

MATLAB EXPO 2018

What's New in MATLAB
and Simulink **R2018a** **R2018b**



Adam Sifounakis
Sr. Application Engineer

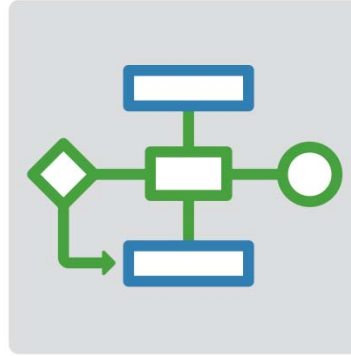


Platform Productivity



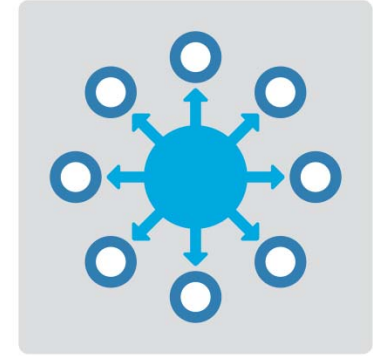
**Getting your work
done faster**

Workflow Depth



**Support for your
entire workflow**

Application Breadth

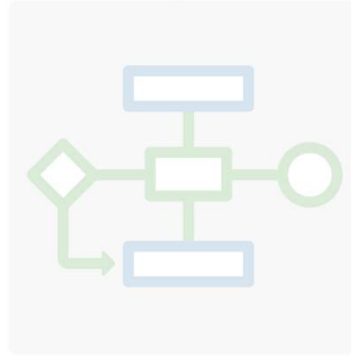


**Products for the
work you do**

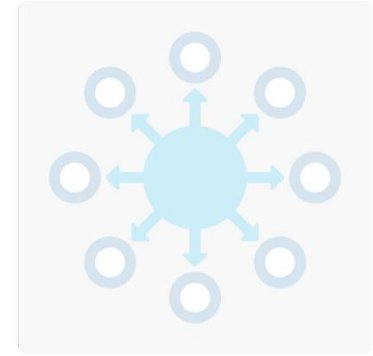
Platform Productivity



Workflow Depth



Application Breadth



- **Create Your Designs Faster**
- **Simplify Analysis**
- **Simulate Faster and Scale Your Work**

Create Your Designs Faster – Live Editor

Explore and Analyze Storm Events

Frequency of Events

Explore the frequency of various storm events and locations and the associated damage costs.

```
clear
load prepEvents
data = timetable2table(data);
head(data)
```

Visualize with a Heatmap

This is helpful in exploring patterns across categories like the events and locations.

```
bigFigure;
heatmap(data, 'state', 'weathercats');
xlabel('State')
ylabel('Storm Event')
title('Frequency of Events by Location')
```

	Time
1	22-Jul-2016
2	15-Jul-2016
3	15-Jul-2016
4	16-Jul-2016
5	15-Jul-2016
6	15-Jul-2016
7	15-Jul-2016
8	15-Jul-2016

MATLAB

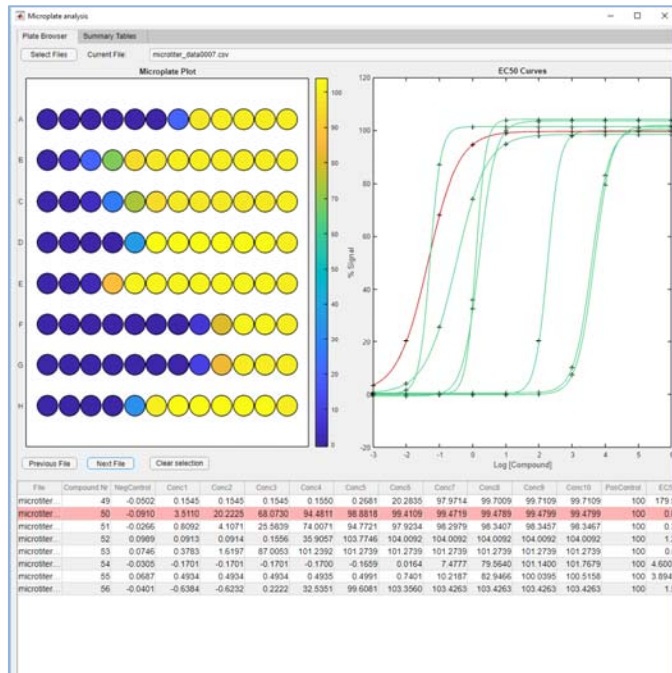
Live Editor

```
1 timer('ExecutionMode', 'fixedDelay')
   timer('ExecutionMode', value, options)
```

ExecutionMode value

- 'fixedDelay'
- 'fixedRate'
- 'fixedSpacing'
- 'singleShot'

Create Your Designs Faster – App Designer



MATLAB
App Designer

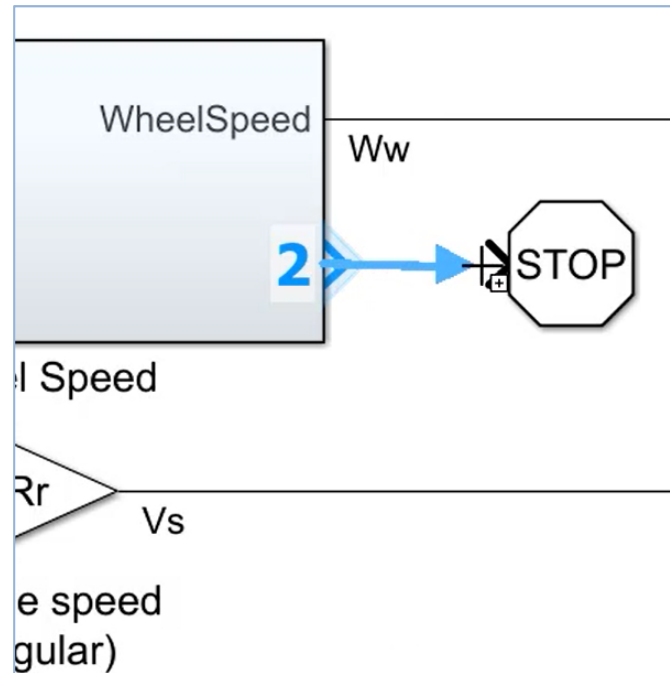
The screenshot shows the MathWorks File Exchange interface. The main heading is 'GUIDE to App Designer Migration Tool for MATLAB'. Below the heading, it specifies 'version 1.0 (15.1 KB) by MathWorks App Designer Team'. A descriptive text reads: 'Use the GUIDE to App Designer Migration tool to help transition your GUIDE apps to App Designer.' The interface includes a search bar and a navigation menu.

Create Your Designs Faster – Simulink Onramp

The screenshot displays the Simulink Onramp environment. On the left, a task description for 'Task 1' is shown, which involves connecting a signal line labeled 'velocity' to a Signal Assessment block. The main workspace contains a Simulink model for a falling object with air drag. The model includes a gravitational force input of 9.81, a mass block (1/mass), an integrator, and a drag force coefficient block (0.05) with a square-law block (u^2). The equations $\Sigma F = ma$ and $-mg + \alpha v^2 = ma$ are displayed above the model. On the right, a 'Signal Assessment' window shows a plot of 'Value' versus 'Time'. The plot compares the 'Signal requirement' (orange line) and 'My signal' (blue line), both showing a curve that starts at 0 and decays towards a value of approximately -15. A 'Requirements' section below the plot indicates that the connected signal meets the requirement.

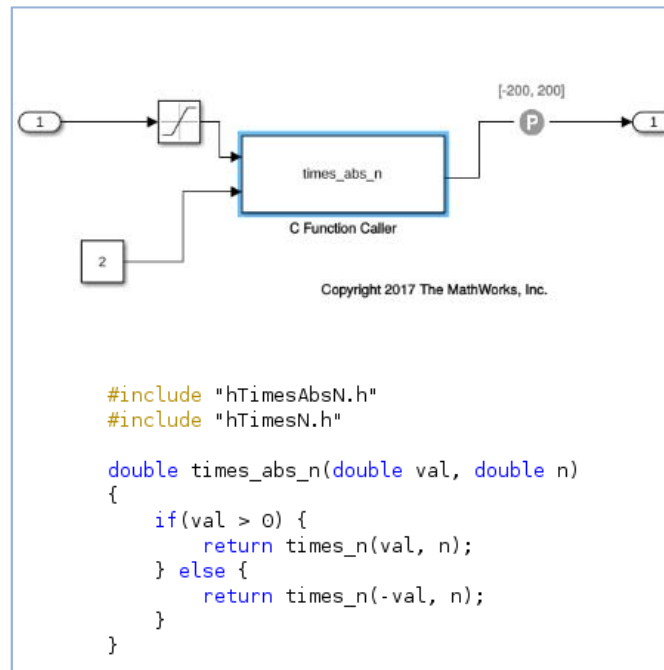
Simulink

Create Your Designs Faster – Smarter Editing

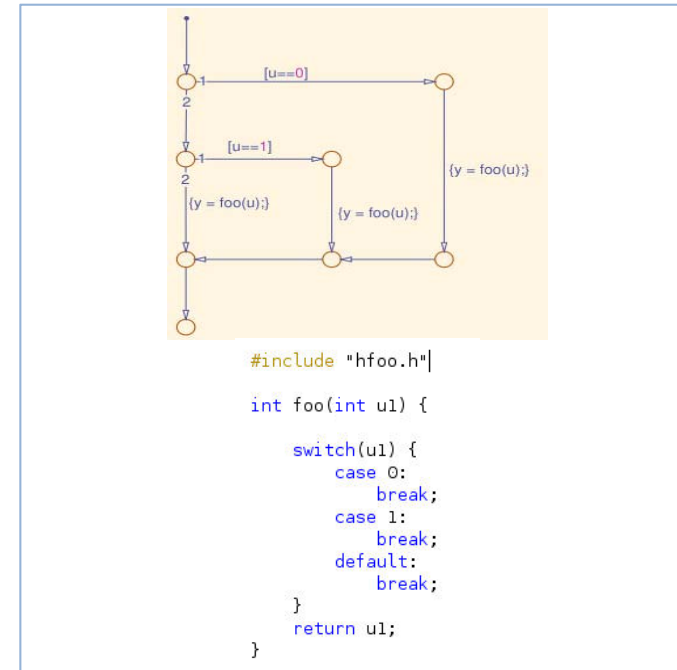


Simulink

Create Your Designs Faster – C Caller Block



Simulink

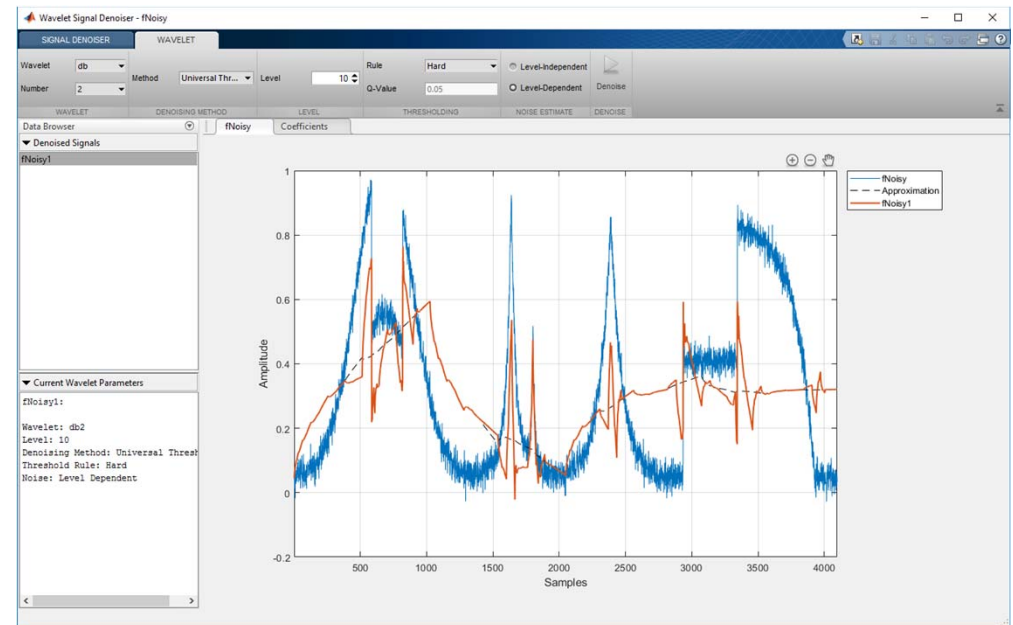


Stateflow

Simplify Analysis with Apps

Interactive applications automate common technical computing tasks

- Signal Analyzer app
 - Visualize, measure, analyze, and compare signals in the time domain, frequency domain, and time-frequency domain
- Econometric Modeler app
 - Perform time series analysis, specification testing, modeling, and diagnostics
- Analog Input Recorder app
 - Acquire and visualize analog input signals
- Wavelet Signal Denoiser app
 - Visualize and denoise time series data

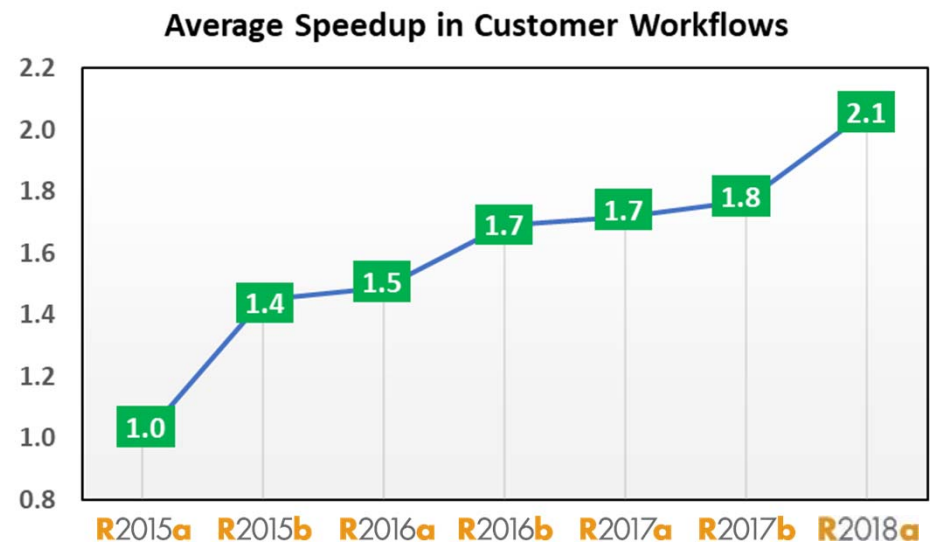


[Signal Processing Toolbox](#)
[Econometrics Toolbox](#)
[Data Acquisition Toolbox](#)
[Wavelet Toolbox](#)

Simulate Faster – Faster MATLAB Execution

Redesigned execution engine runs MATLAB code faster

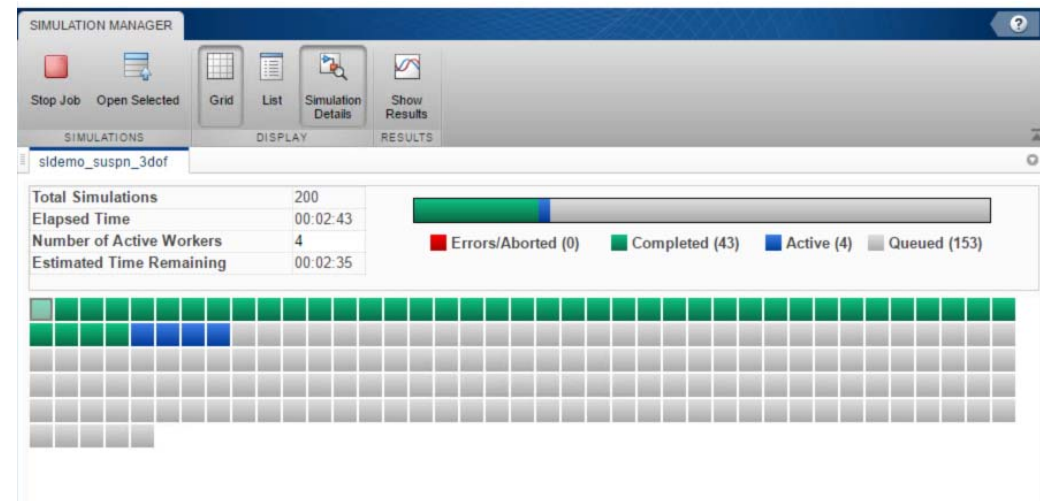
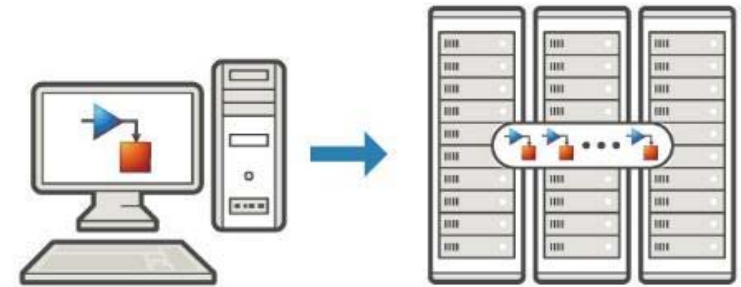
- All MATLAB code is now be JIT compiled
- MATLAB runs your code over twice as fast as it did just three years ago
- No need to change a single line of your code
- Increased speed of MATLAB startup in R2018a and R2018b



Scale Your Work – Simulate in Parallel

Use parallel computing to run multiple simulations faster

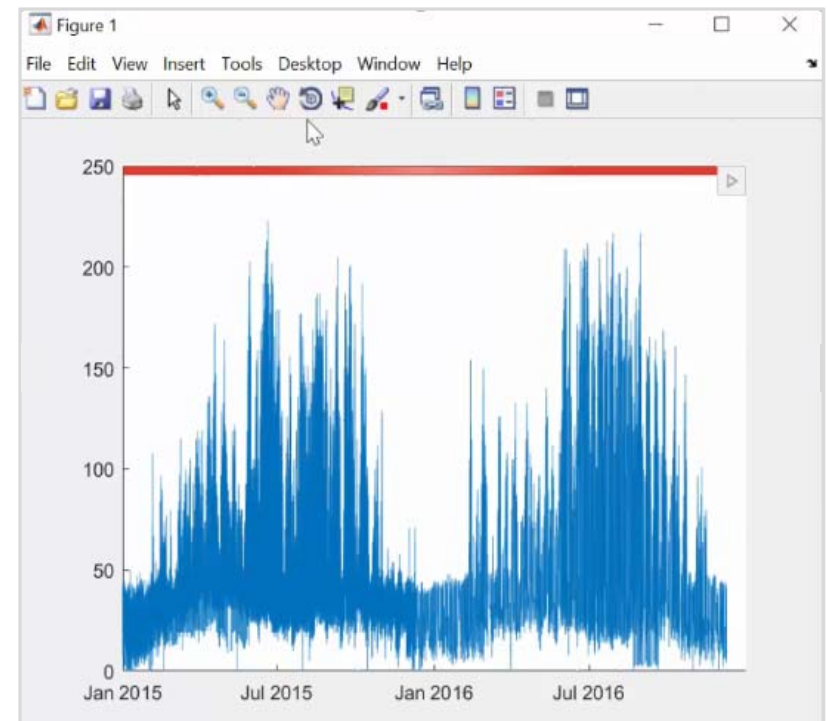
- Run multiple parallel simulations with `parsim`
- Run simulations in the background with `batchsim`
- Monitor simulation status and progress in the Simulation Manager



Scale Your Work – Easily Work with Big Data

Use tall arrays to manipulate and analyze data that is too big to fit in memory

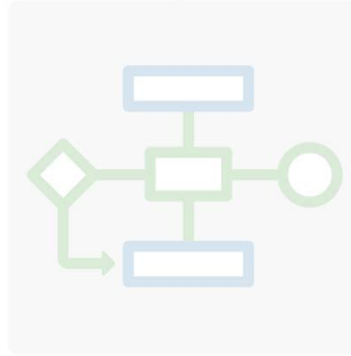
- Use familiar MATLAB functions and syntax
- Built-in support for hundreds of functions
- Customization support for importing, processing, and exporting data
- Works with Spark + Hadoop clusters



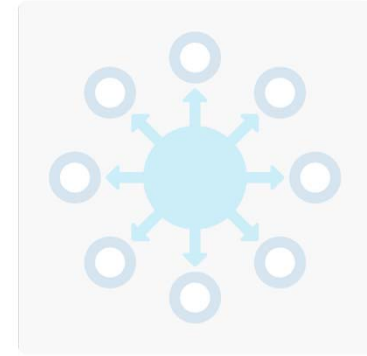
Platform Productivity



Workflow Depth



Application Breadth

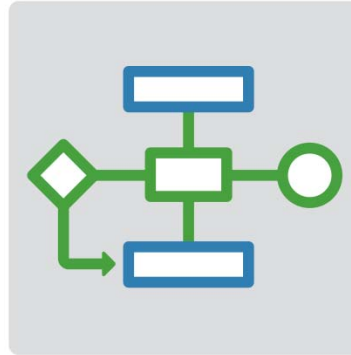


- **Create Your Designs Faster**
- **Simplify Analysis**
- **Simulate Faster and Scale Your Work**

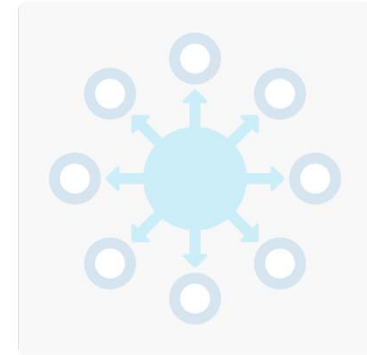
Platform Productivity



Workflow Depth



Application Breadth



- **Deployment of MATLAB Algorithms and Applications**
- **Code Generation from Simulink Models**
- **Verification and Validation**

Access Data / Deploy MATLAB Algorithms and Applications

Access Data



Sensors



Files



Databases

Analyze Data



Data exploration



Preprocessing



Domain-specific algorithms

Develop



AI model



Algorithm development

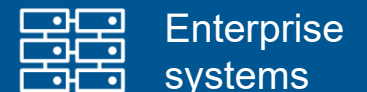


Modeling & simulation

Deploy



Desktop apps



Enterprise systems



Embedded devices

Access Remote Data

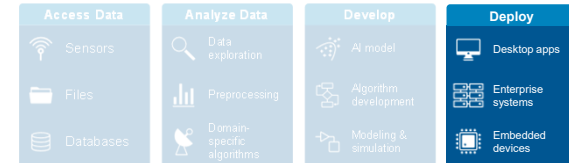
Access Data	Analyze Data	Develop	Deploy
Sensors	Data exploration	AI model	Desktop apps
Files	Preprocessing	Algorithm development	Enterprise systems
Databases	Domain-specific algorithms	Modeling & simulation	Embedded devices

Read and write data to and from remote locations using datastore objects

- Amazon S3
(offered by Amazon Web Services)
- Windows Azure® Storage Blob
(offered by Microsoft)
- Hadoop Distributed File System (HDFS)

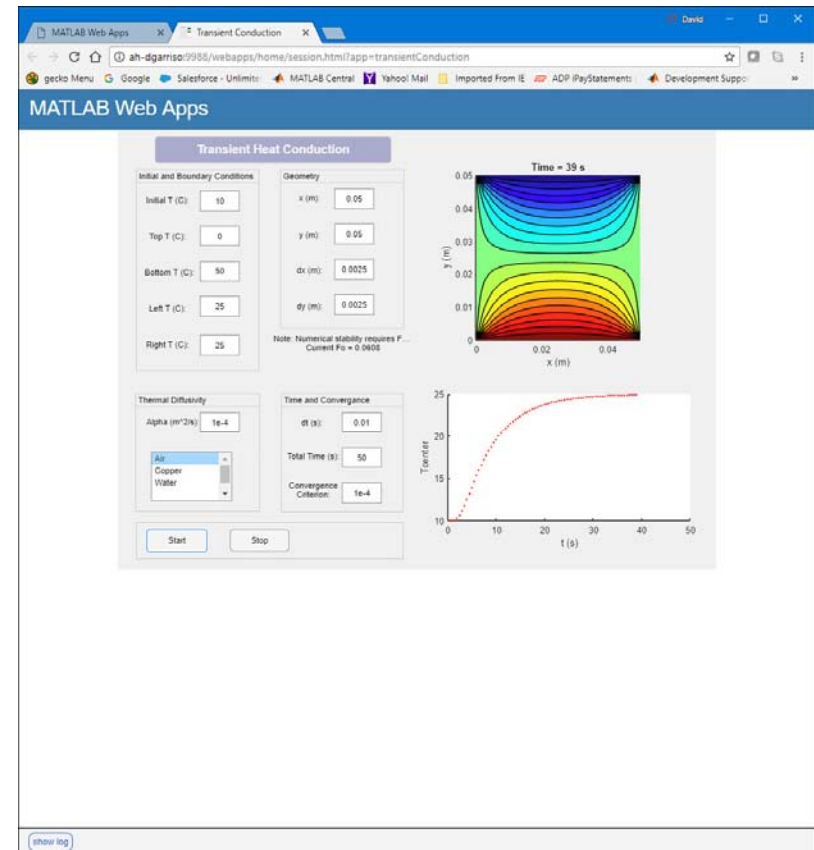


Deploy MATLAB Web Apps

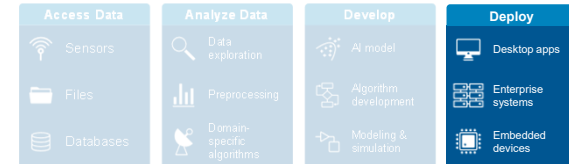


Share App Designer apps on the Web using MATLAB Compiler

- Package the app for deployment to the MATLAB App Server
- Add the app to the library of MATLAB Web Apps on the server
- Run the app in a browser from any machine with access to the server

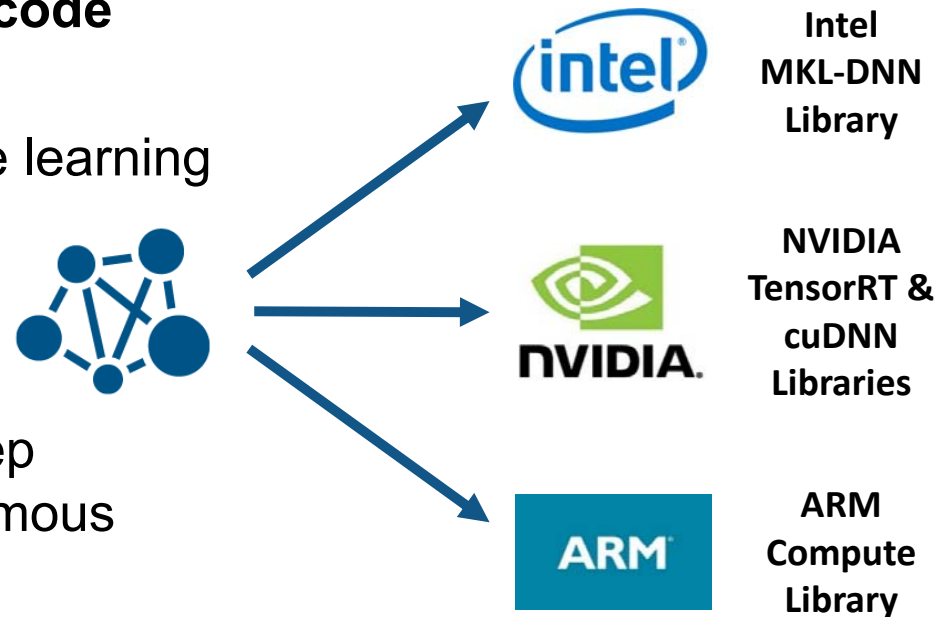


Deploy MATLAB Algorithms



Deploy machine learning and deep learning models using automatically generated code

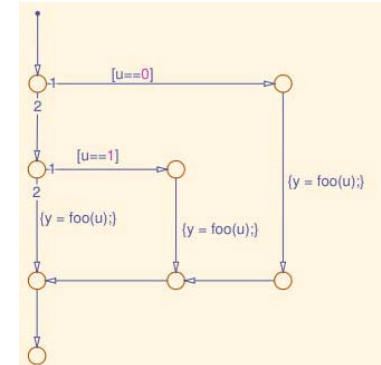
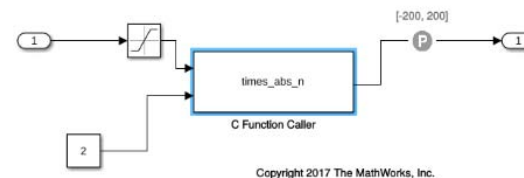
- Generate C code for predictive machine learning and deep learning models
- Generate optimized CUDA code for deep learning, embedded vision, and autonomous systems



Verify models that include C/C++

Analyze and generate tests for Simulink and Stateflow models that use custom code

- Perform design error detection, property proving and test generation for the C/C++ code
- Works with C Caller blocks and Stateflow charts



```
#include "hTimesAbsN.h"
#include "hTimesN.h"

double times_abs_n(double val, double n)
{
    if(val > 0) {
        return times_n(val, n);
    } else {
        return times_n(-val, n);
    }
}
```

```
#include "hfoo.h"

int foo(int u1) {
    switch(u1) {
        case 0:
            break;
        case 1:
            break;
        default:
            break;
    }
    return u1;
}
```

Connecting Your Design to Hardware

Connect directly to hardware with support packages

- Live streaming to and from hardware
- Run Simulink models on low-cost hardware, such as Arduino, Raspberry Pi, and LEGO
- Automatically generate code and run it on microprocessors, FPGAs, and more



Arduino



Raspberry Pi Zero W



Raspberry Pi 3 Model B+



Microsemi FPGA



LEGO EV3

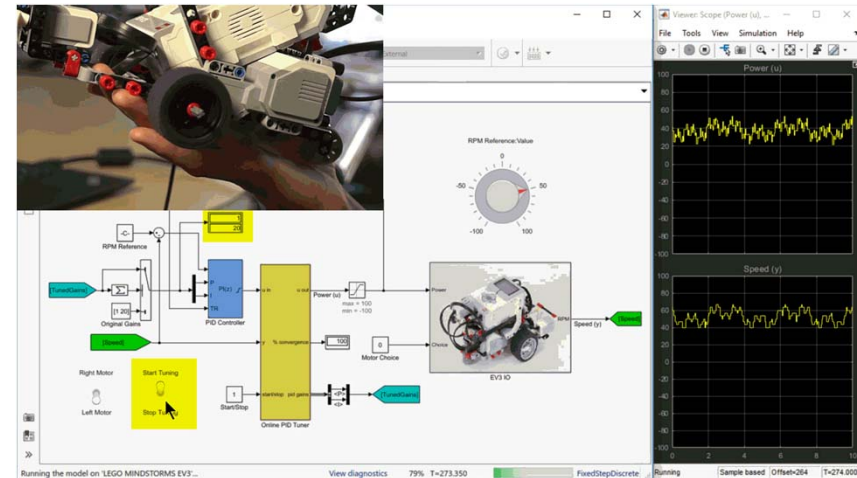
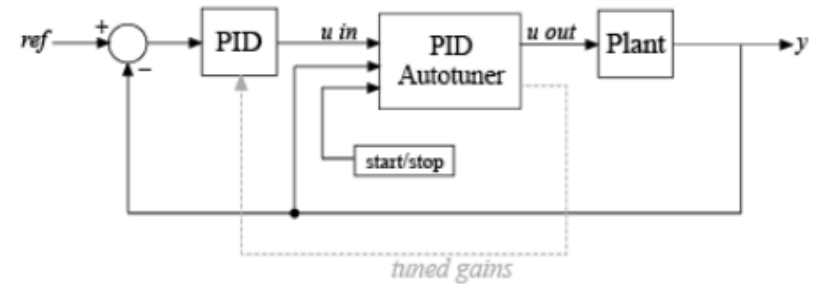


ADALM-PLUTO

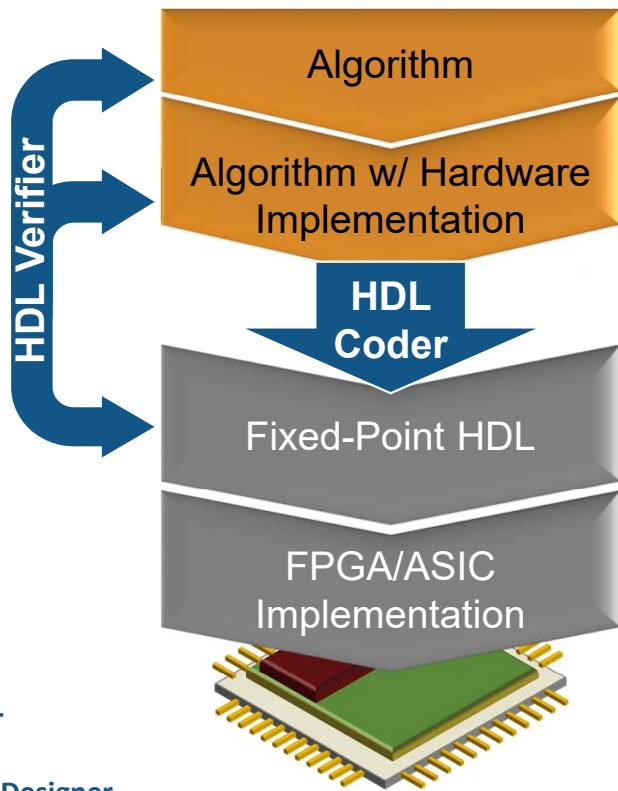
Closed-Loop PID Autotuning

Deploy algorithm that performs PID autotuning without opening the feedback loop

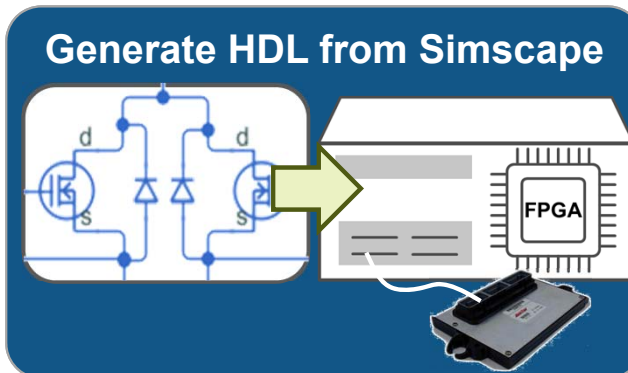
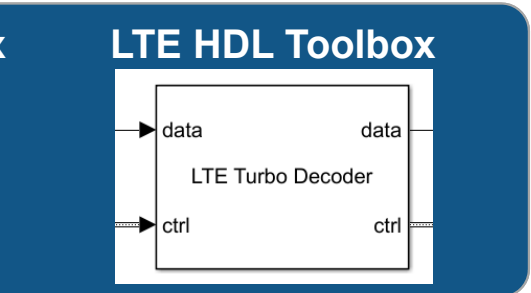
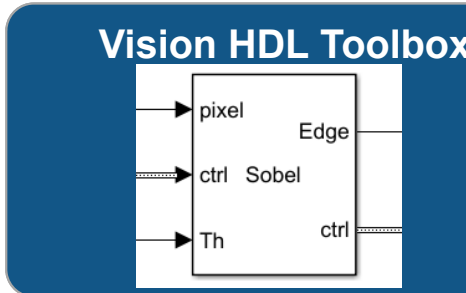
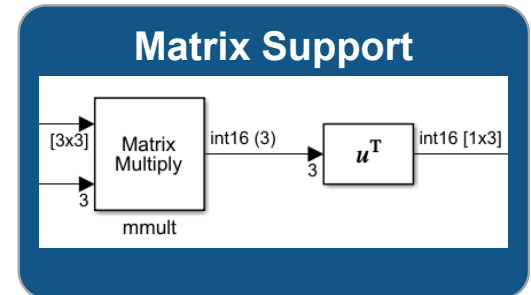
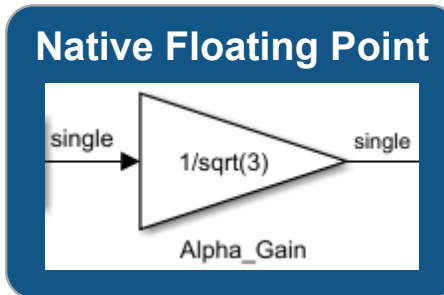
- Use Closed-Loop PID Autotuner block to generate autotuning code and deploy to embedded software
- Estimation experiment is performed without opening the feedback loop
- Use to tune PID controller gains for a plant model in Simulink or for a physical plant



Deploying to FPGA or ASIC Hardware



HDL Verifier
HDL Coder
Fixed-Point Designer
Vision HDL Toolbox
LTE HDL Toolbox



Import Verilog code

```

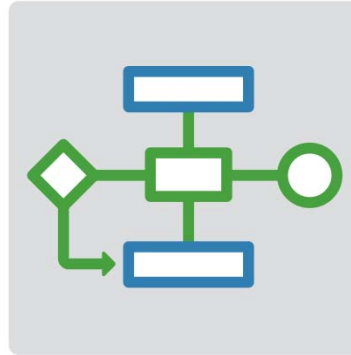
1  module bitselect(a,c);
2
3  input [1:0] a;
4  output [1:0] c;
5
6  assign c[0] = 0;
7  assign c[1] = a[2];
8
9  endmodule

```

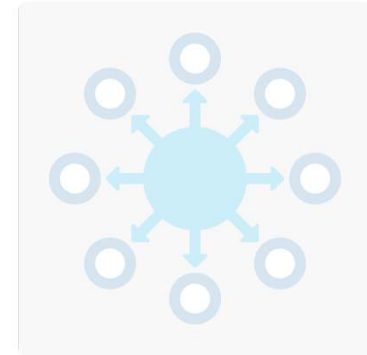
Platform Productivity



Workflow Depth



Application Breadth

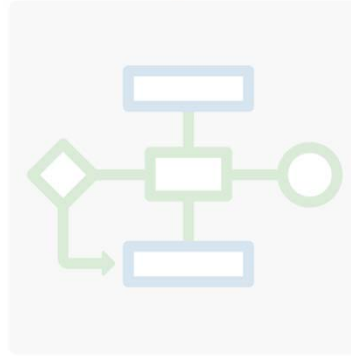


- **Deployment of MATLAB Algorithms and Applications**
- **Code Generation from Simulink Models**
- **Verification and Validation**

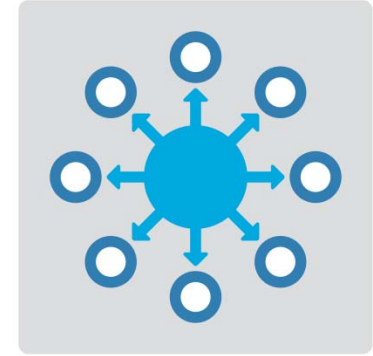
Platform Productivity



Workflow Depth

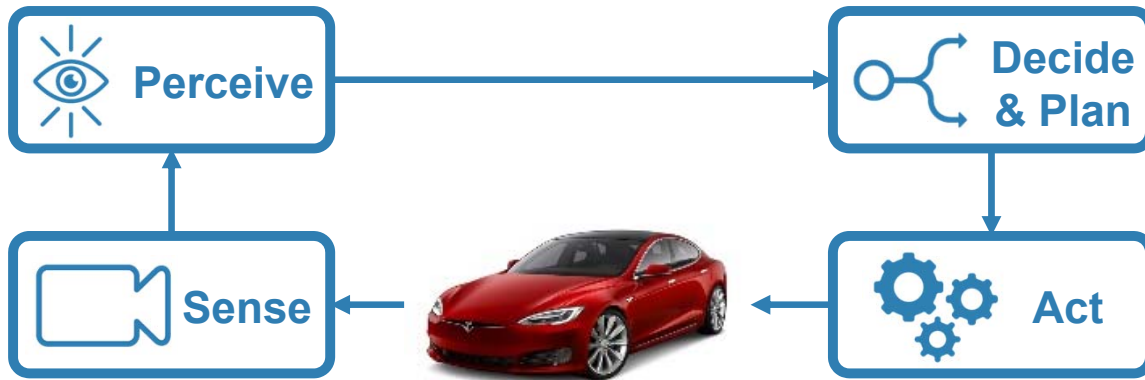


Application Breadth



- **Autonomous Systems**
- **Wireless Communications**
- **Artificial Intelligence (AI)**

Designing Autonomous Systems



- Computer Vision System Toolbox
- Robotics System Toolbox
- Deep Learning Toolbox
- Computer Vision System Toolbox
- Automated Driving System Toolbox
- Sensor Tracking and Fusion Toolbox **New Product**
- Model Predictive Control Toolbox
- Vehicle Dynamics Blockset **New Product**

Design with the Latest Wireless Standards



Model Physical Systems with Simscape

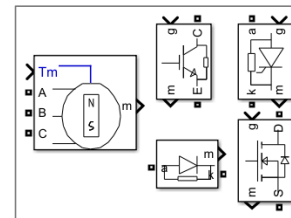
Model and simulate electronic, mechatronic, and electrical power systems

- Convert SPICE models to Simscape components
- Generate HDL code from Simscape models for faster simulation on FPGA's

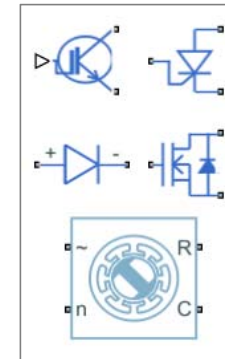
Model HVAC control systems and flexible beams

Simscape
Simscape Multibody
Simscape Electrical
HDL Coder

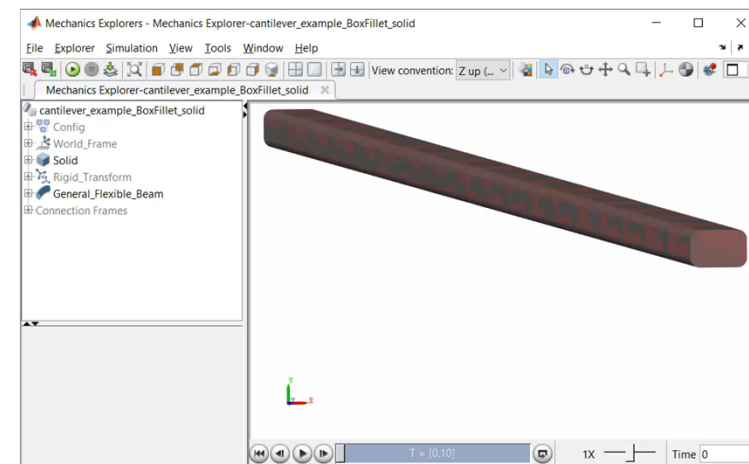
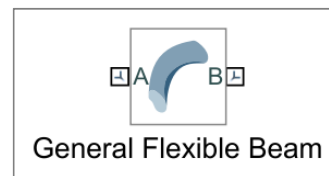
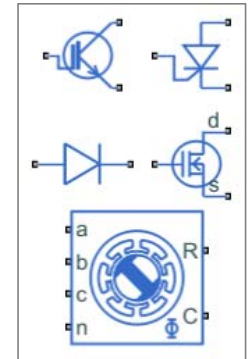
Specialized



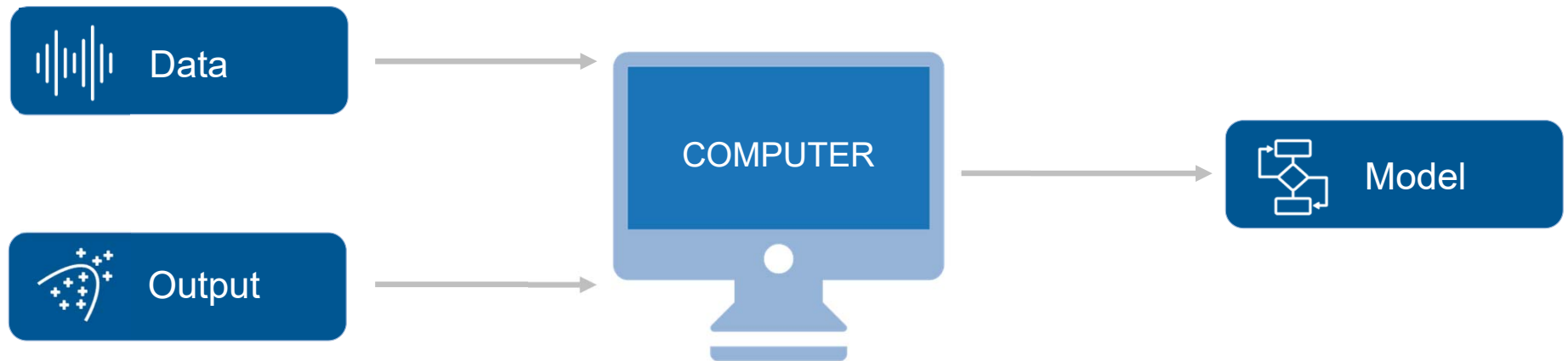
Fast



High Fidelity



Artificial Intelligence

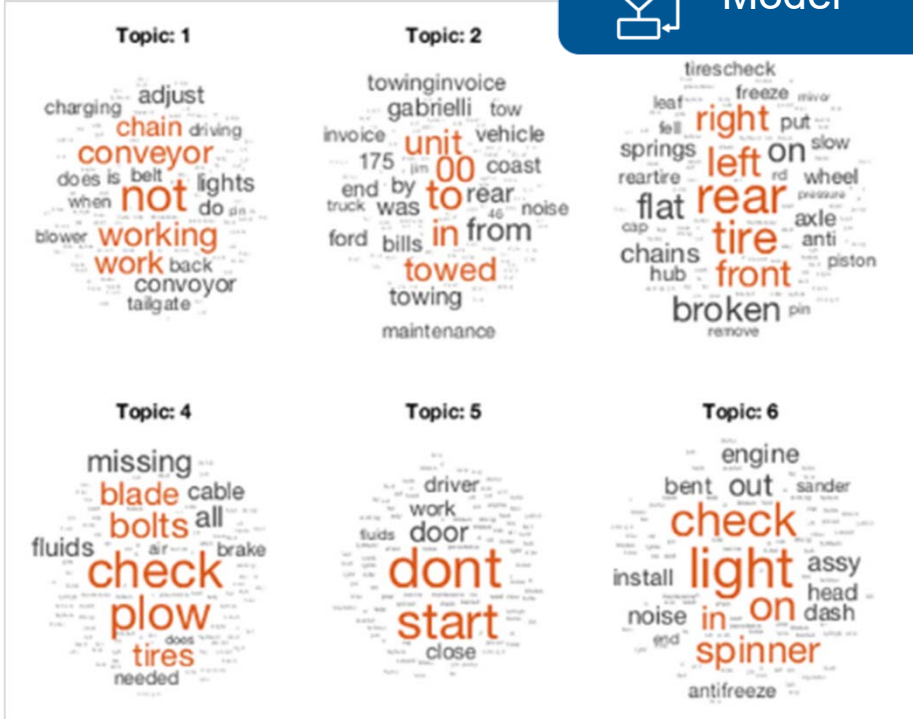


Text Analytics



```

repairNotes = 617x1 string array
"PM SERVICE, CHECK TURN SIGNAL, CLUNKING NOISE"
"SERVICEROB,EXT,5604"
"NEED 4 PLOW PINS"
"INSTALL SPINNER ASSY"
"DONT START"
"DOG BONE PIN BROKEN"
"NEED SERVICE, CHECK BRAKES"
"HYD CAP CHECK ENGINE LIGHT ON"
"TARP VALVE STICKINGRIGHT SIDE MIRROR BRACKET I"
"HANDLES IN CAB LOOSE"
"NO PLOW LIGHTS"
"WILL NOT START"
    
```

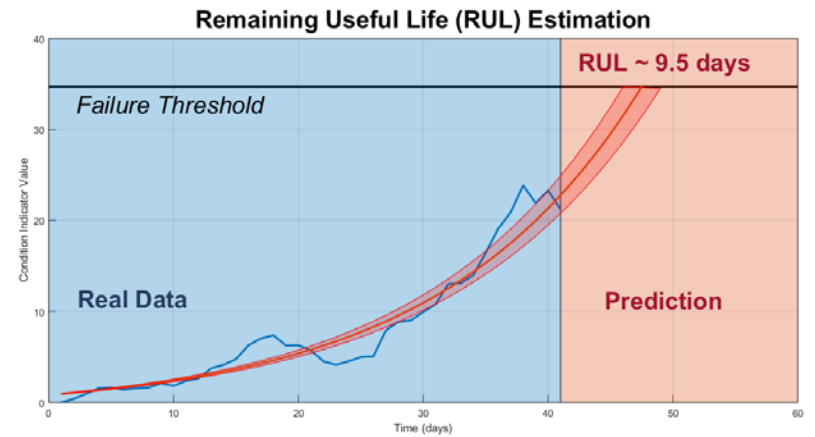
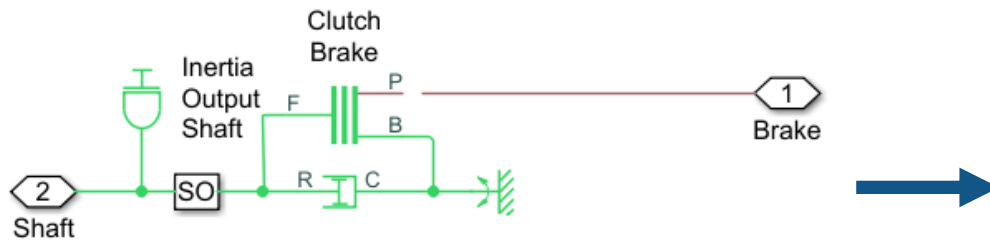


Predictive Maintenance

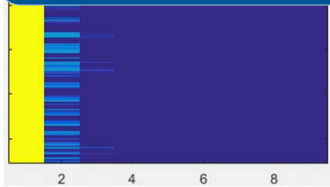
Data

Sensors

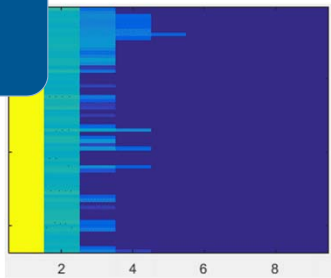
Model



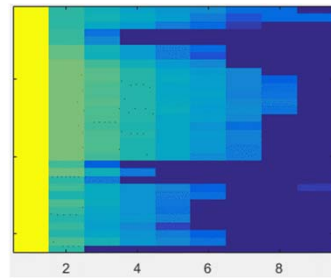
Output



Normal Operation



Monitor Closely



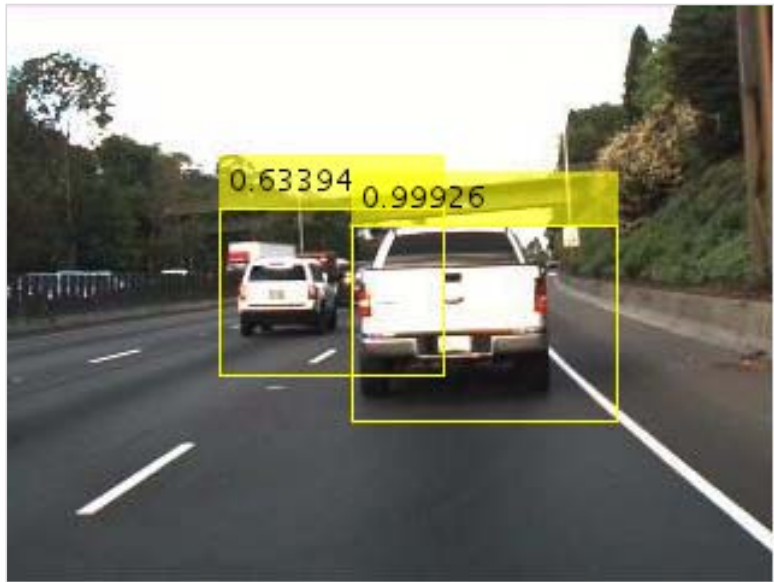
Maintenance Needed

Deep Learning

 Data



 Model



 Output

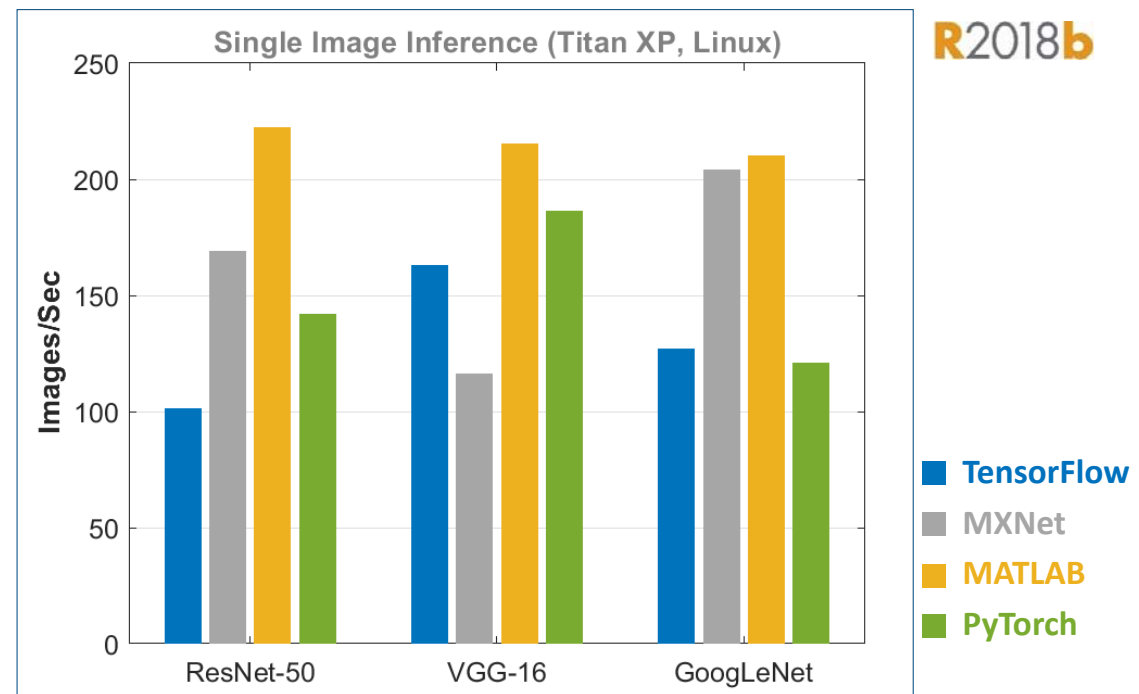


Deep Learning Toolbox
 Computer Vision System Toolbox
 GPU Coder
 MATLAB Coder

Deep Learning

Design, build, and visualize convolutional neural networks

- Access the latest models or build your own
- Import pretrained models and use transfer learning
- Automate ground-truth labeling using apps
- Use NVIDIA GPUs to train your models
- Automatically generate high-performance CUDA code for embedded deployment



FREE

Learn to Use MATLAB for Deep Learning in 2 Hours

[Launch Deep Learning Onramp](#)

The screenshot displays the MATLAB Deep Learning Onramp interface. The top navigation bar shows 'My Courses', 'Deep Learning Onramp', and '51% complete'. The current task is '2.2 Making Predictions: (1/2) Make a prediction'. The interface is divided into several sections:

- Task 2:** Contains instructions and a code editor. The code is:


```
pred = classify(net,img);
```
- Info:** Explains the `classify` function and the pretrained AlexNet network.
- Test Suite:** Shows a successful test result: 'Is pred1 created correctly?' with a green checkmark.
- Code Editor:** Shows the following code:


```
deepnet = alexnet;

img1 = imread('file01.jpg');
imshow(img1)

pred1 = classify(deepnet,img1)
```
- Workspace:** Displays the output of the code:

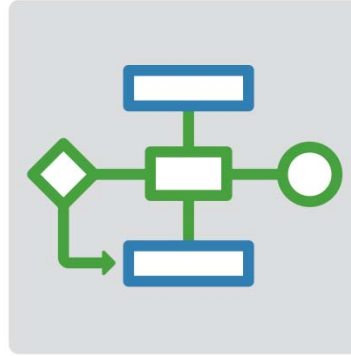

```
pred1 = categorical
seashore
```
- Image Display:** Shows a photograph of a seashore, which is the image being classified.

Platform Productivity



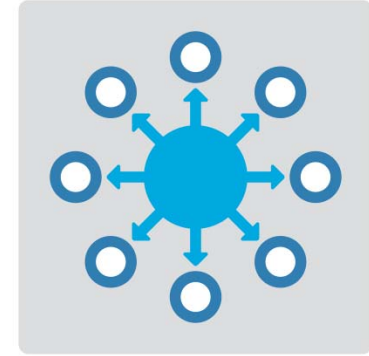
- Design Faster
- Simplify Analysis
- Simulate and Scale

Workflow Depth



- Deploy Applications
- Code Generation
- Verification and Validation

Application Breadth



- Autonomous Systems
- Wireless Communications
- Artificial Intelligence (AI)

Upgrade your MATLAB Code and Simulink Models

Web Browser - (3 Errors) Code Compatibility Report

(3 Errors) Code Compatibility Report

Code Compatibility Report [Top](#) [3 Errors](#) [1 Warning](#) [304 Checks](#) [2 Files](#)

Analysis Date: 05-Sep-2017 14:32:08
MATLAB Version: R2017b

Incompatibility and Syntax Errors

Row	Filename	Line	Description
1	classifyBloodPressure.m	18	TREEFIT has been removed.
2	classifyBloodPressure.m	21	TREEDISP has been removed. Use TREEVIEW methods instead.
3	classifyBloodPressure.m	24	TREEVAL has been removed. Use TREEPREDICT methods instead.

Warnings and Other Recommendations

Row	Filename	Line	Description
1	classifyBloodPressure.m	7	RAND or RANDN with 'Z' is no longer recommended. Use RANDI or RANDJ instead.

Upgrade Advisor - sf_climate_control

File Edit Run Settings Help

Find: [Disable Upgrade Notifications](#)

Upgrade Project Report

100% Passed

Passed 7 Models, 1 Libraries, 8 MATLAB Code
Need attention - - -

Show: All Files | All Results

Filename	Check Name	Result
AnalogControl.mdl	Check model settings for migration to simplified initialization mode	Passed
analyzeModelFiles.m	Check that the model is saved in SLX format	Passed with fixes
billOfMaterials.m	Check usage of function-call connections	Need attention
checkCodeProblems.m	Check and set embedded target model to use ert.tlc system target file	Passed
DigitalControl.slx	Check and update masked blocks in library to use promoted parameters	Passed
f14_airframe.slx	Check and update mask image display commands with unnecessary imread() function calls	Passed
f14_airframe_test.m	Check and update mask to affirm icon drawing commands dependency on mask workspace	Passed
find_top_models.m	Check and update model to use toolchain approach to build generated code	Passed
LinearActuator.slx		
NonLinearActuator.mdl		
rebuild_s_functions.m		
runUnitTest.m		
slproject_f14.slx		
upgrade_project.m		
vertical_channel.slx		
wind_gust_lib.slx		

Checks run on 02/01/2018 10:44

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Identify Variant Model blocks and convert those to Vari

Analysis

Upgrade Variant Model blocks to Variant Subsystems contain offers enhanced capabilities while maintaining equivalent fun variant models will be removed in a future release.

[Run This Check](#)

Result: ✔ Passed

Identify Variant Model blocks at model level.

✔ Passed
No Variant Model blocks found.

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