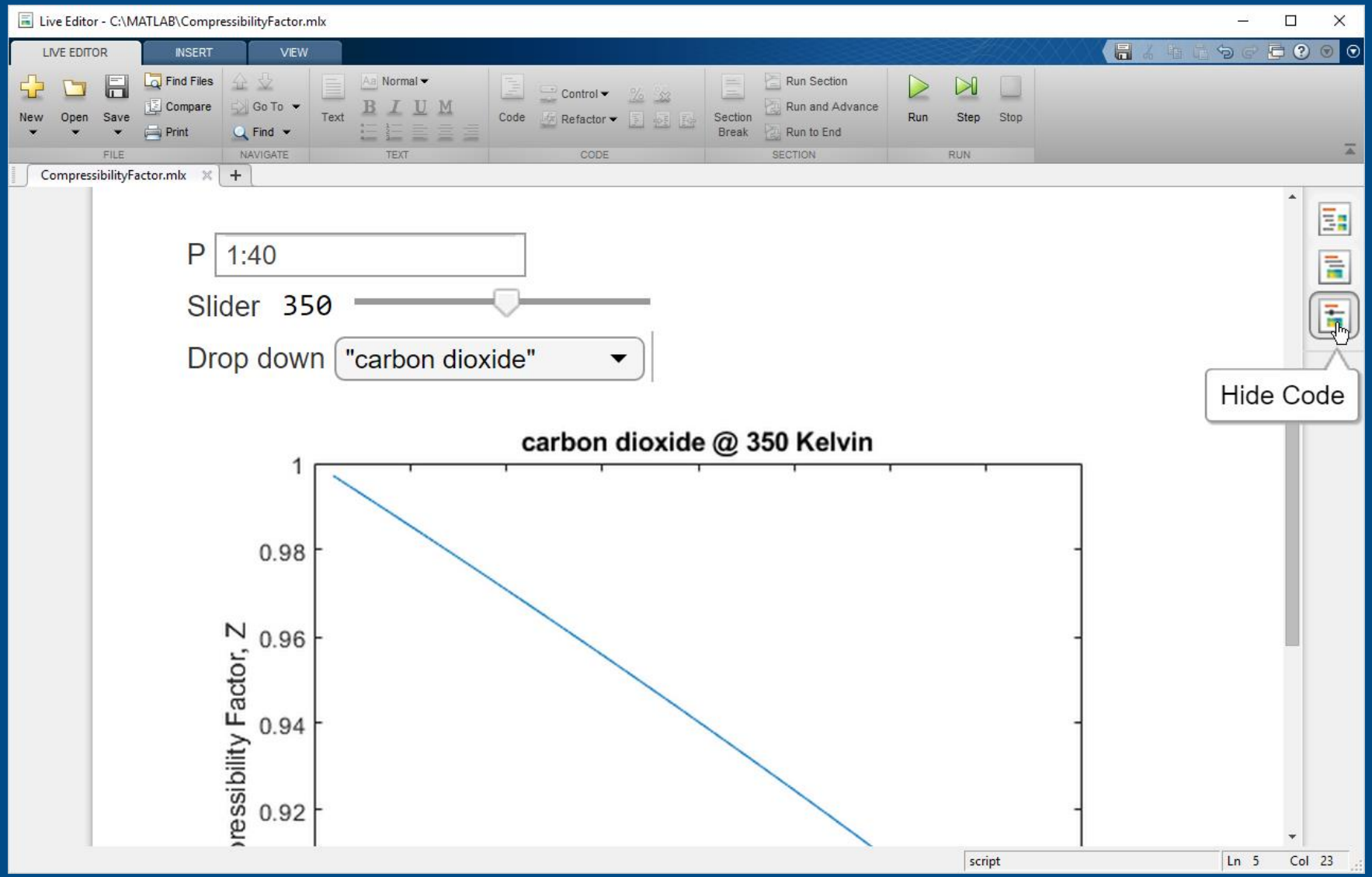
Sharing Live Scripts



Sharing Live Scripts



Sharing Live Scripts

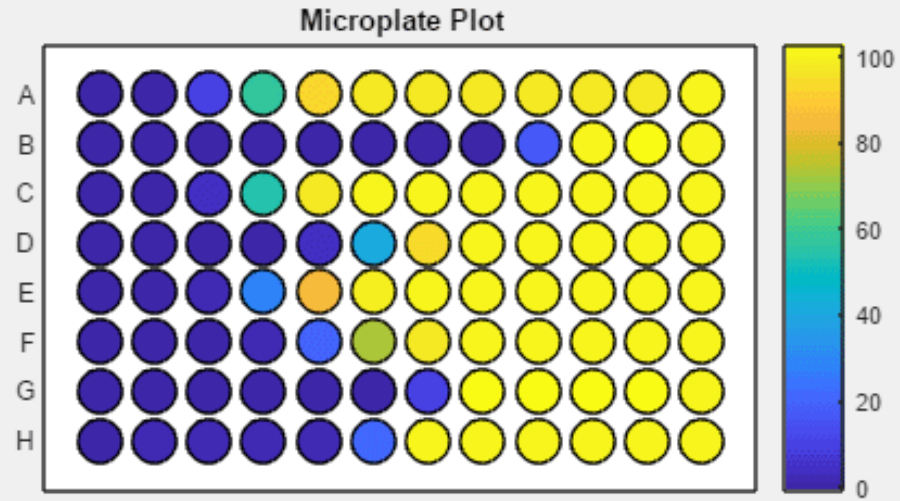


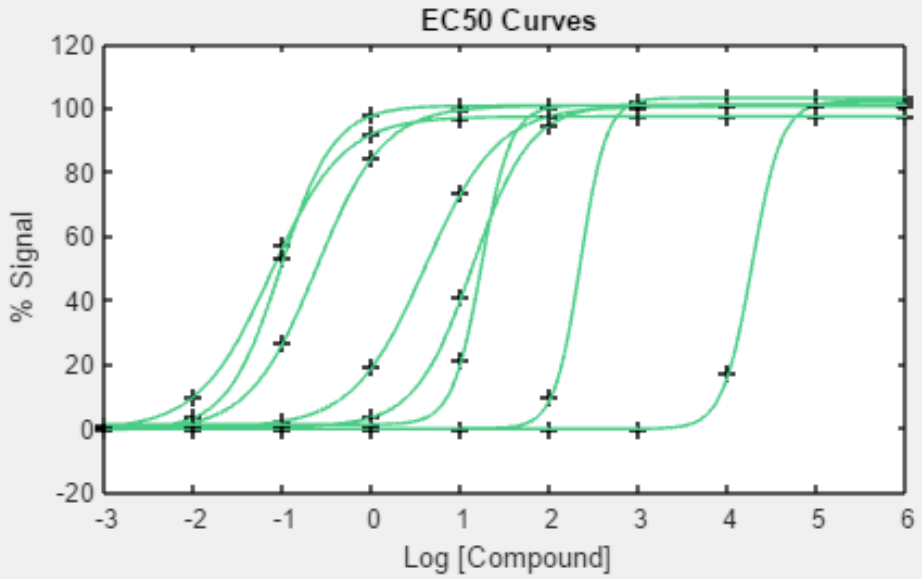
Creating Apps

Output

Plate Browser | Summary Tables

Select Files | Current File: microtiter_data0001.csv

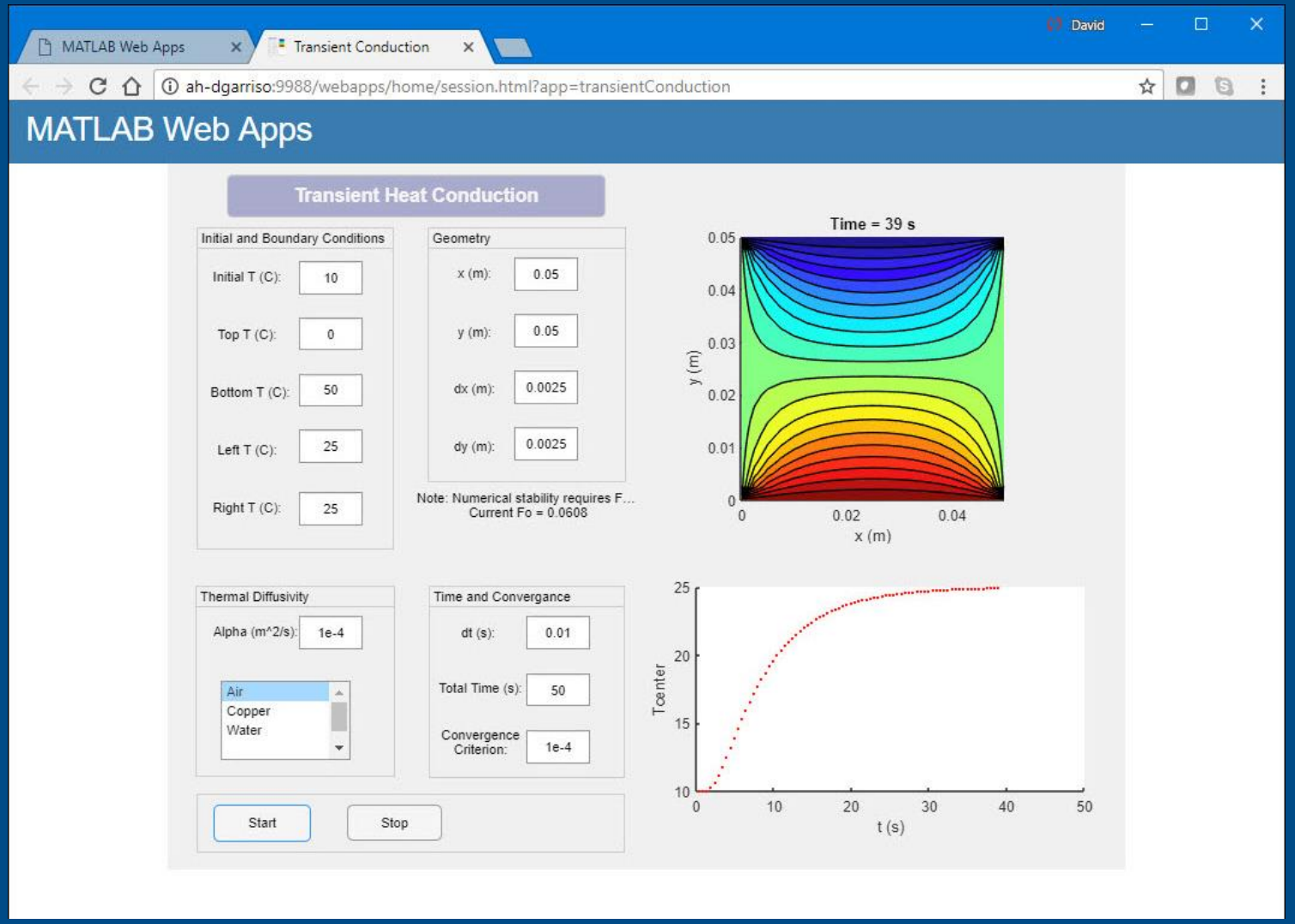




Previous File | Next File | Clear selection

File	Compound Nr	NegControl	Conc1	Conc2	Conc3	Conc4	Conc5	Conc6	Conc7	Conc8
microtiter_d...	1	-0.0741	0.3564	9.8759	56.8743	91.7323	96.7084	97.1532	97.1910	97.1940
microtiter_d...	2	-0.0143	-0.5044	-0.5044	-0.5044	-0.5044	-0.5044	-0.5043	-0.4544	17.0436
microtiter_d...	3	0.0054	-0.4702	3.1998	52.9698	97.5746	100.5006	100.6086	100.6086	100.6086
microtiter_d...	4	0.1096	0.2325	0.2385	0.3712	3.2339	41.1060	94.7343	100.6591	100.9487
microtiter_d...	5	-0.0572	-0.7461	1.7104	26.8872	84.5134	99.2335	100.4717	100.5601	100.5700

Deploying Web Apps



Using MATLAB & Simulink to Build Algorithms in Everything

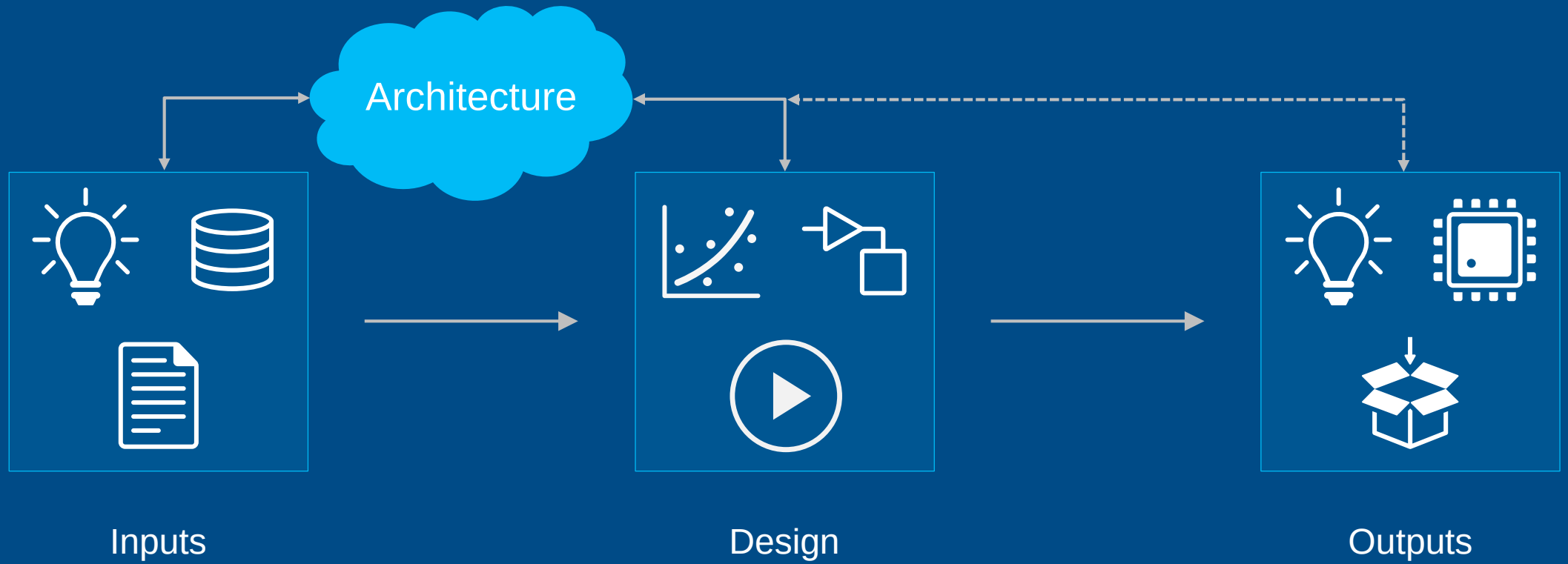
Inputs

Design

Outputs

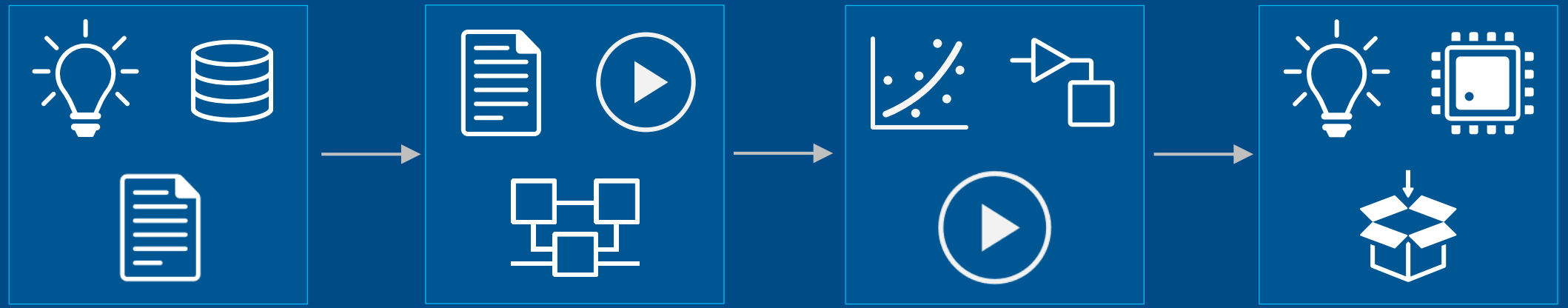
MATLAB&SIMULINK®

Evaluating Architectures



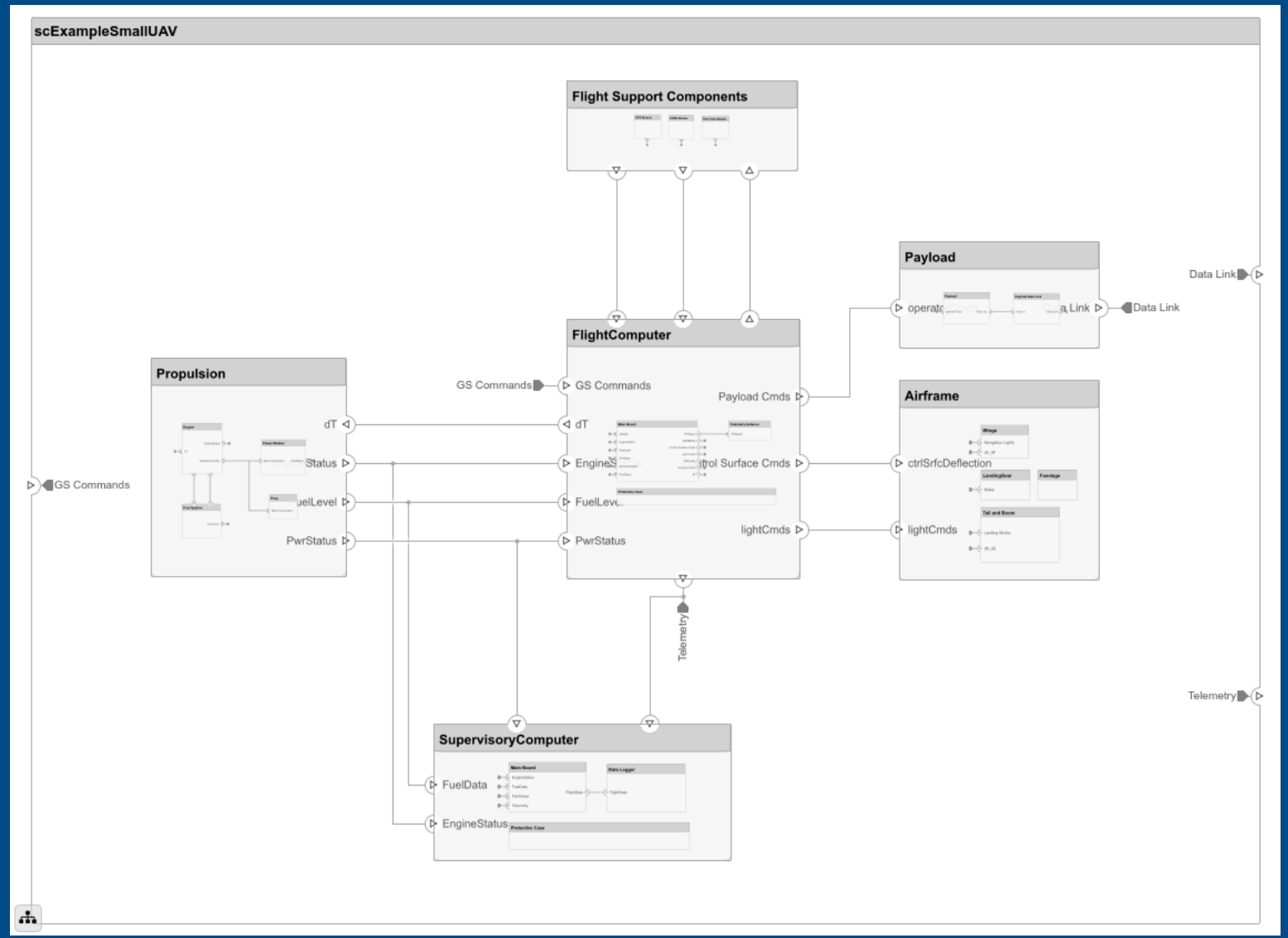
MATLAB&SIMULINK®

Evaluating Architectures



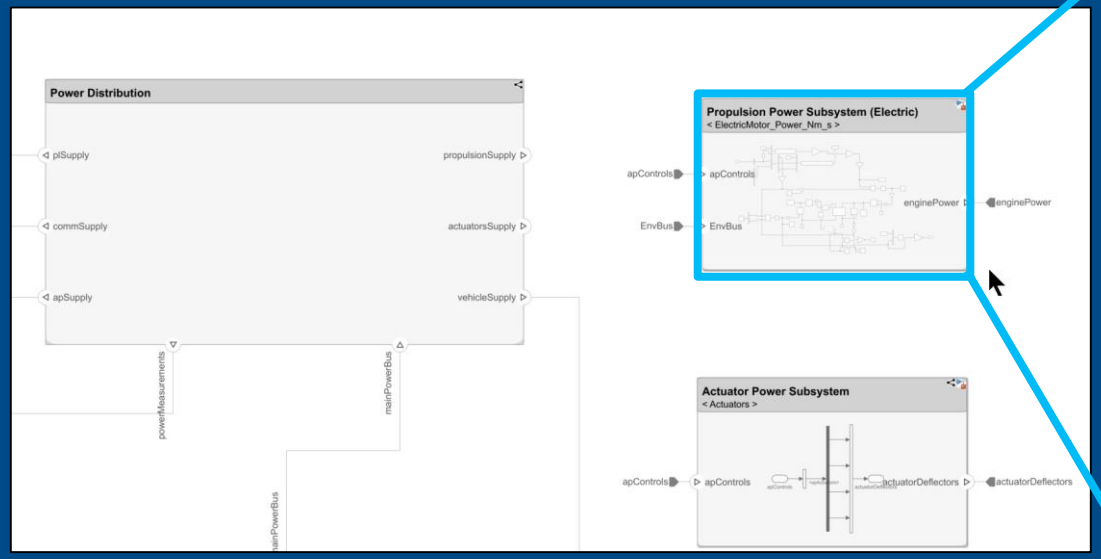
MATLAB&SIMULINK

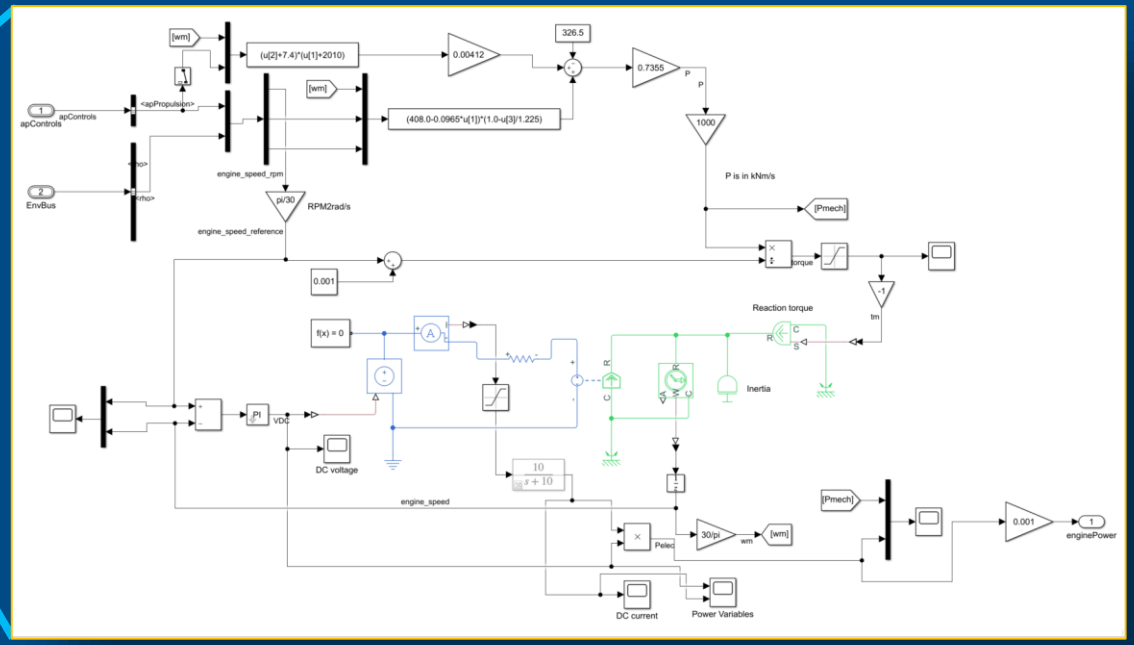
Designing System and Software Architectures



System Composer

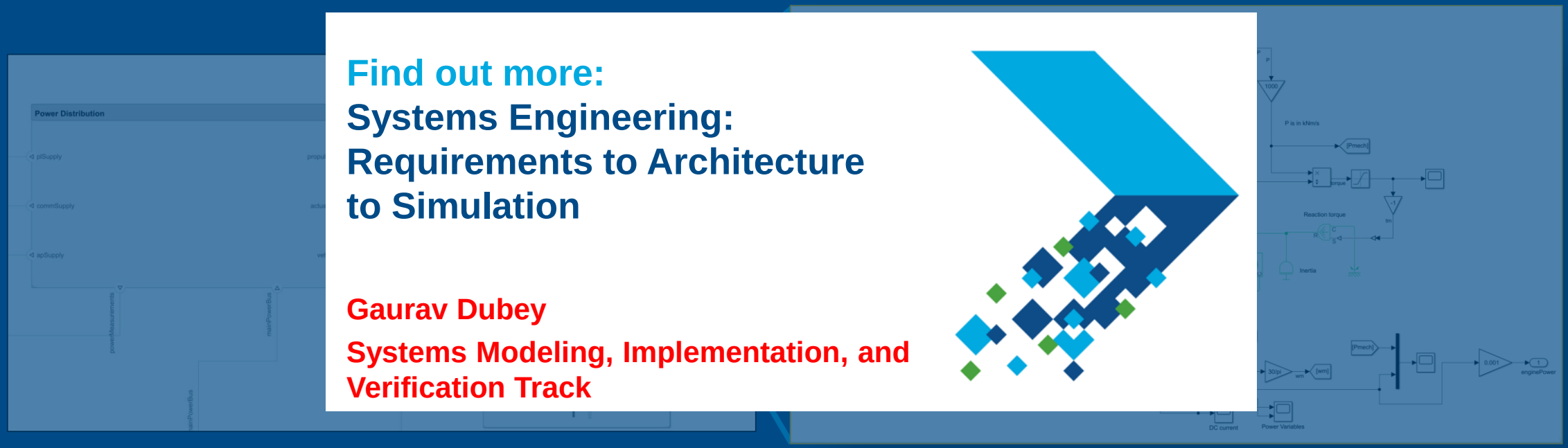
Designing System and Software Architectures





System Composer

Designing System and Software Architectures



Find out more:

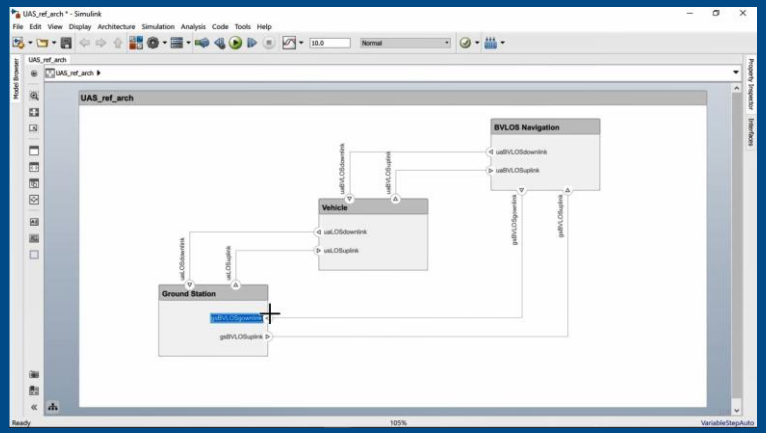
Systems Engineering: Requirements to Architecture to Simulation

Gaurav Dubey

Systems Modeling, Implementation, and Verification Track

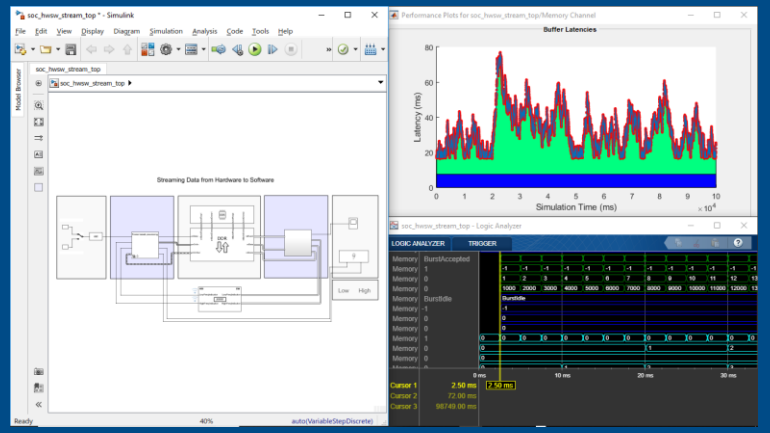
Designing Beyond System and Software Architectures

Systems and Software



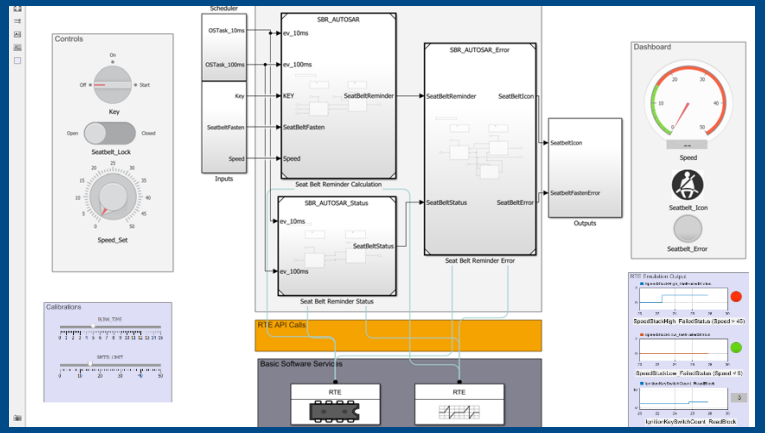
System Composer

SoC Hardware and Software



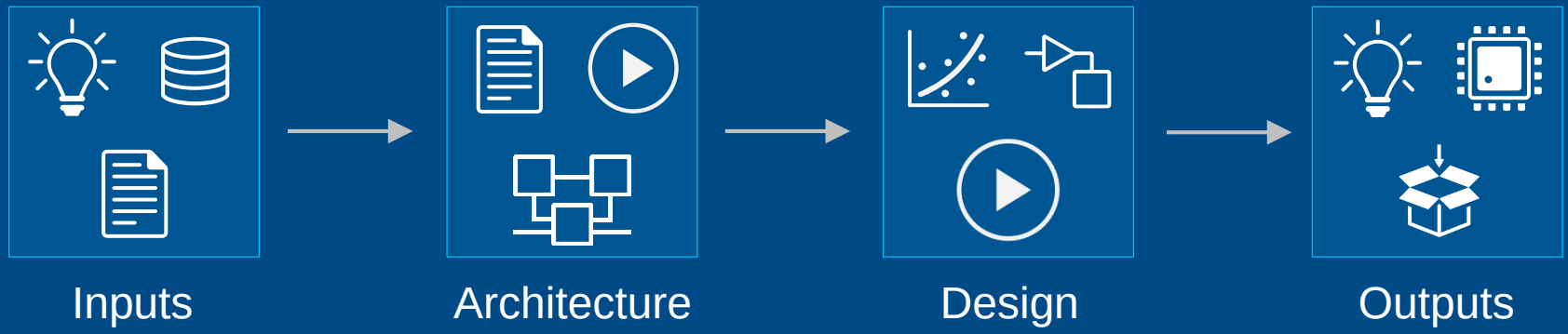
SoC Blockset

AUTOSAR Software



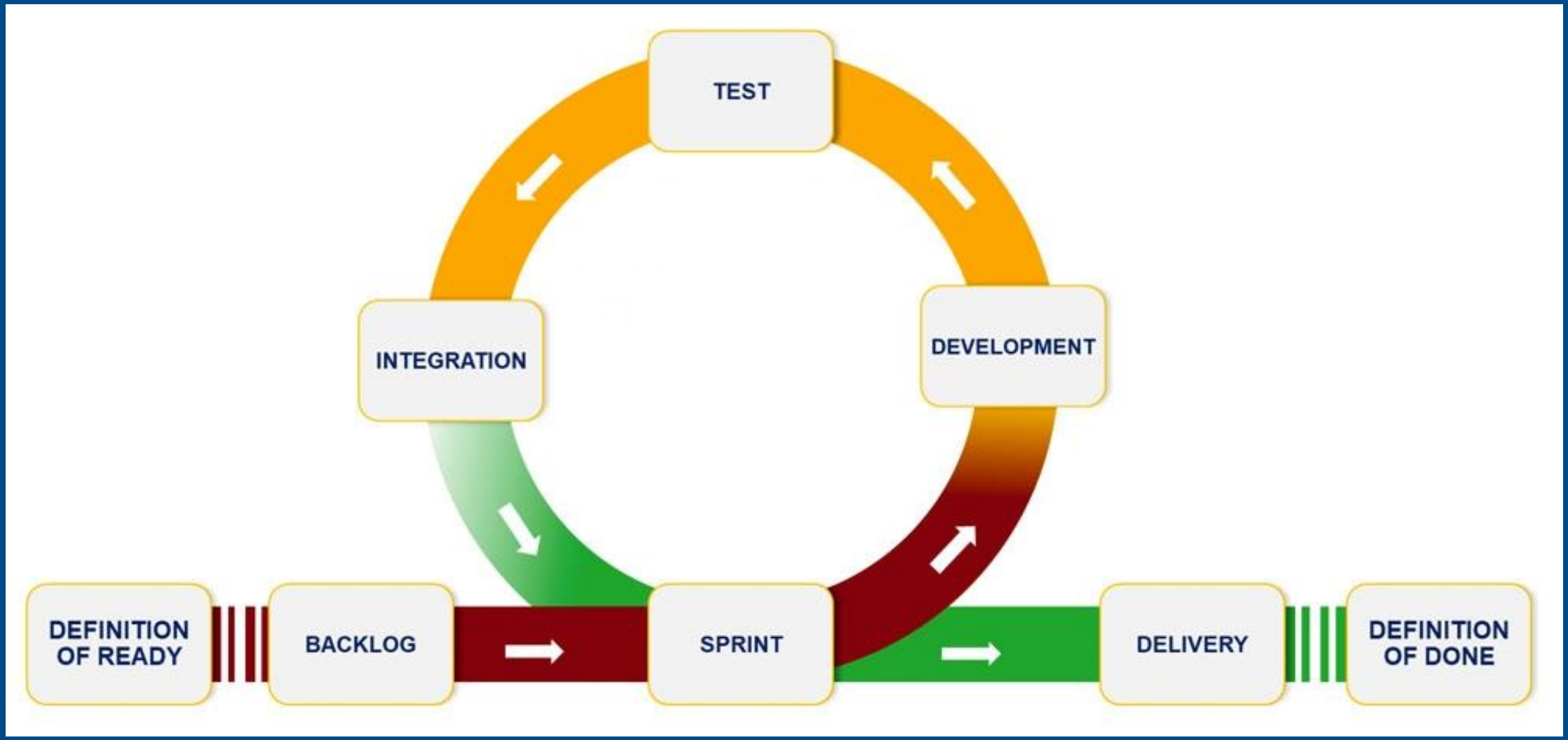
AUTOSAR Blockset

Using MATLAB & Simulink to Build Algorithms in Everything



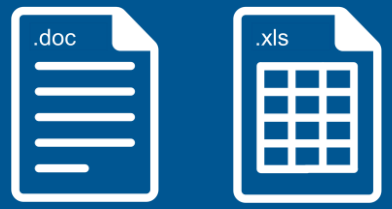
MATLAB&SIMULINK®

Using MATLAB & Simulink to Build Algorithms in Everything



Integrating with Third-party Requirements Tools

External Requirements



Requirements Management Tools

R2019a

ReqIF

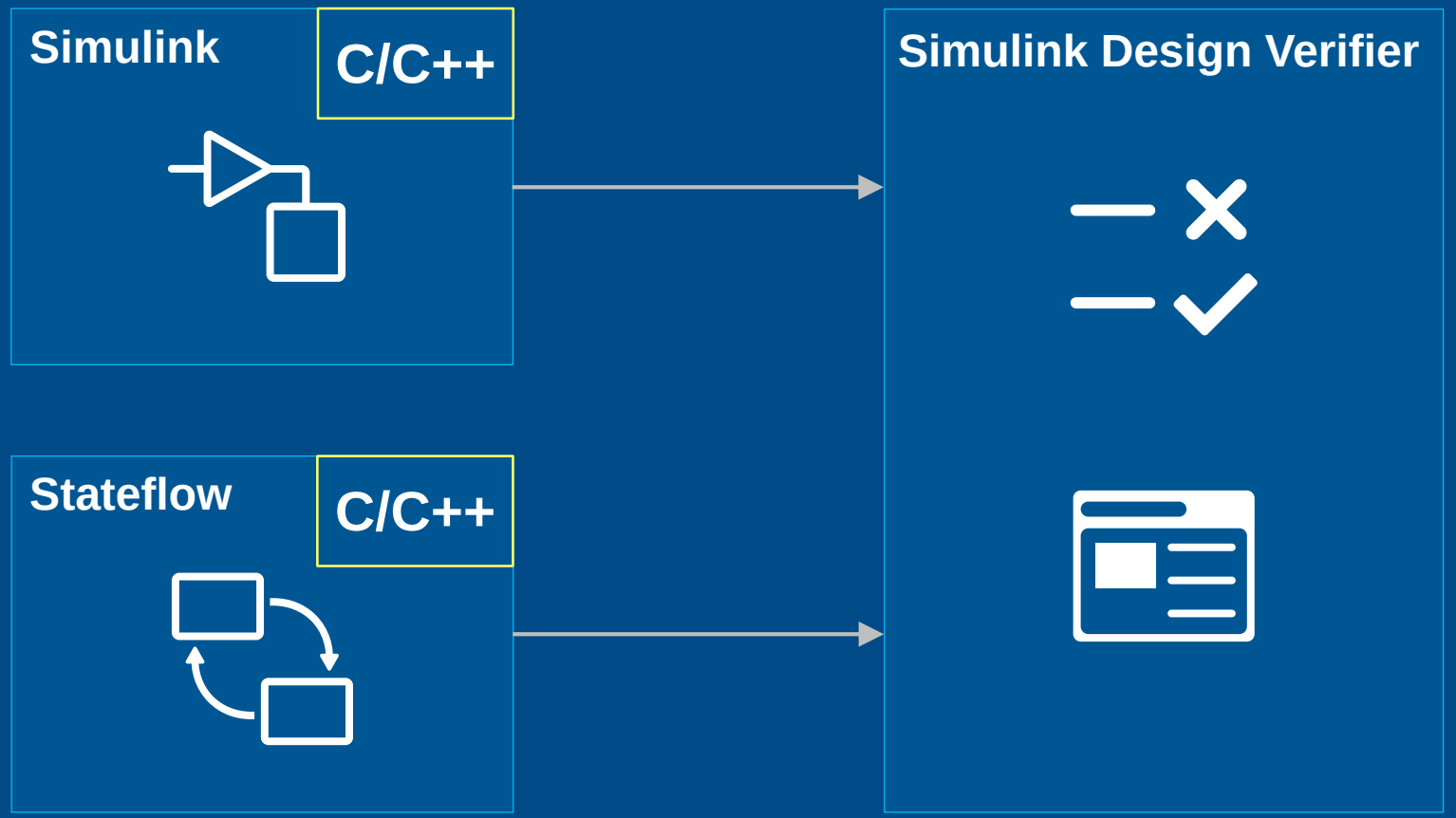
Simulink Requirements

External Requirements

Authored Requirements

Simulink Requirements

Include Custom Code in Test & Verification



Include Custom Code in Test & Verification

Simulink

C/C++

Simulink Design Verifier

Find out more:

Simplifying Requirements-Based Verification with Model-Based Design

Vamshi Kumbham

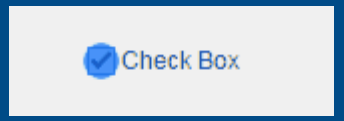
Systems Modeling, Implementation, and Verification Track

Using the MATLAB Unit Test Framework

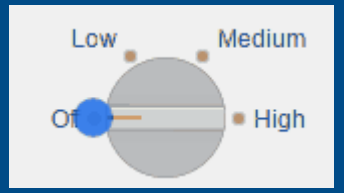

```
>> result.table
ans =
  2×6 table
                                Name                                Passed    Failed    Incomplete    Duration    Details
    ____________________________________________________________    ______    ______    __________    ________    _____________
    'test_Predictions/Test_ModelType'                               true      false       false       0.12241     [1×1 struct]
    'test_Predictions/Test_Prediction'                              false     true        true        0.11542     [1×1 struct]
```


Using the MATLAB App Testing Framework

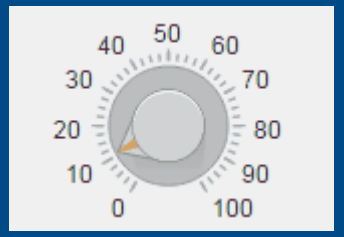

```
testCase.press(myApp.checkbox)
```



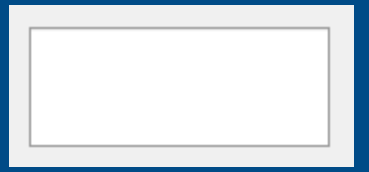

```
testCase.choose(myApp.discreteKnob, "Medium")
```



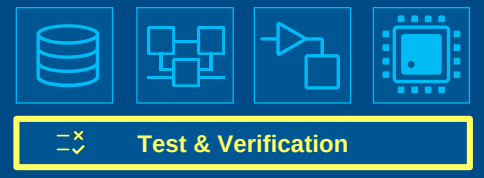

```
testCase.drag(myApp.continuousKnob, 10, 90)
```

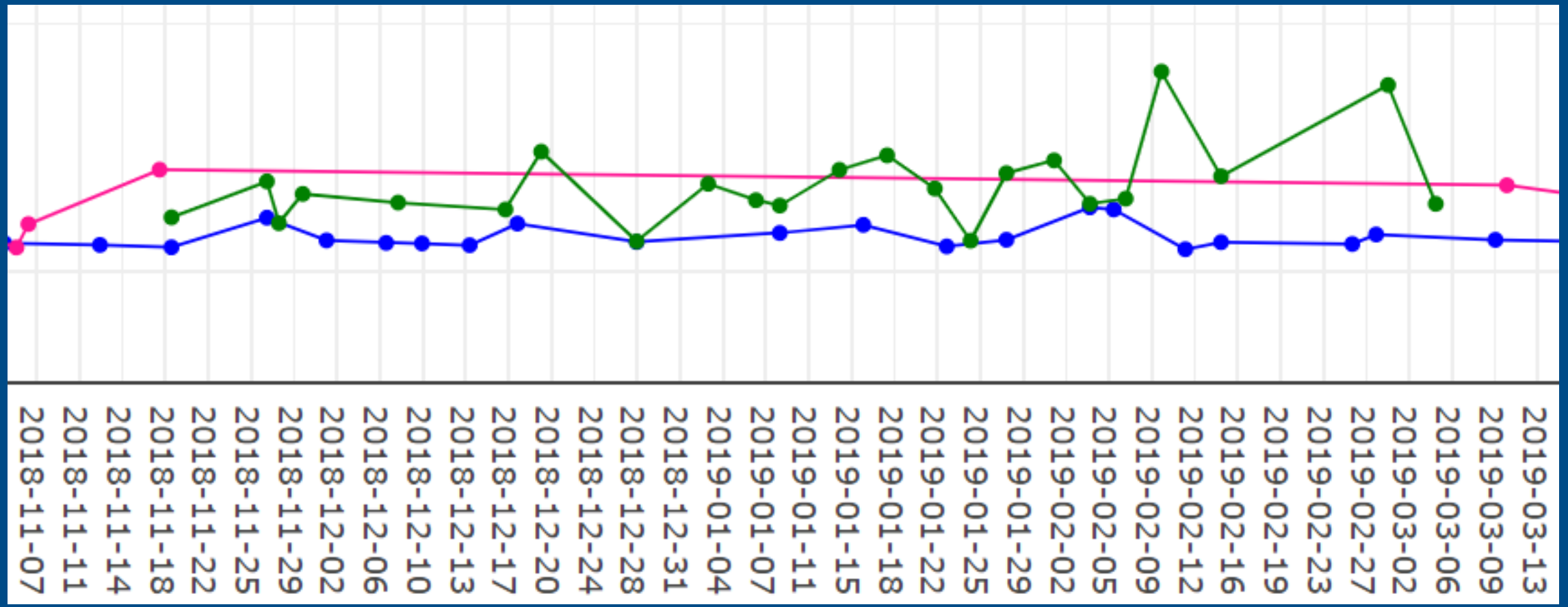



```
testCase.type(myApp.editfield, myTextVar)
```



Using the MATLAB Performance Testing Framework





Using Continuous Integration

MATLAB https://plugins.jenkins.io/

Using Continuous Integration

Jenkins

Blog Documentation

← Find plugins

MATLAB 1.0.0

Minimum Jenkins requirement: 2.7.3
ID: matlab

Installs: No usage data available
GitHub →
Last released: 2 days ago

Maintainers

MathWorks

Dependencies

bouncycastle API v.2.16.0 (implied) (what's this?)
Command Agent Launcher v.1.0 (implied) (what's this?)
JDK Tool v.1.0 (implied) (what's this?)
JAXB v.2.3.0 (implied) (what's this?)

The Jenkins plugin for MATLAB® enables you to easily run your MATLAB tests and generate test artifacts in formats such as JUnit, TAP, and Cobertura code coverage reports.

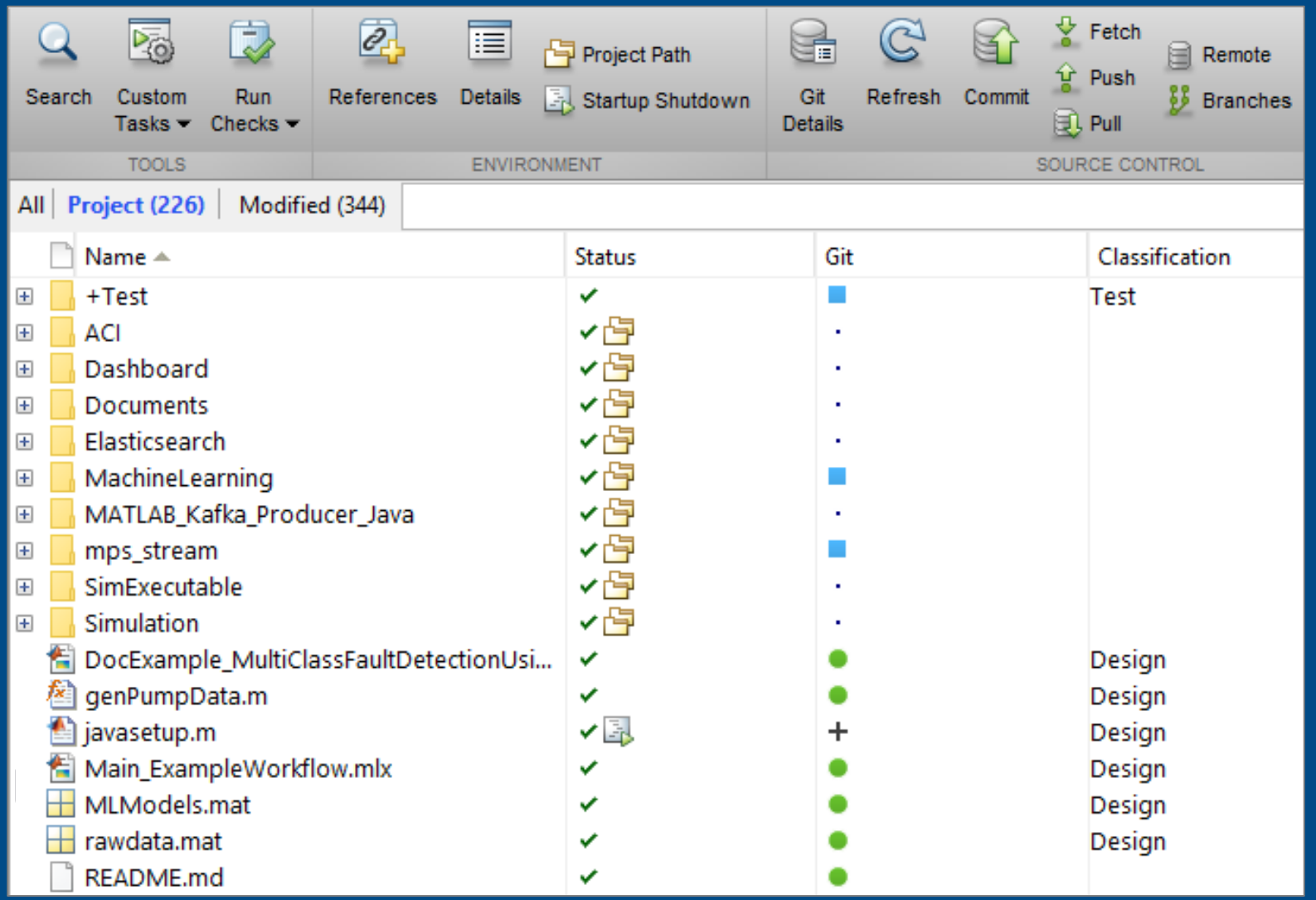
Features

- Support to run MATLAB tests, present in the Jenkins workspace automatically. (This also includes the tests present in .prj files)
- Generate tests artifacts in JUnit , TAP & Cobertura code coverage formats.
- Support to run tests, using custom MATLAB command or custom MATLAB script file.

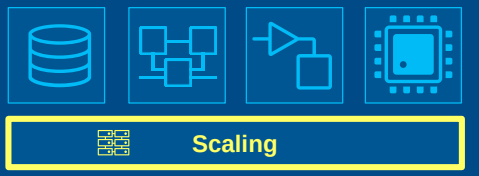
MATLAB **https://plugins.jenkins.io/matlab**

Using Projects in MATLAB

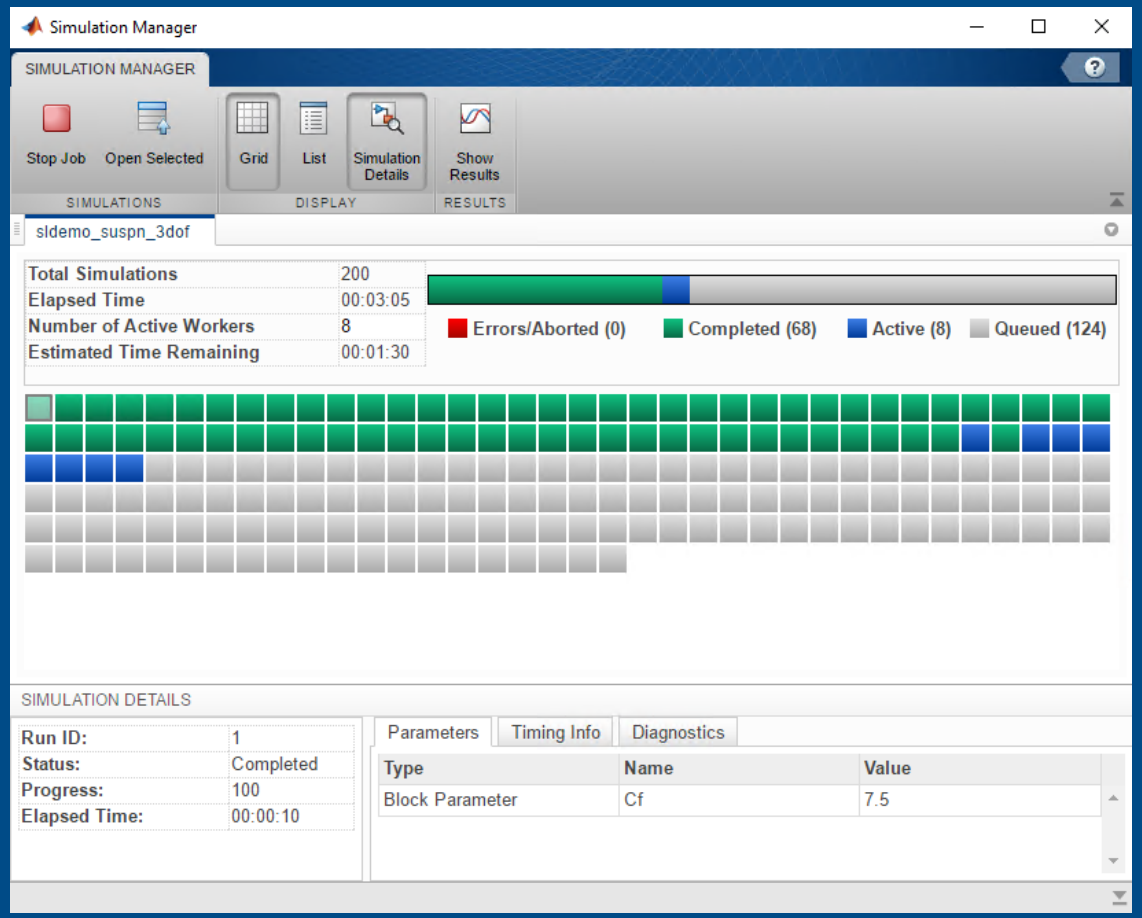
Collaboration



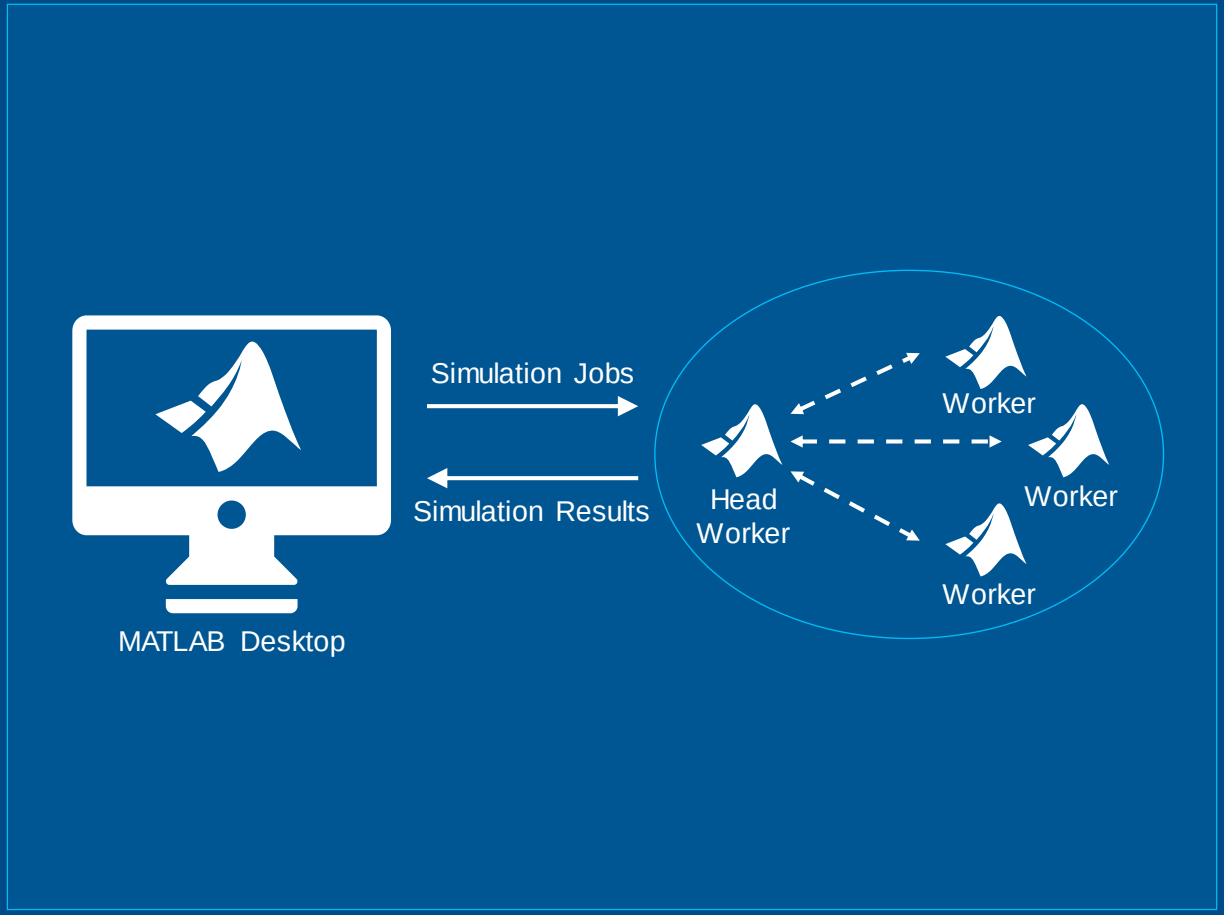
Parallel Simulations in Simulink



Simulation Manager

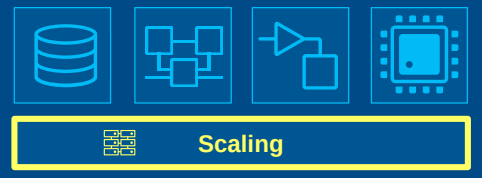


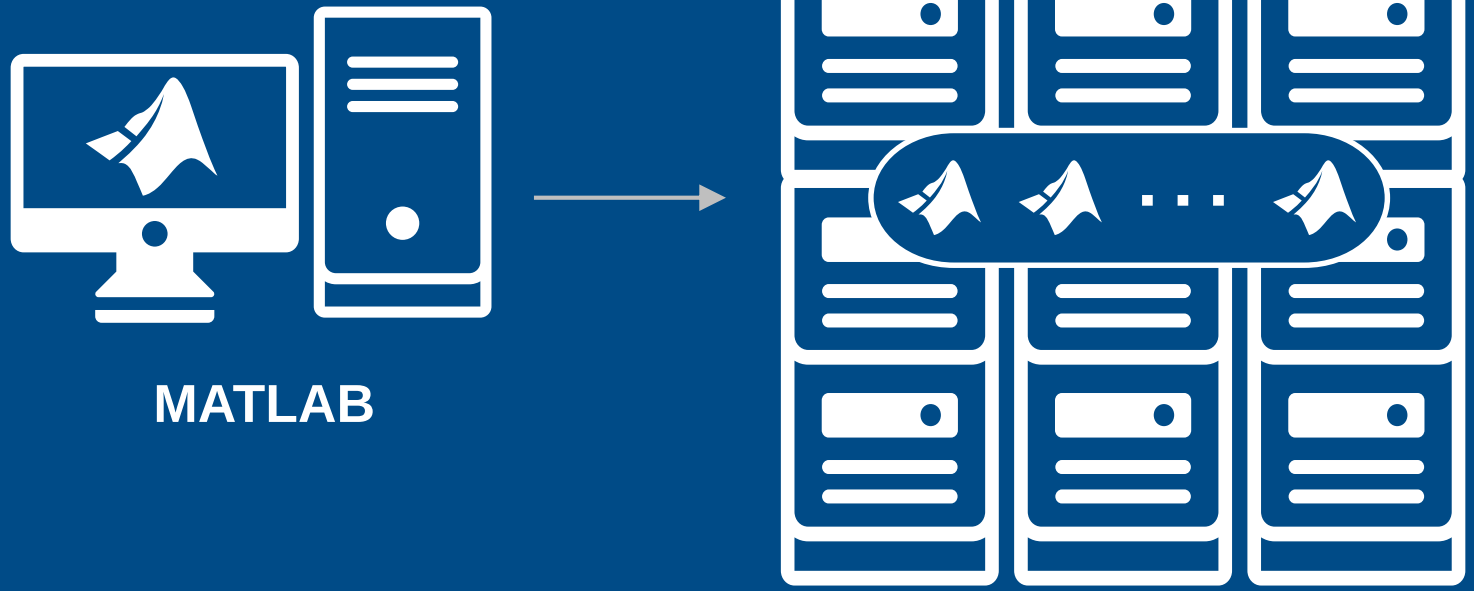
batchsim



Simulink
Parallel Computing Toolbox

Scaling Computations on Clusters and Clouds





MATLAB

Parallel Computing Toolbox

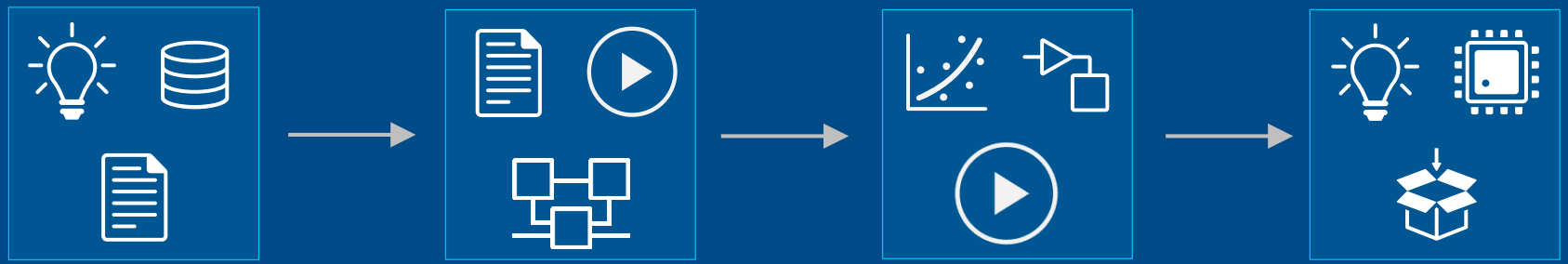
MATLAB Parallel Server

Cloud

GPU

Multi-core CPU

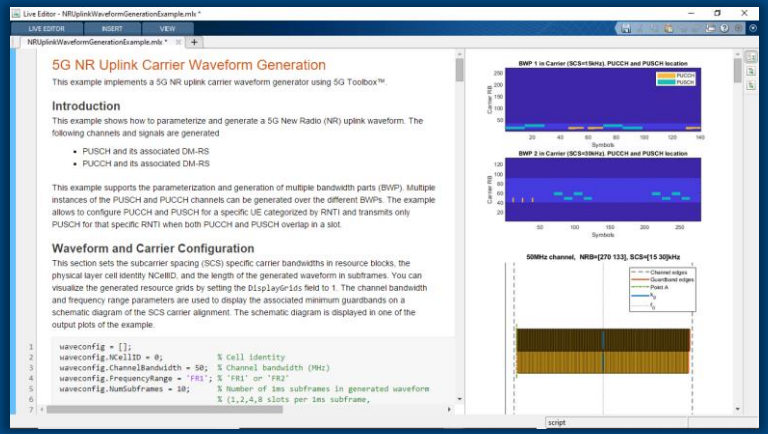
Using MATLAB & Simulink to Build Algorithms in Everything



MATLAB&SIMULINK

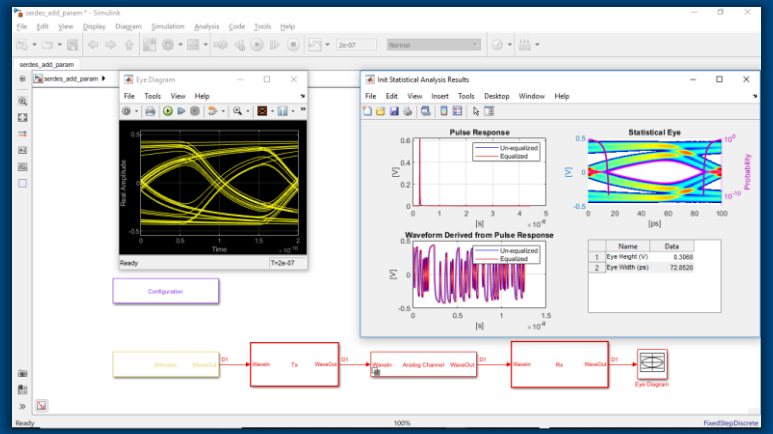
Specialized Tools for Building Algorithms in Everything

Communications



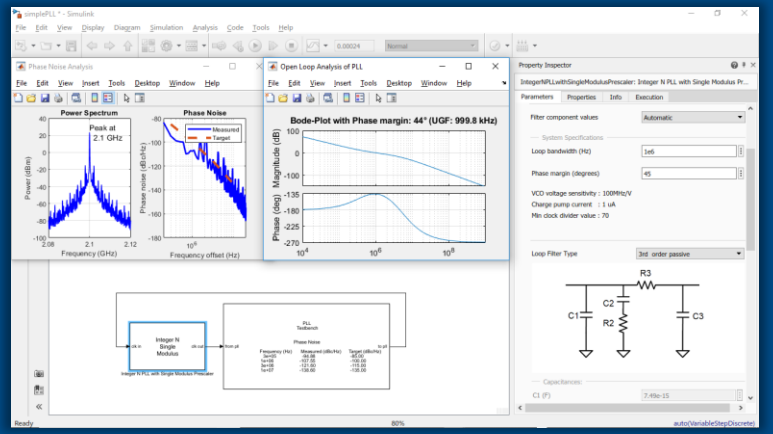
5G Toolbox

Physical interconnects



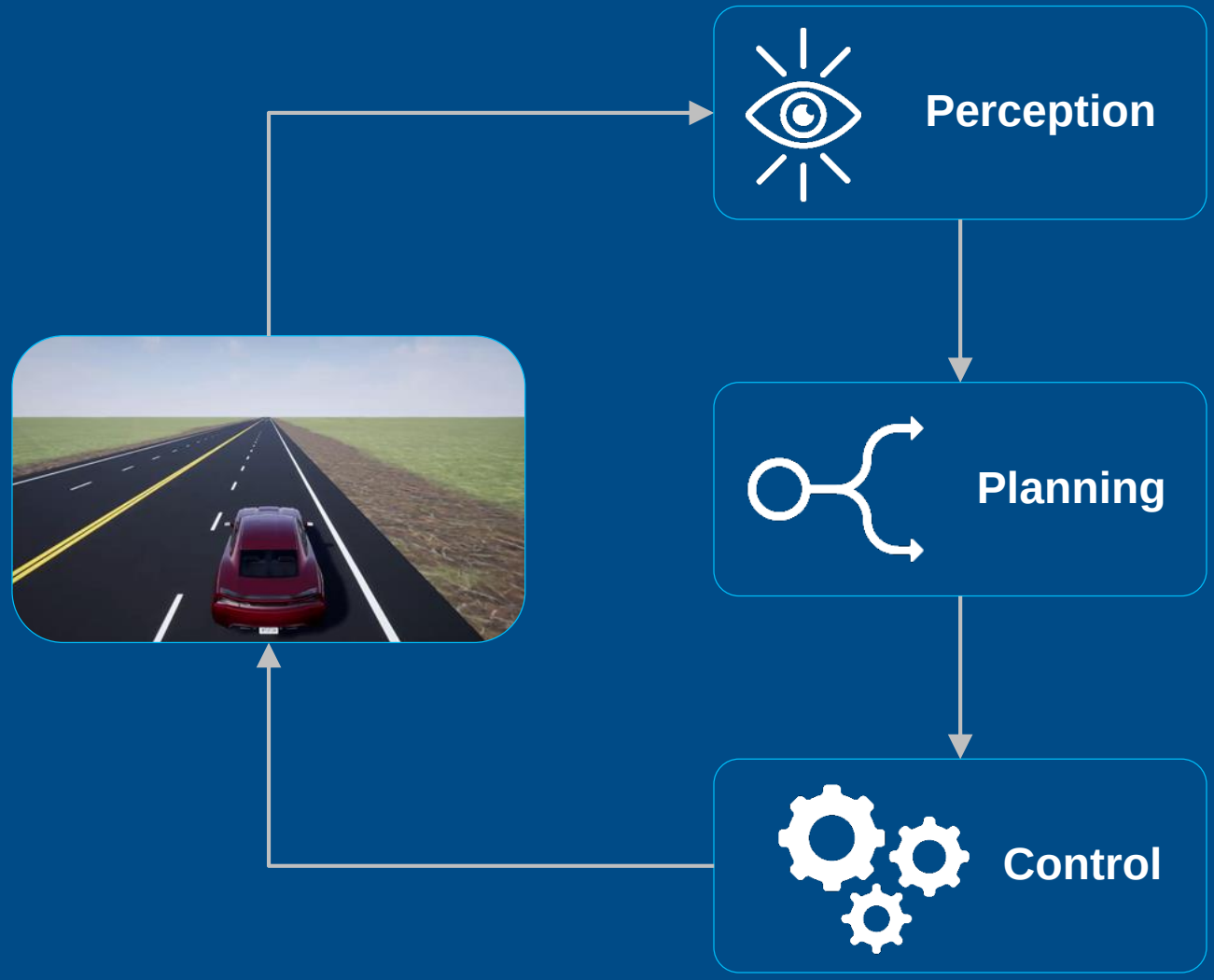
SerDes Toolbox

Analog Mixed-Signal

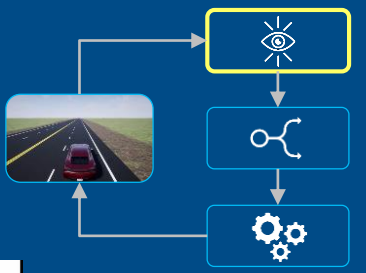


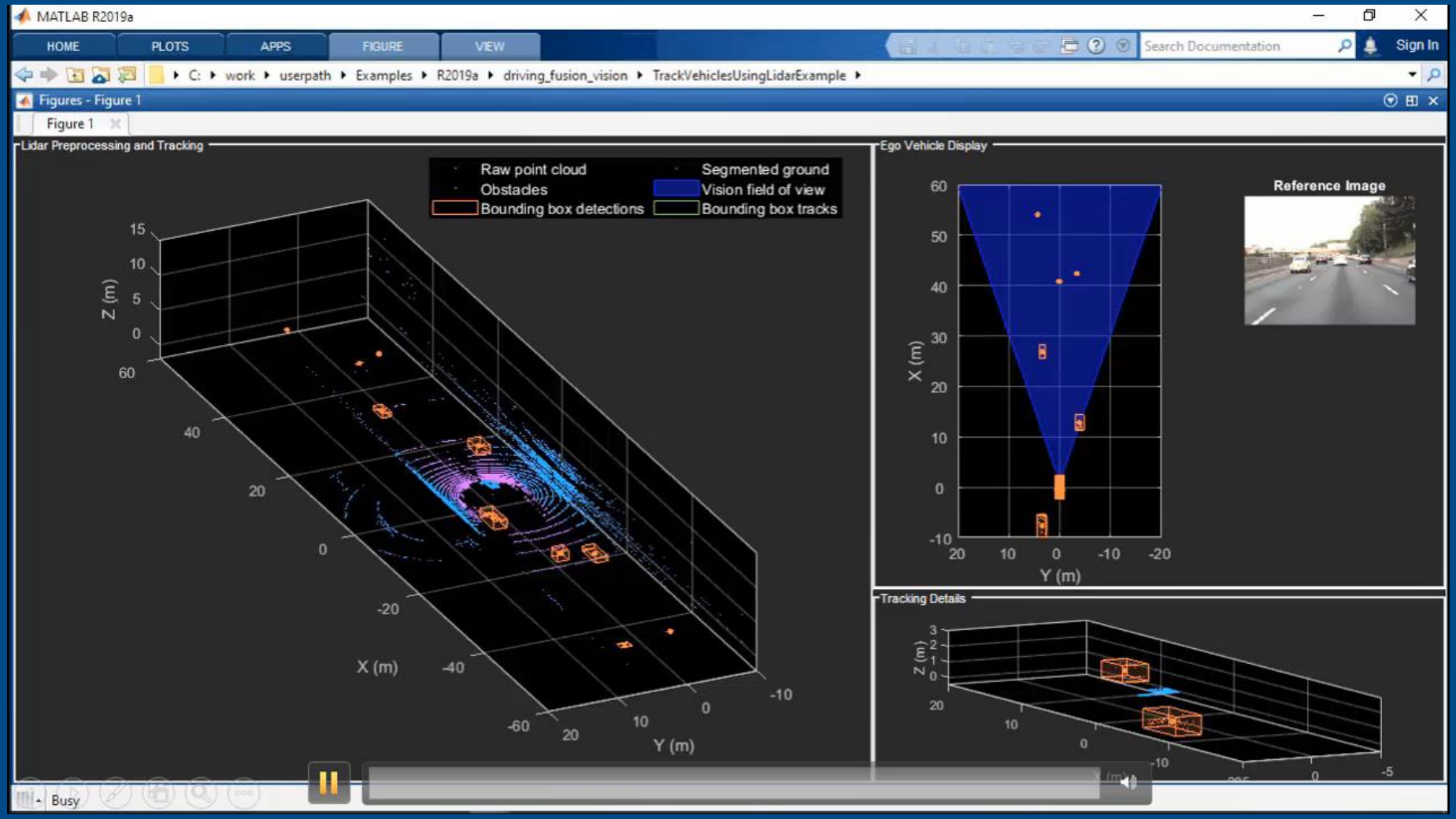
Mixed-Signal Blockset

Developing Autonomous Systems



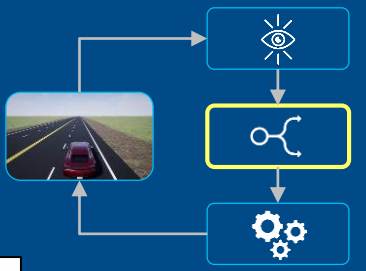
Evaluate Sensor Fusion Architectures

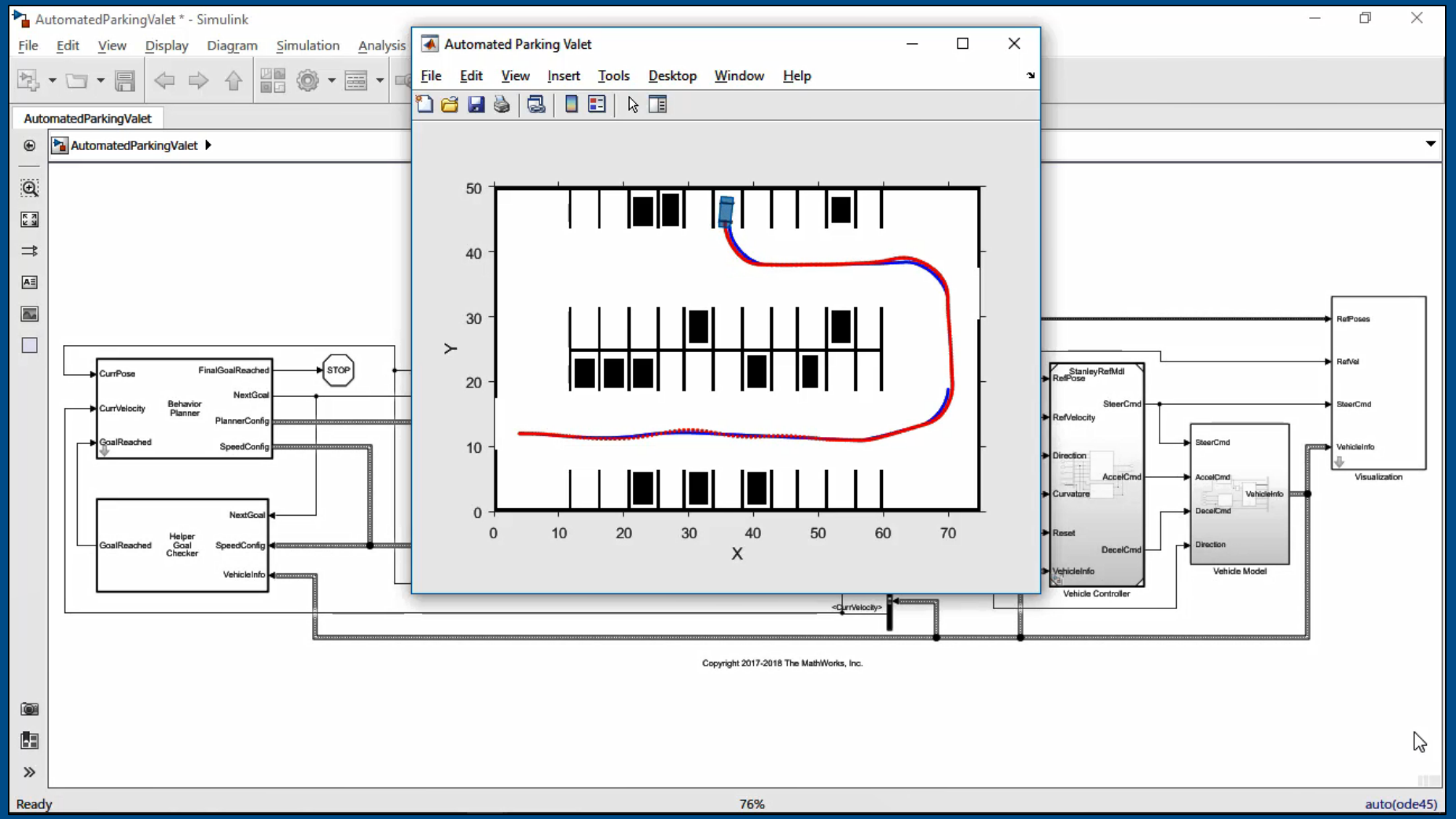




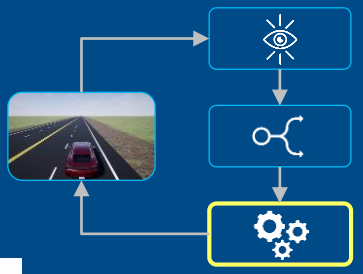
Sensor Fusion and Tracking Toolbox

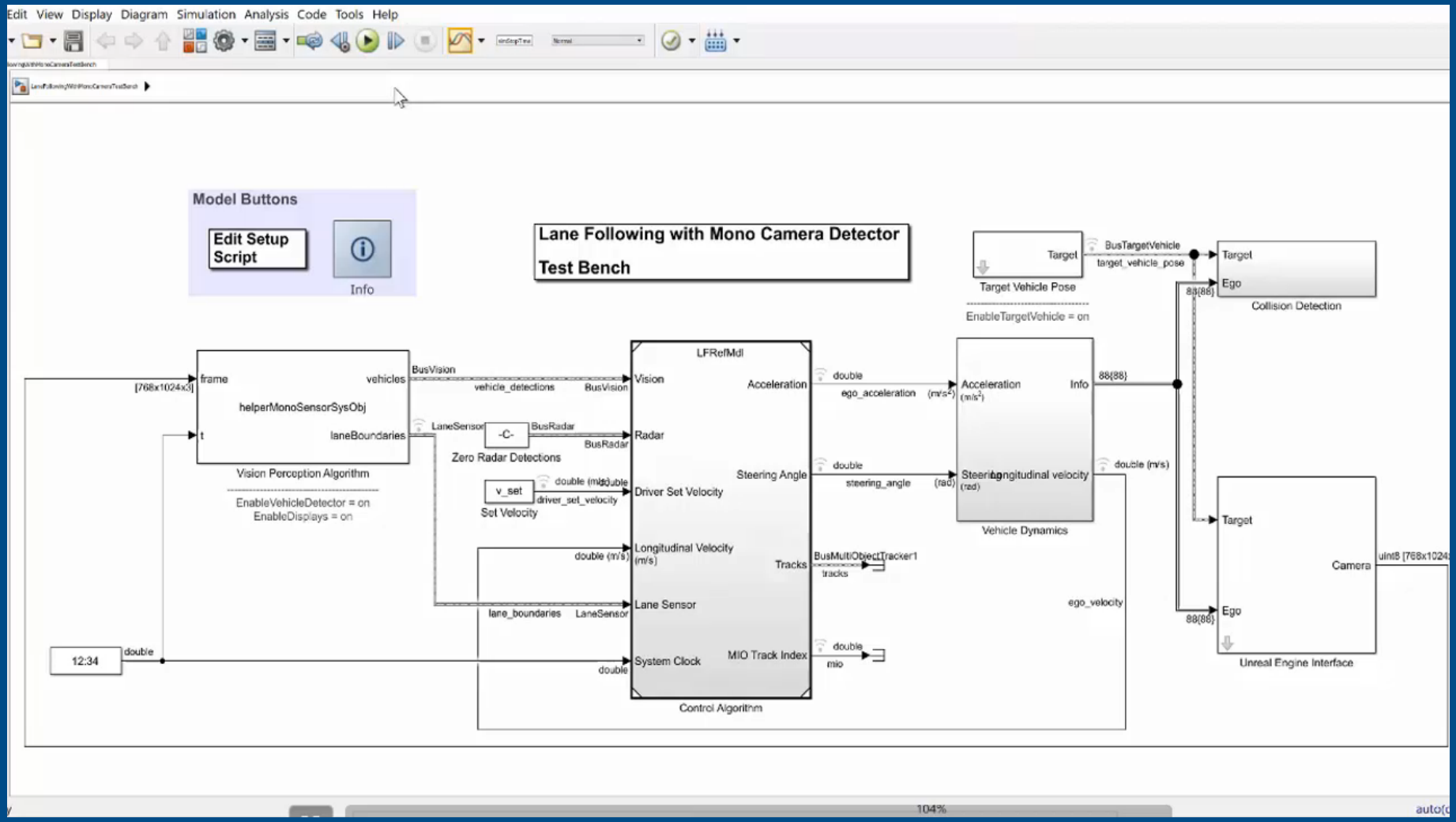
Simulate Path Planning Algorithms





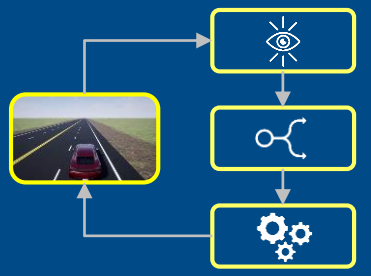
Design Lane-following and Spacing Control Algorithms



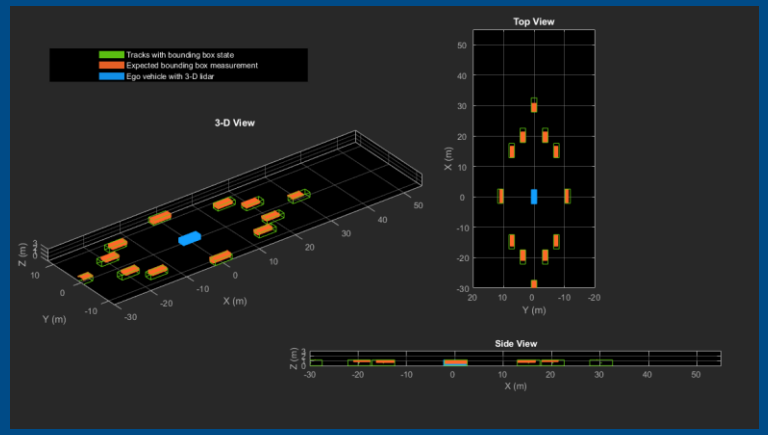


Model Predictive Control Toolbox

Developing Autonomous Systems

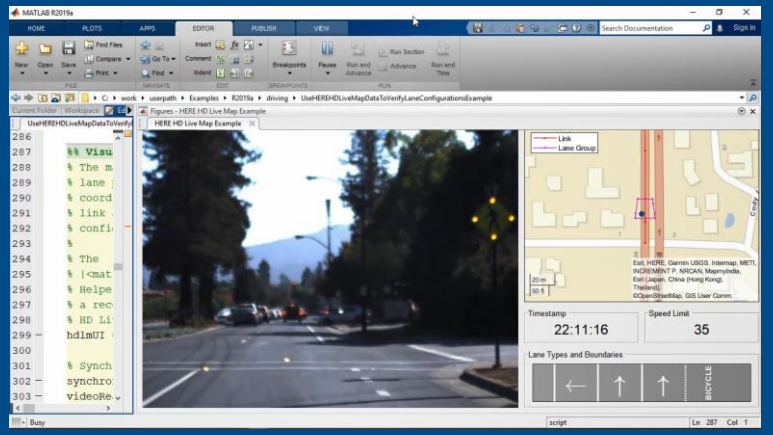


Lidar Processing & Tracking



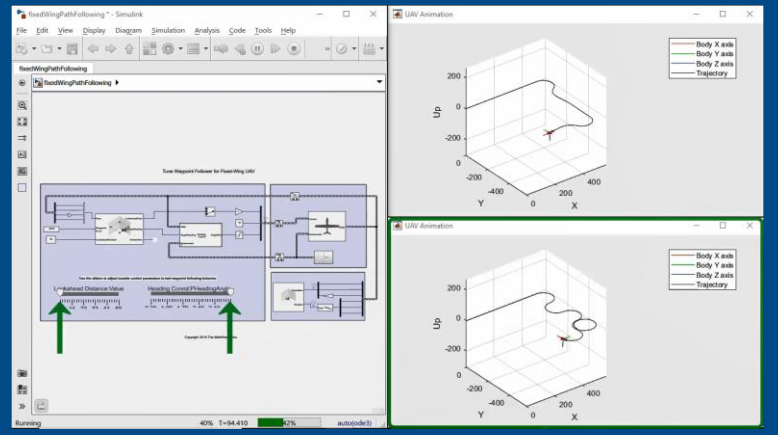
Computer Vision Toolbox

HERE HD Maps & OpenDRIVE Roads



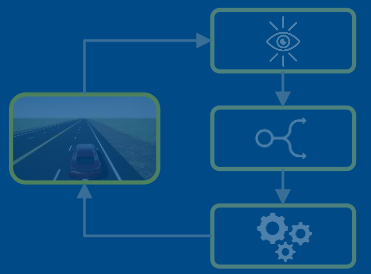
Automated Driving Toolbox

UAV Algorithms



Robotics System Toolbox

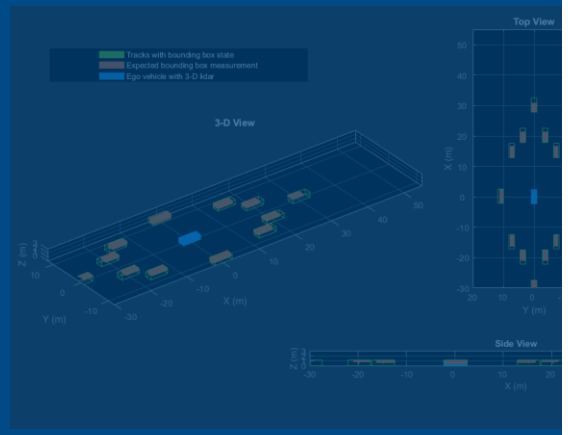
Developing Autonomous Systems

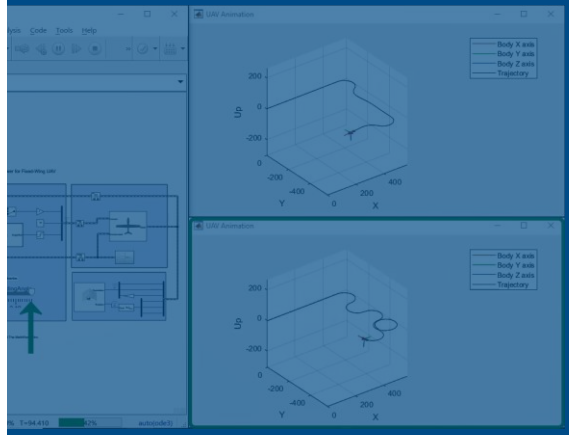


Lidar Processing & Tracking

HERE HD Maps &

UAV Algorithms





Find out more:

Automated Driving System Design and Simulation

Dr. Amod Anandkumar

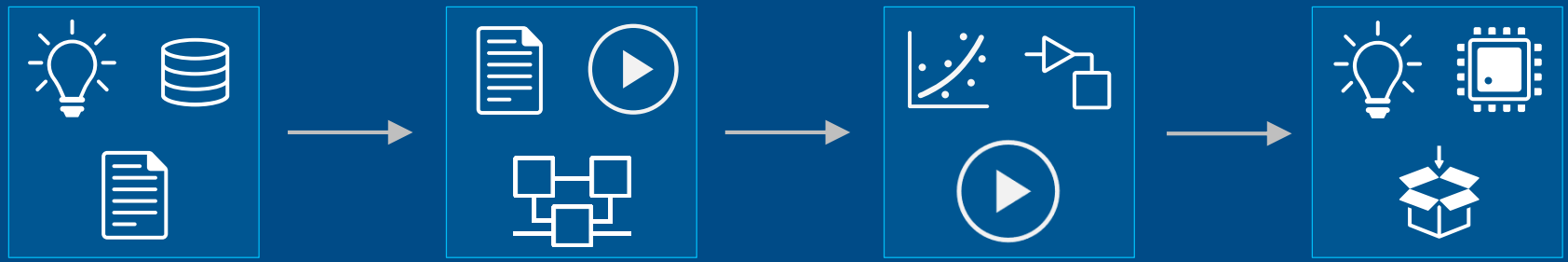
Deep Learning and Autonomous Systems Track

Computer Vision Toolbox

Automated Driving Toolbox

Robotics System Toolbox

Using MATLAB & Simulink to Build Algorithms in Everything



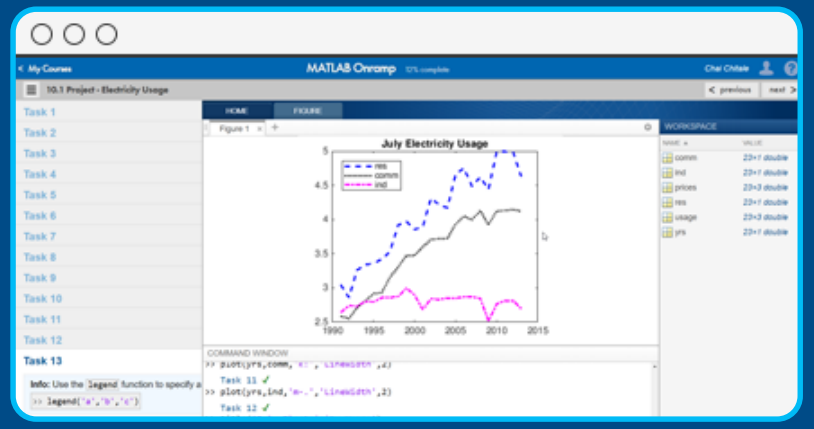
Test & Verification

Collaboration

Scaling

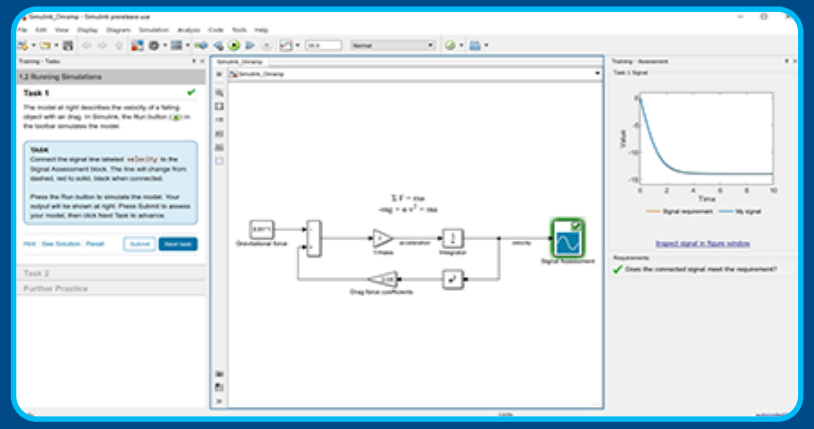
MATLAB&SIMULINK

Get Started



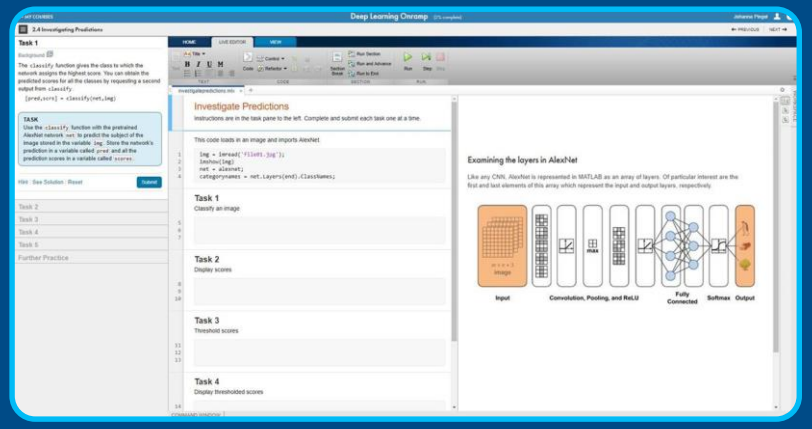
MATLAB Onramp

Quickly learn the essentials of MATLAB.



Simulink Onramp

Learn to create, edit, and troubleshoot Simulink models.



Deep Learning Onramp

Learn to use deep learning techniques in MATLAB for image recognition.

MATLAB EXPO 2019