

MATLAB EXPO 2018

What's New in MATLAB
and Simulink **R2017b** **R2018a**

 Prashant.Rao@mathworks.in

 @_prashantrao_

 prashantrao

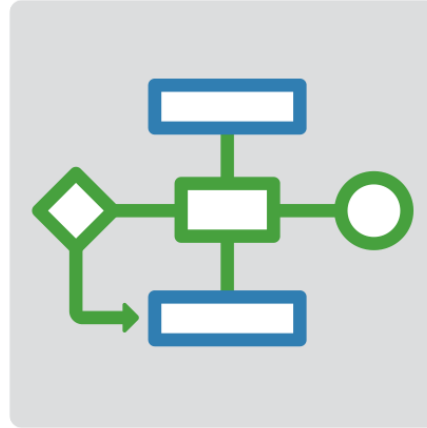


Platform Productivity



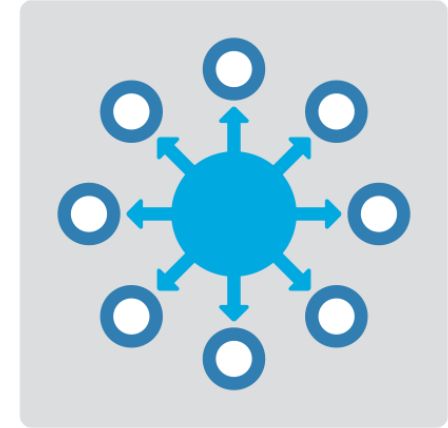
**Getting your work
done faster**

Workflow Depth



**Support for your
entire workflow**

Application Breadth

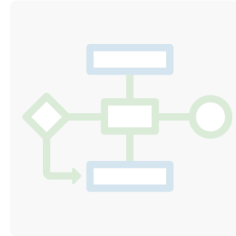


**Products for the
work you do**

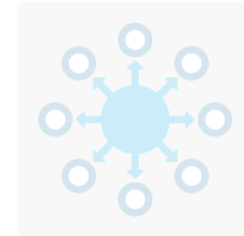
Platform Productivity



Workflow Depth



Application Breadth



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

Create Your Designs Faster

The screenshot shows the MATLAB Live Editor interface with a script titled "Explore and Analyze Storm Events". The script includes the following code:

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

Below the code, there is a section titled "Visualize with a Heatmap" with the following code:

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

The output of the script is displayed on the right side of the editor. It shows the first 8 rows of the data table:

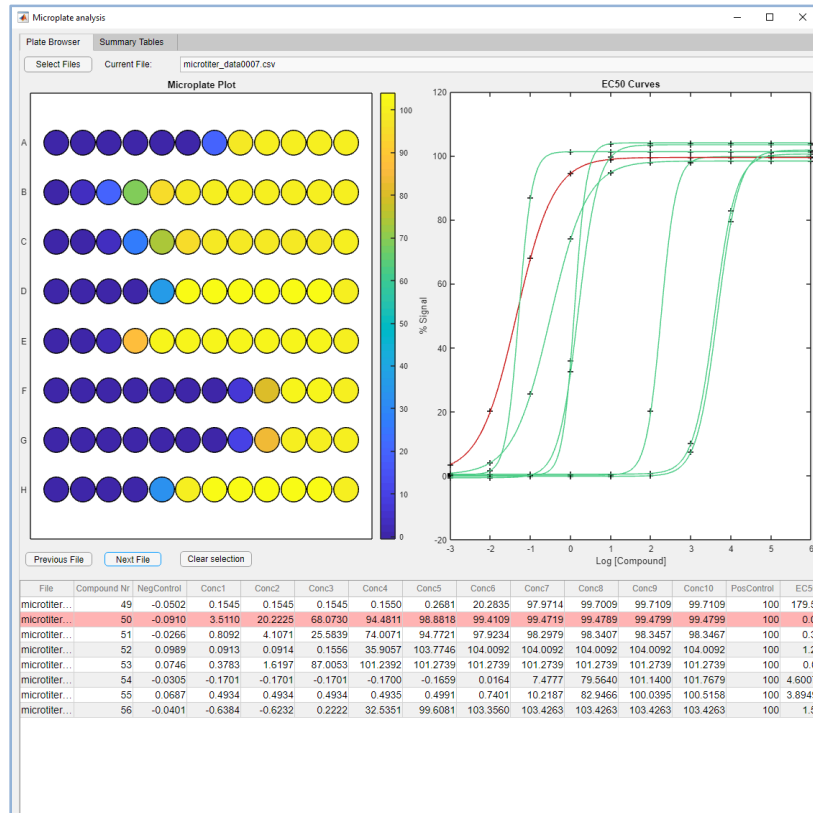
	Time
1	22-Jul-2016
2	15-Jul-2016
3	15-Jul-2016
4	16-Jul-2016
5	15-Jul-2016
6	15-Jul-2016
7	15-Jul-2016
8	15-Jul-2016

Below the table is a heatmap visualization. The y-axis is labeled "Storm Event" and lists various weather categories such as Avalanche, Blizzard, Coastal Weather, Dense Fog, Drought, Dust Devil, Dust Storm, Extreme Heat, Flood, Freezing Fog, Frost/Freeze, Funnel Cloud, Hail, Heat, Heavy Rain, Hurricane, Ice Storm, Lightning, Sandstorm, Snow, Thunderstorm Wind, Tornado, Tropical Storm, and Waterspout. The x-axis represents different states. The heatmap shows the frequency of each storm event across the states.

MATLAB

Live Editor

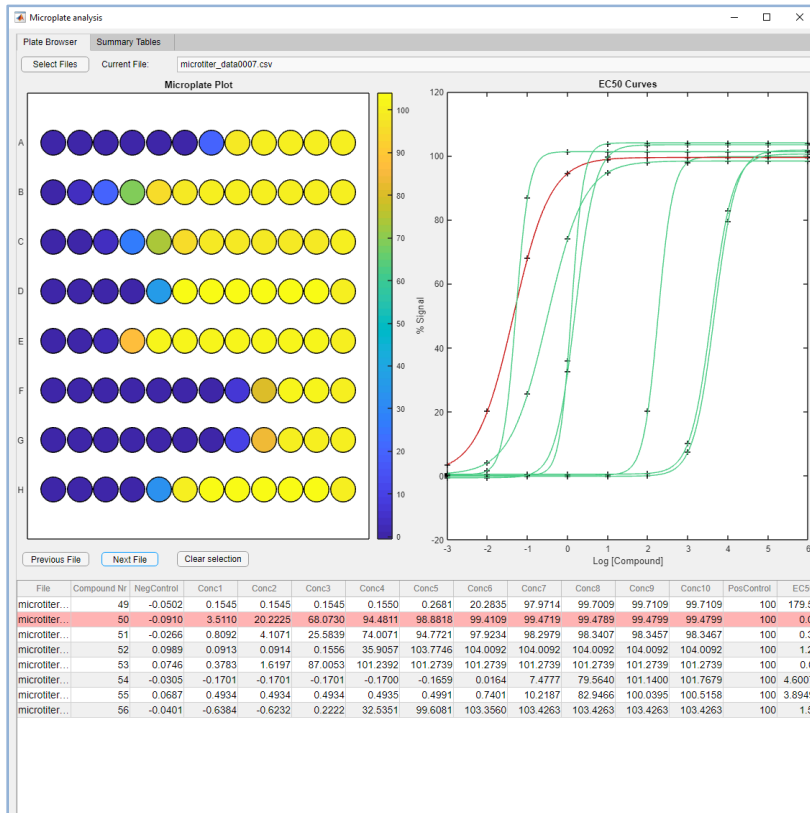
Create Your Designs Faster



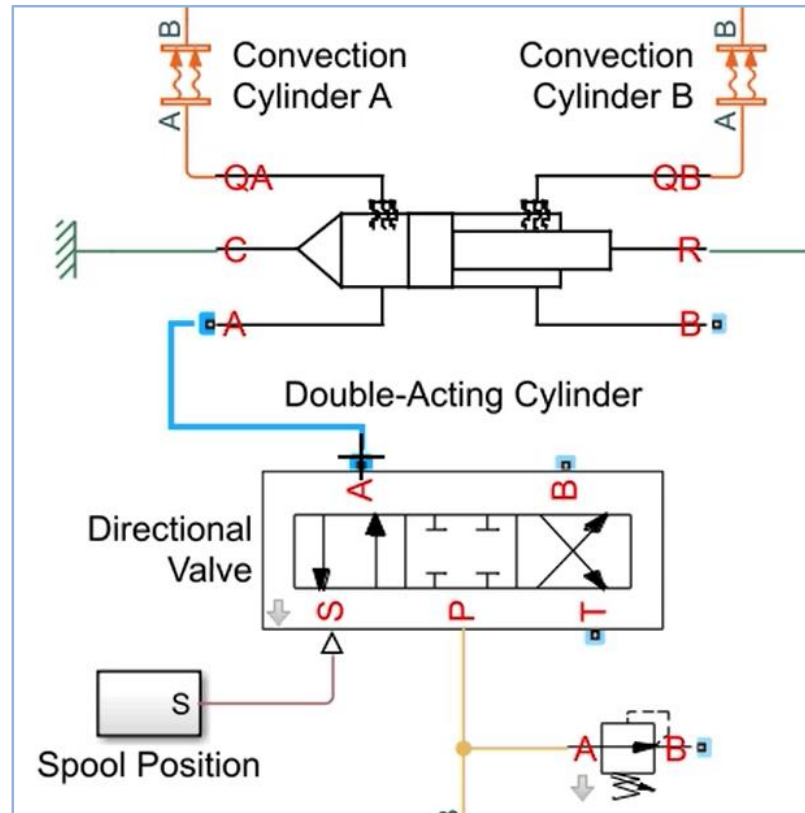
MATLAB
App Designer

The screenshot shows the MathWorks File Exchange page. 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 at the bottom reads: 'Use the GUIDE to App Designer Migration tool to help transition your GUIDE apps to App Designer.'

Create Your Designs Faster

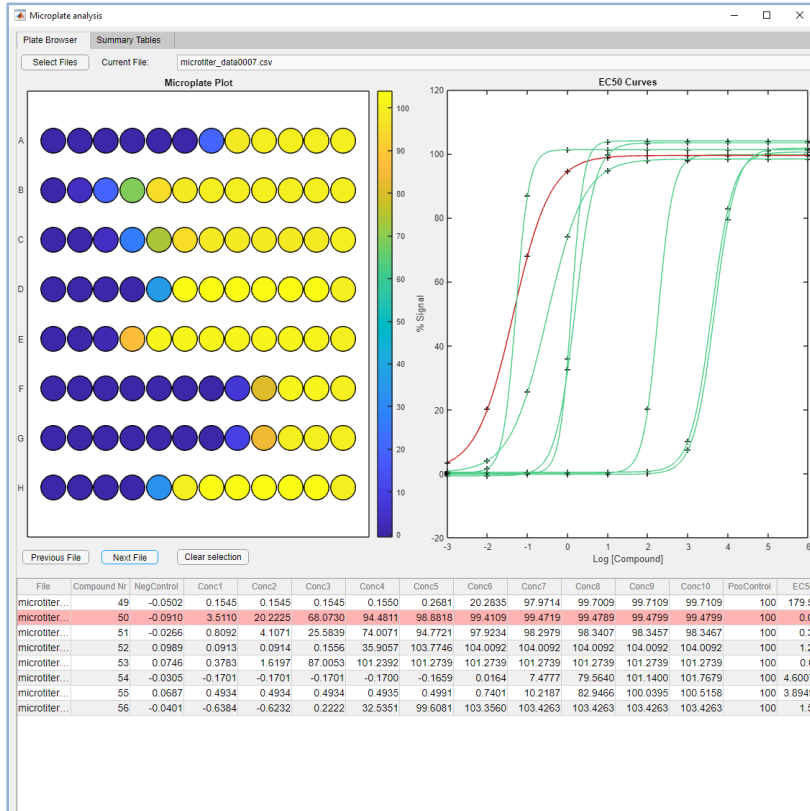


MATLAB

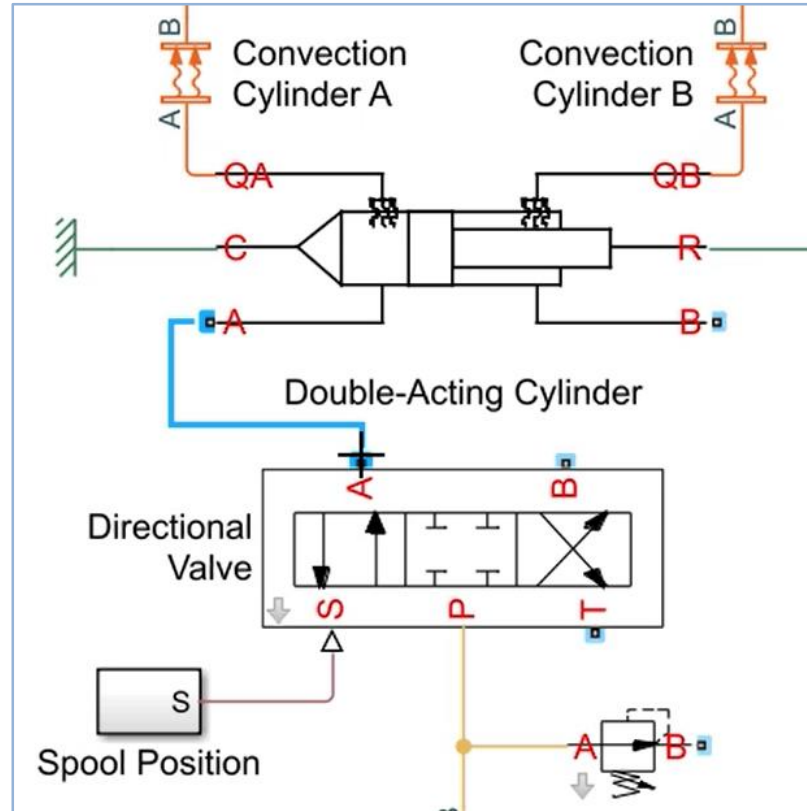


Simulink

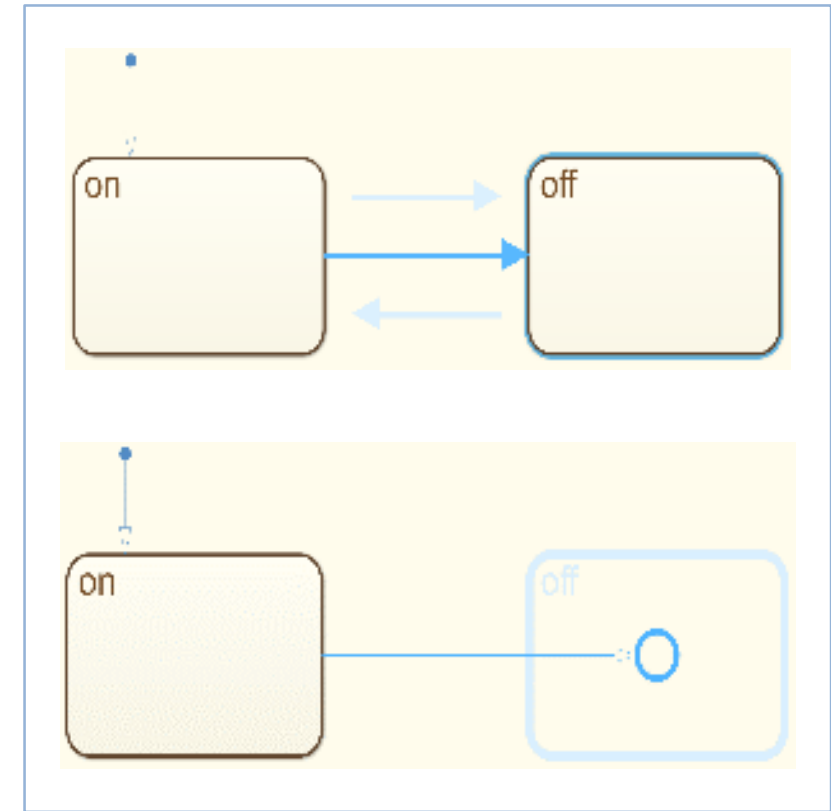
Create Your Designs Faster



MATLAB



Simulink

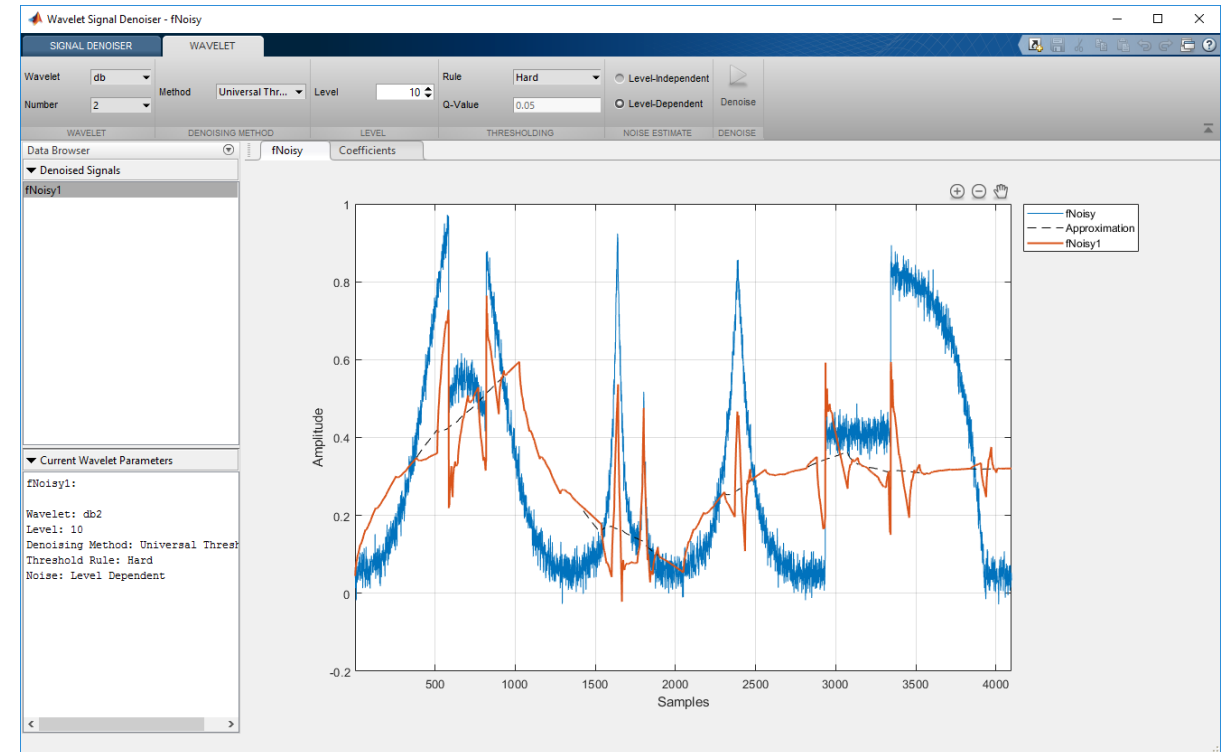


Stateflow

Simplify Analysis with Apps

These interactive applications automate common technical computing tasks

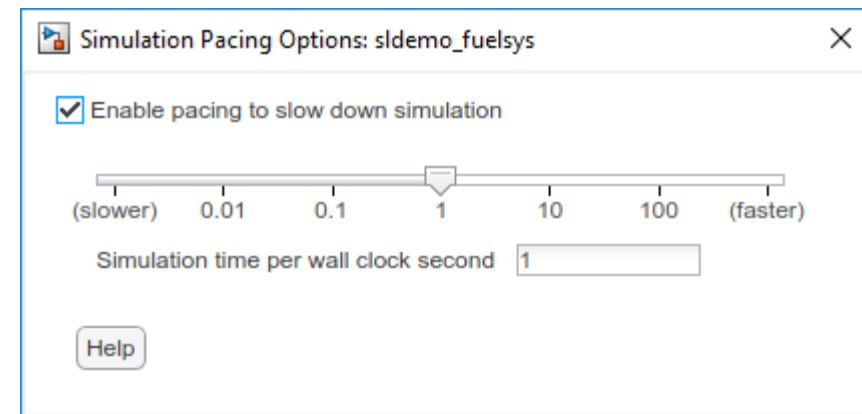
- **Econometric Modeler app**
 - Perform time series analysis, specification testing, modeling, and diagnostics
- **Analog Input Recorder app**
 - Acquire and visualize analog input signals
- **Wavelet Signal Denoiser app**
 - Visualize and denoise time series data



Simplify Analysis by Simulating at Wall Clock Speed

Slow down the simulation for easier model interactivity

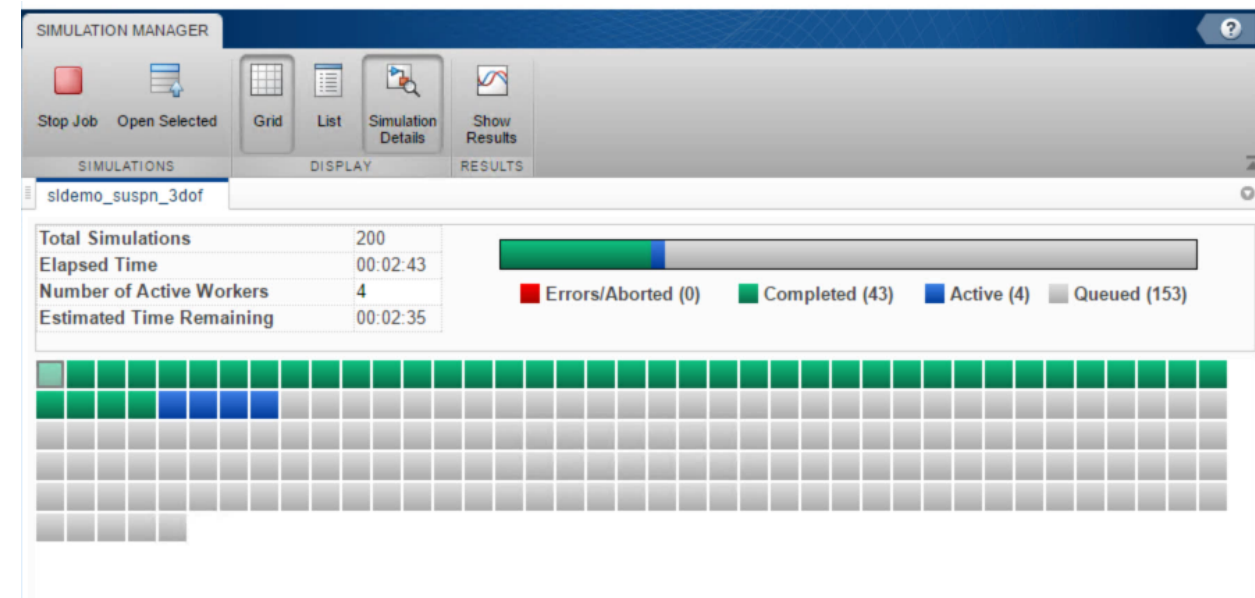
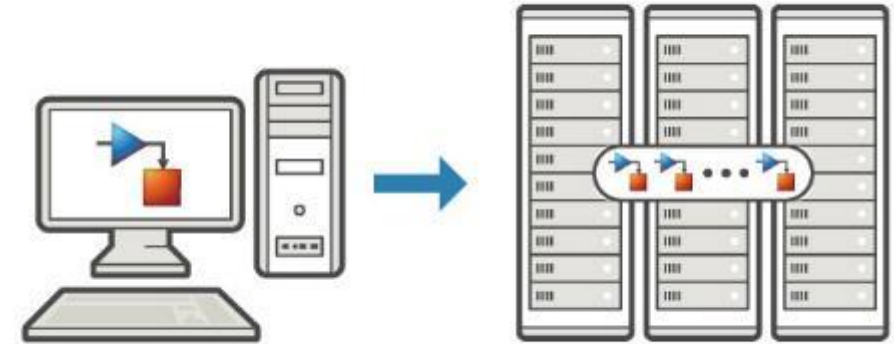
- Especially for models controlled and monitored via Dashboard blocks and other displays
- Useful when model is connected to hardware



Scale Your Work

Use parallel computing to run multiple simulations faster

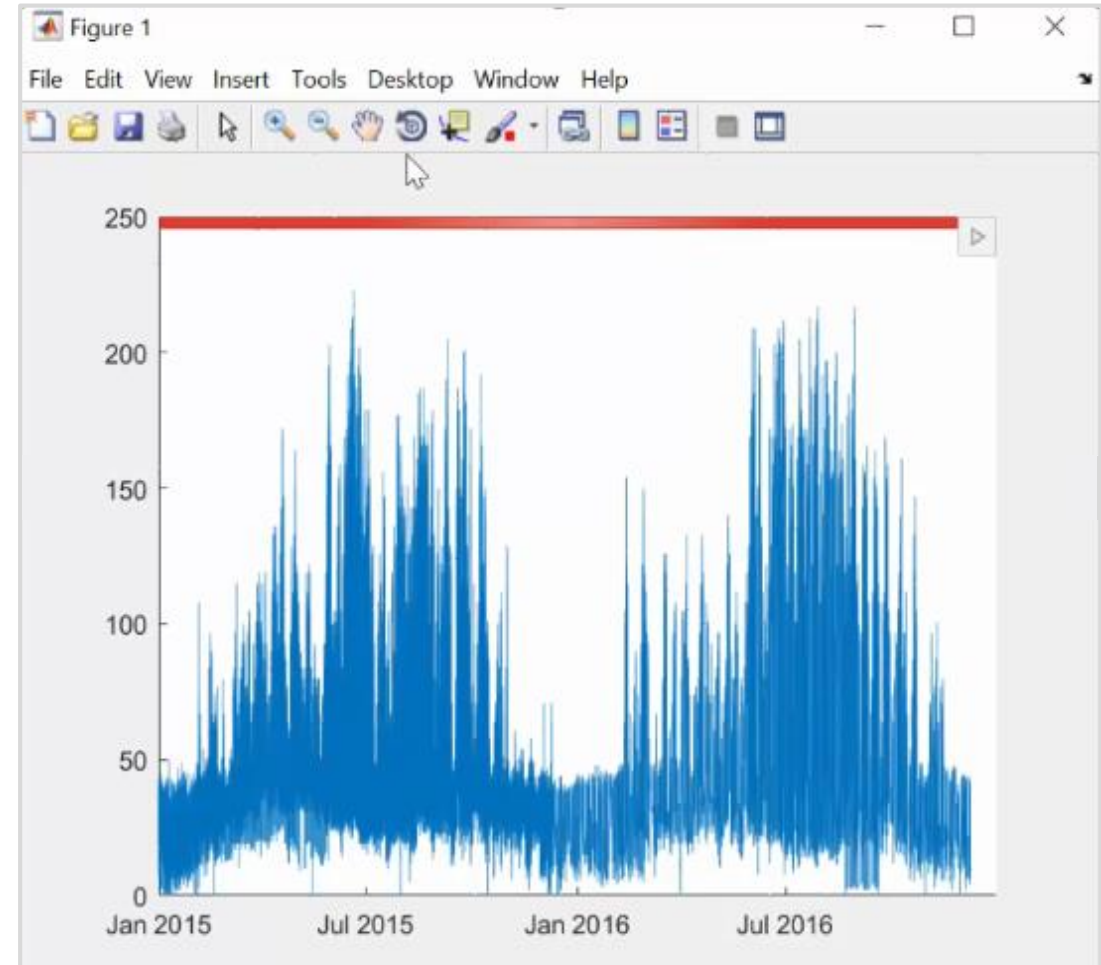
- Run multiple parallel simulations with `parsim`
- Monitor simulation status and progress in the Simulation Manager



Scale Your Work

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

- Use familiar MATLAB functions and syntax
- Support for hundreds of functions
- Works with Spark + Hadoop clusters

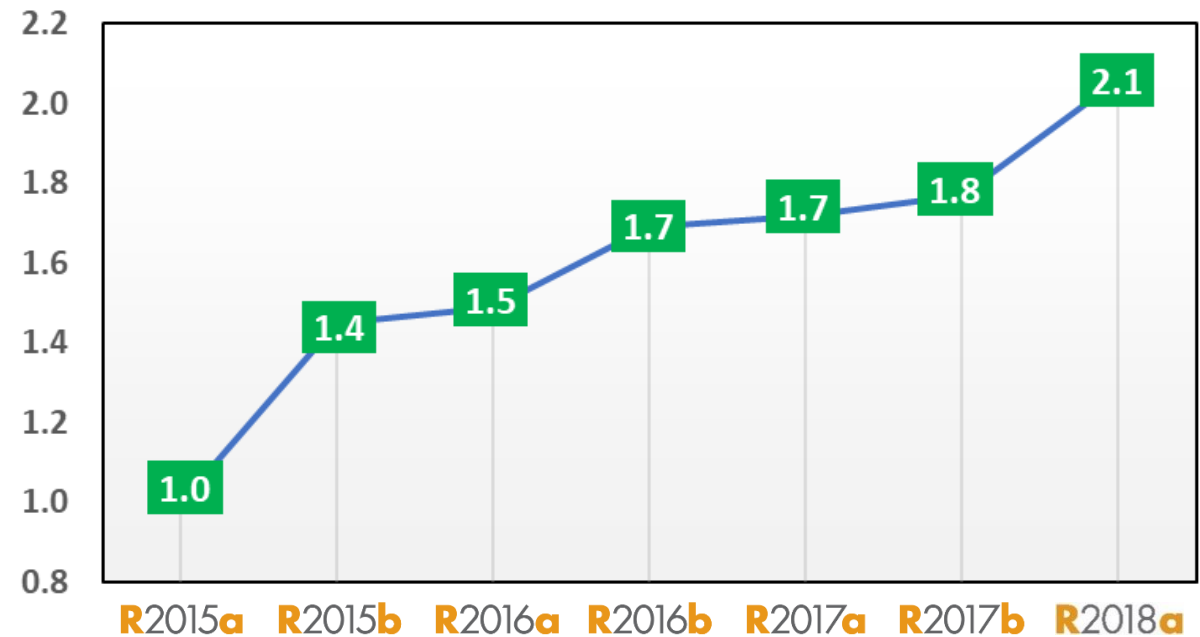


Simulate Faster

Redesigned execution engine runs MATLAB code faster

- All MATLAB code can 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

Average Speedup in Customer Workflows



Team Collaboration

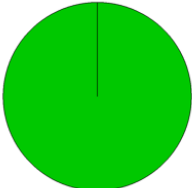
Use advanced software development features to manage, test, and integrate MATLAB code

MATLAB® Test Report

Timestamp: 04-Jan-2017 13:28:06
 Host: AH-SDE
 Platform: win64
 MATLAB Version: 9.1.0.441655 (R2016b)

Number of Tests: 17
 Testing Time: 0.4516 seconds

Overall Result: PASSED



17 passed

Overview

C:\Documents\MATLAB\OOP\Blip\Demos\Extensions\UnitTest\Class\

BlipTests.BlipSizeLengthTests	0.1403 seconds
BlipTests.BlipSubsasnTests	0.1542 seconds
BlipTests.BlipSubsrefTests	0.1572 seconds

Details

C:\Documents\MATLAB\OOP\Blip\Demos\Extensions\UnitTest\Class\

BlipTests.BlipSizeLengthTests

- [scalarBlipSize](#)
 The test passed.
 Duration: 0.0863 seconds [\(Overview\)](#)
- [vectorBlipSize](#)
 The test passed.
 Duration: 0.0027 seconds [\(Overview\)](#)
- [scalarBlipLength](#)
 The test passed.
 Duration: 0.0044 seconds [\(Overview\)](#)

Team Collaboration

Use advanced software development features to manage, test, and integrate MATLAB code

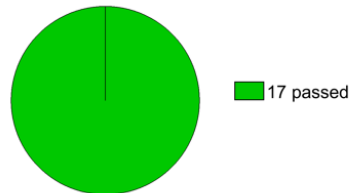
Identify differences between model elements, Stateflow charts, and MATLAB Function blocks

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BlipTests.BlipSizeLengthTests

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- vectorBlipSize**
The test passed.
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The test passed.
Duration: 0.0044 seconds

Three-Way Merge - mine_slproject_f14.slx

MERGE

Previous Next Linked Scrolling Top Model Bottom Model Highlight Now Always Highlight in Models Filter Accept & Close

NAVIGATE HIGHLIGHT FILTER FINISH

Theirs: 340c64c37beb096a316e58a11358a8387d026b5f Base: e317566e2ad5f02f38f648e7d08716367a0fac Mine: mine_slproject_f14.slx

Simulink Pilot PilotGain Pilot:1 -> Bus Creator:1 PilotGain:1 Bus Creator:1

Model Configuration Sets Configuration Solver

Target: targetFile.slx

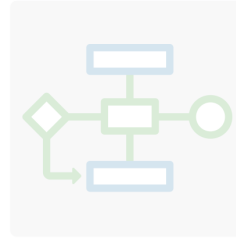
Resolve remaining 1 changes

TYPE	UNRESOLVED	RESOLVED
Conflict	1	0
Conflicted manual merge	0	0
Manual merge	0	0
Automatic	0	4
Total	1	4

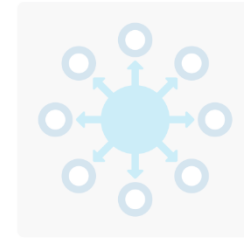
Platform Productivity



Workflow Depth



Application Breadth

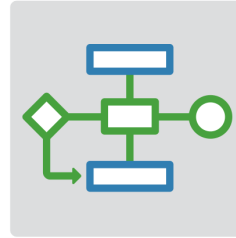


- **Create Your Designs Faster**
- **Simplify Analysis**
- **Simulate Faster and Scale Your Work**
- **Collaborate**

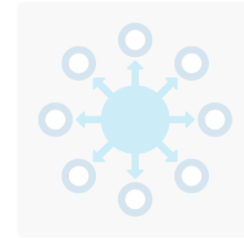
Platform Productivity



Workflow Depth



Application Breadth



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

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

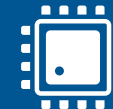
Deploy



Desktop apps

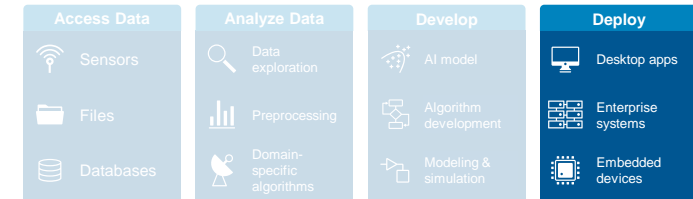


Enterprise systems



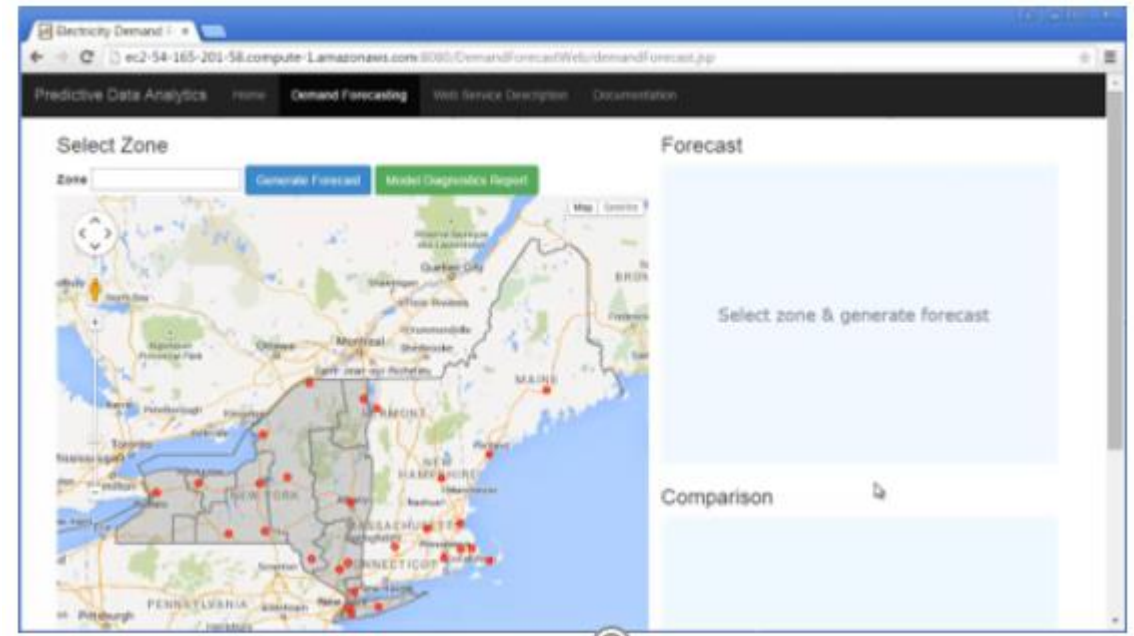
Embedded devices

Deploy MATLAB Algorithms and Applications

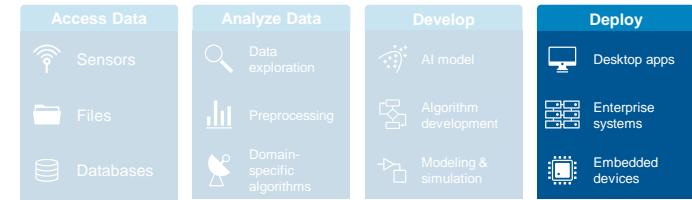


Share your work outside of MATLAB without having to recode your algorithms

- Standalone desktop applications
- Add-ins for Microsoft Excel
- Software components to integrate with other languages (*C/C++*, *.NET*, *Python*, *Java*)
- Software components for web and enterprise applications

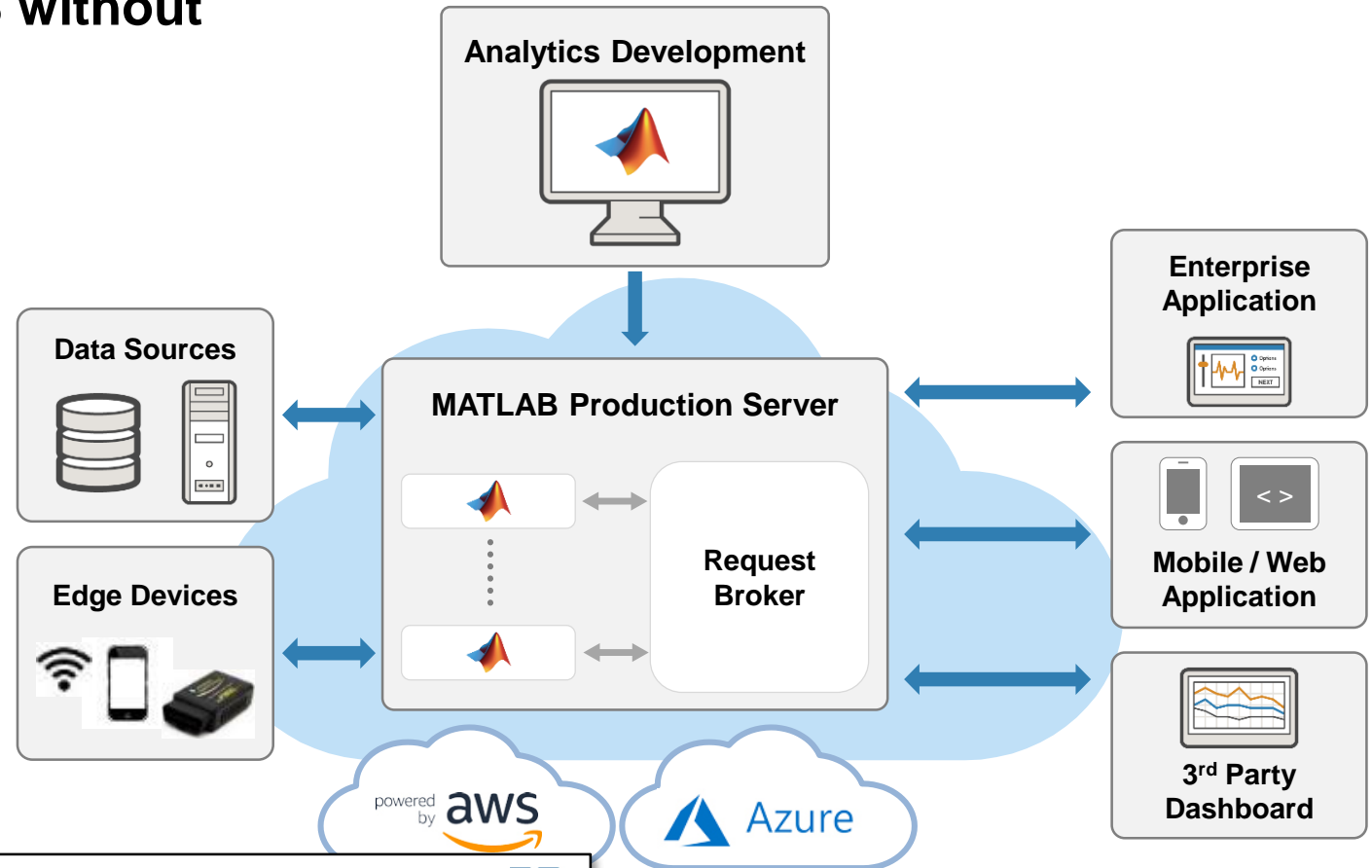


Deploy MATLAB Algorithms and Applications



Share your work outside of MATLAB without having to recode your algorithms

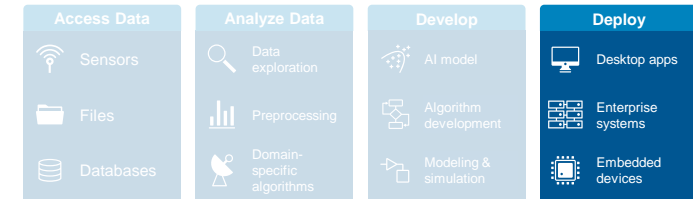
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MATLAB Compiler
 MATLAB Compiler SDK
 MATLAB Production Server

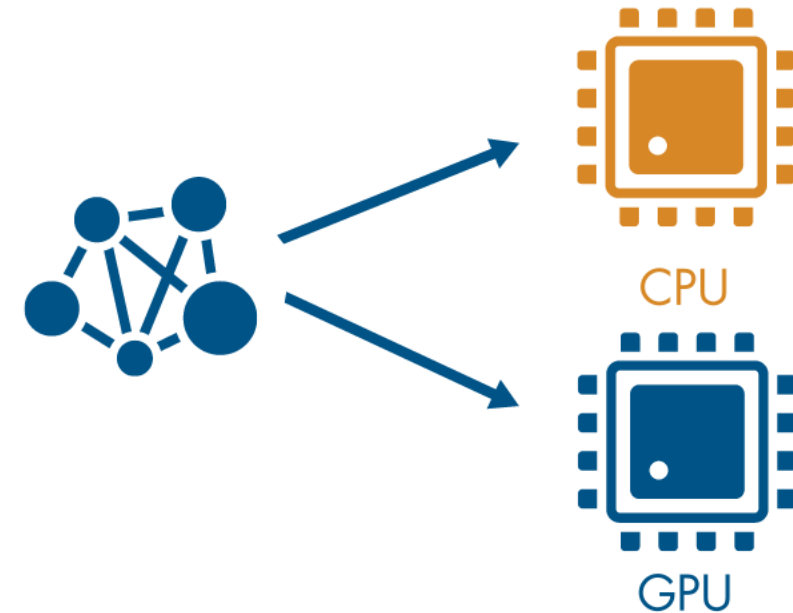
[Scaling up MATLAB Analytics with Kafka and Cloud Services](#)
 Pallavi Kar

Deploy MATLAB Algorithms



Deploy machine learning and deep learning models using automatically generated code

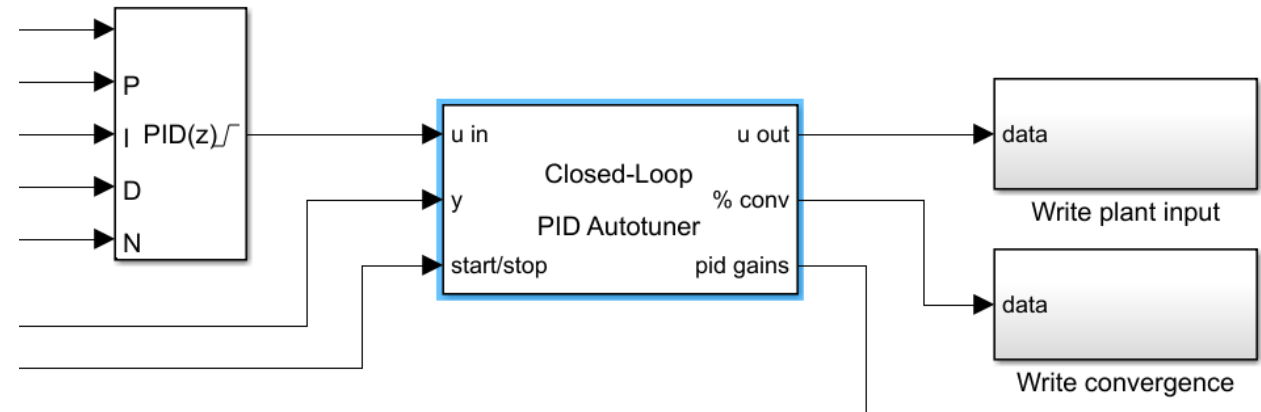
- Generate C code for predictive machine learning and deep learning models
- Generate optimized code for deep learning, embedded vision, and autonomous systems
- Target NVIDIA GPUs as well as Intel and ARM CPUs



PID Control Tuning

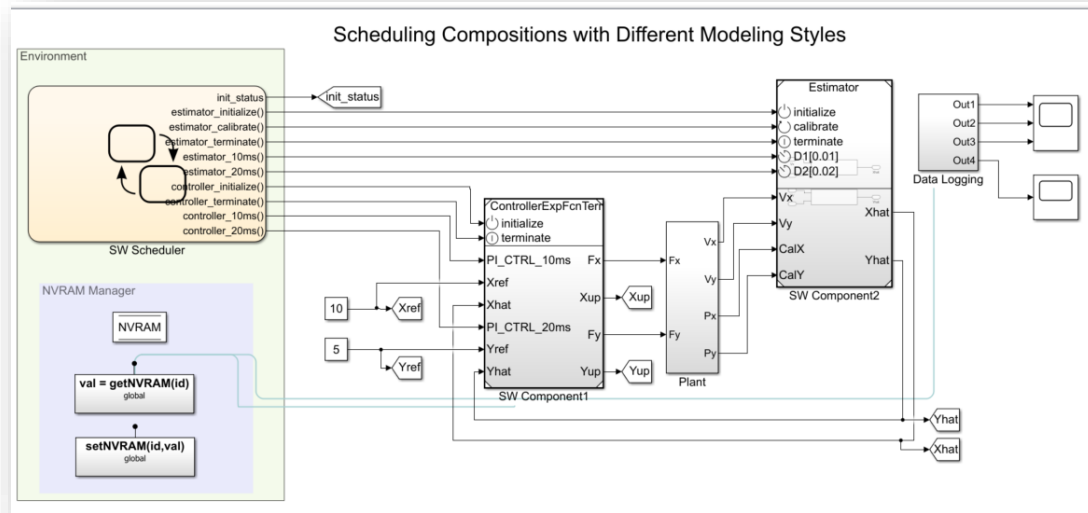
Implement an embedded PID auto-tuning algorithm

- Automatically tune PID controller gains in real time against a physical plant
- No model of plant dynamics required
- Deploy the auto-tuning algorithm to embedded software using automatic code generation



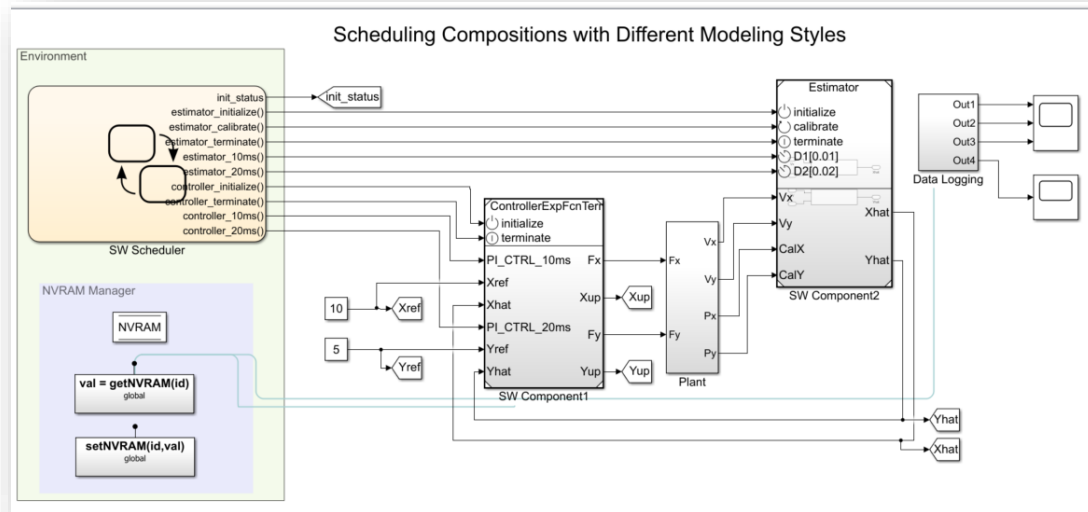
Prepare Your Model for Code Generation

Prepare model components
for code generation



Prepare Your Model for Code Generation

Prepare model components for code generation



Prepare model data for code generation

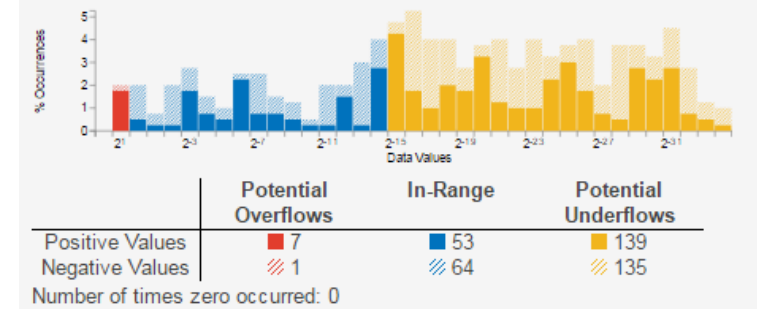
The screenshot shows the FIXED-POINT TOOL interface with several key components highlighted:

- Simulation Ranges:** A dropdown menu for selecting simulation ranges.
- Derived Ranges:** A dropdown menu for selecting derived ranges.
- Propose Data Types:** A button to propose data types for the model.
- Compare Results:** A button to compare simulation results.

 Below the toolbar, the MODEL HIERARCHY and Results tables are visible.

Name	Run	CompiledDT	SpecifiedDT	ProposedDT	Accept	SimM
SRP Subsystem...	Ranges(Double)	double	fixdt(1,13,11)	locked		0
SRP Subsystem...	Ranges(Double)	double	fixdt(1,13,11)	locked		0
SRP Subsystem...	Ranges(Double)	double	fixdt(1,17,15)	fixdt(0,17,22)	<input checked="" type="checkbox"/>	0

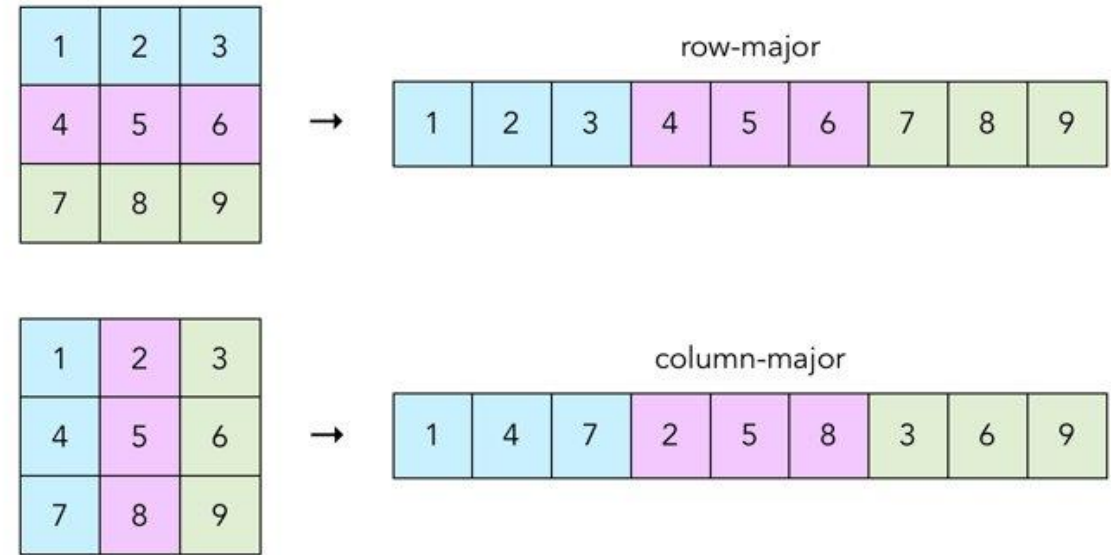
Visualization of Simulation Data



Generate Code from Simulink Models

Access and define all the information in your model related to code generation

- View and define implementation data in one place
- View implementation details without model details
- Improve code performance and ease integration with other C code



Row-major memory layout option



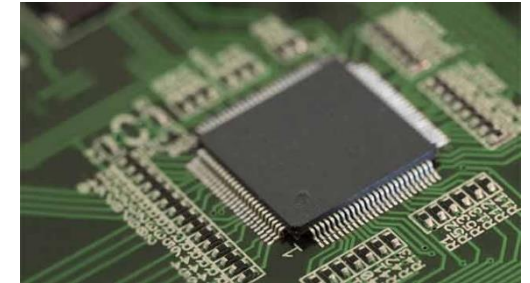
Connecting Your Design to Hardware

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



ARM Cortex



Raspberry Pi



Microsemi FPGA



Nvidia Jetson

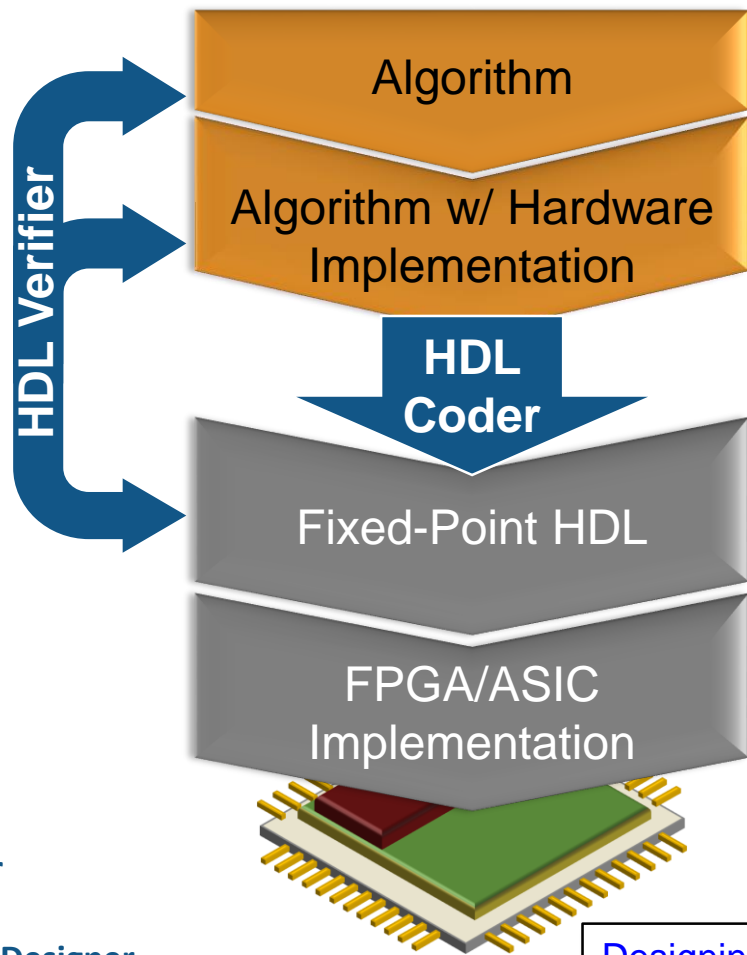


ADALM-PLUTO

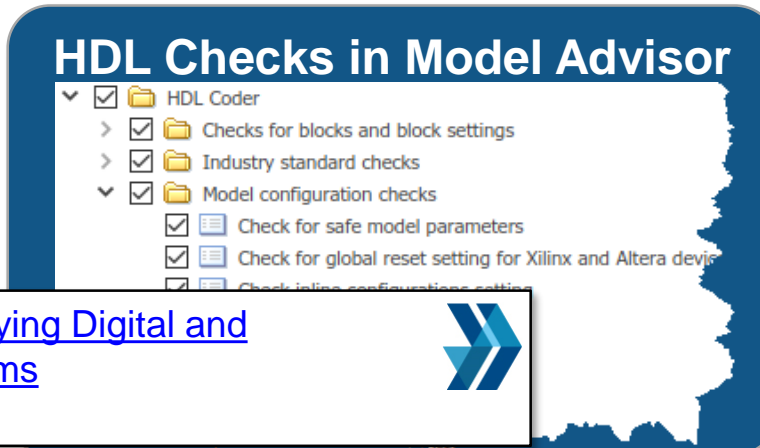
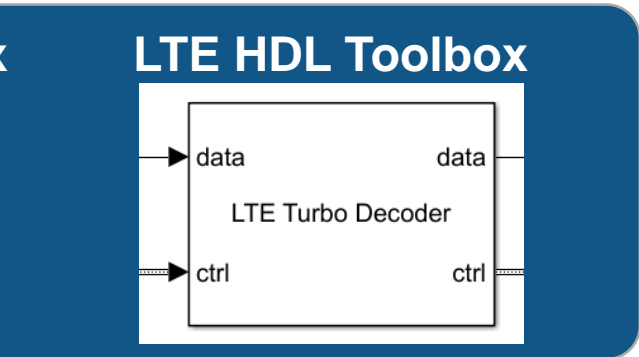
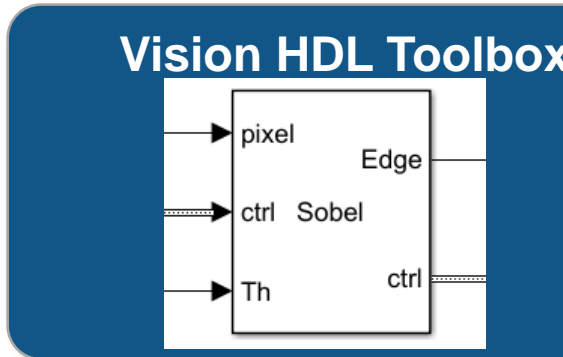
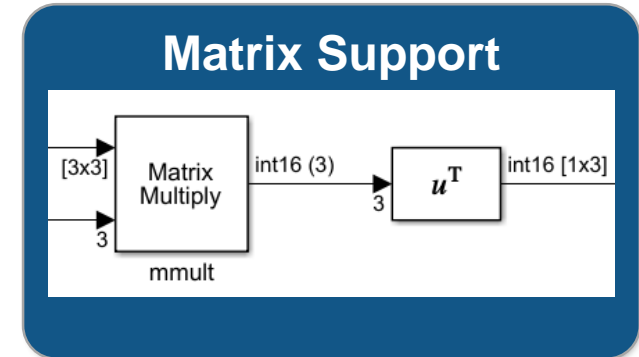
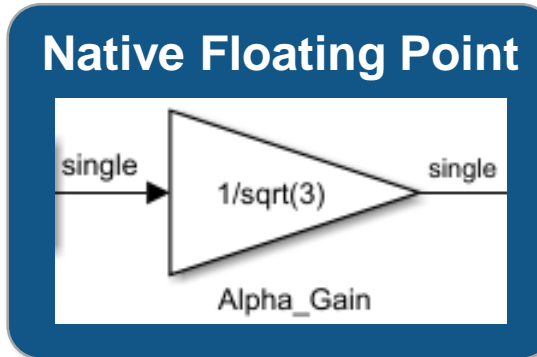
Demo Station:
Hardware Connectivity with
MATLAB and Simulink



Deploying to FPGA or ASIC Hardware



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



[Designing and Verifying Digital and Mixed-Signal Systems](#)
Aniruddha Dayalu



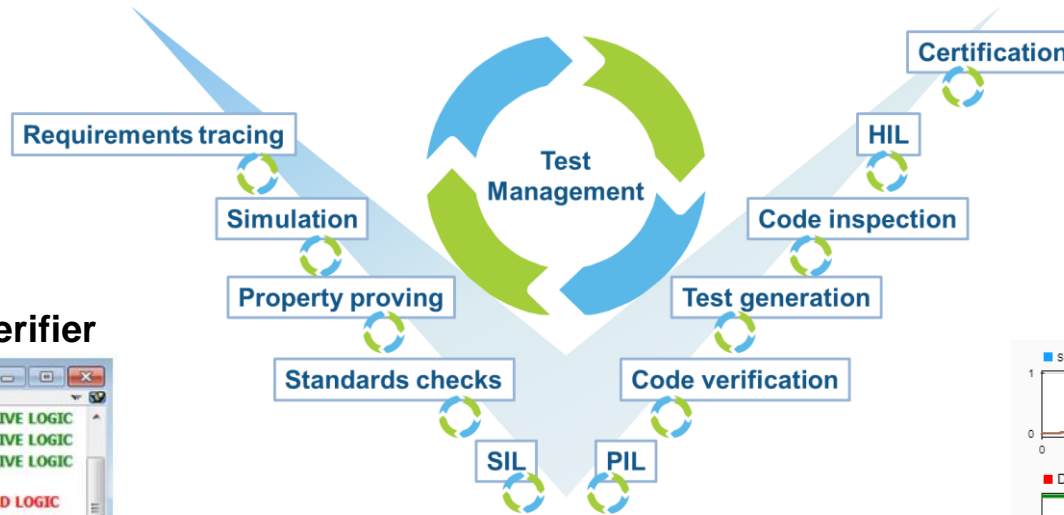
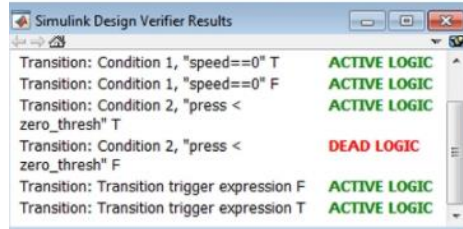
Verification and Validation

Products for the entire workflow

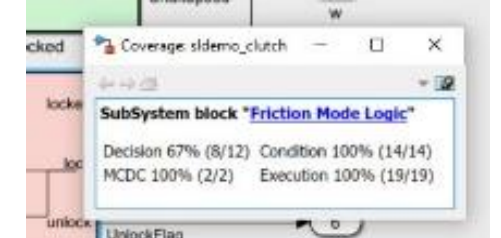
Simulink Requirements R2017b



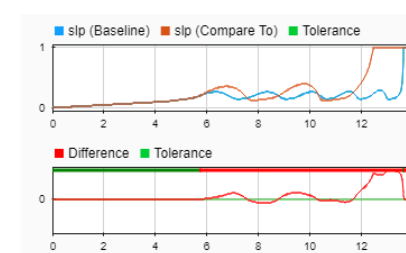
Simulink Design Verifier



Simulink Coverage R2017b



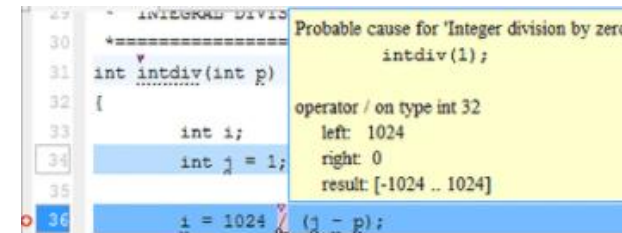
Simulink Test



Simulink Check R2017b

- Modeling Standards for Secure Coding (CERT C, CWE, ISO/IEC TS 17961)
 - Check configuration parameters for secure coding standards
 - Check for blocks not recommended for C/C++ production code deployment
 - Check for blocks not recommended for secure coding standards
 - Check usage of Assignment blocks
 - Check for switch case expressions without a default case
 - Check for bitwise operations on signed integers
 - Check for equality and inequality operations on floating-point values
 - Check integer word lengths
 - Detect Dead Logic

Polyspace



now supports
AUTOSAR
 R2018a

[Verification and Validation of High-Intensity Systems](#)

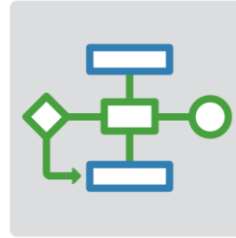
Chethan CU, Vaishnavi H R



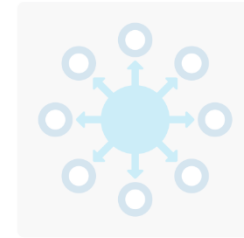
Platform Productivity



Workflow Depth



Application Breadth

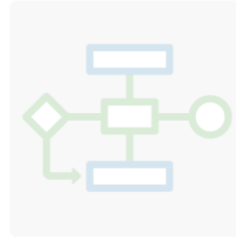


- **Deployment of MATLAB Algorithms and Applications**
- **Code Generation from Simulink Models**
- **Verification and Validation**

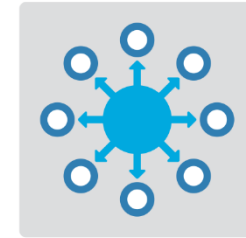
Platform Productivity



Workflow Depth

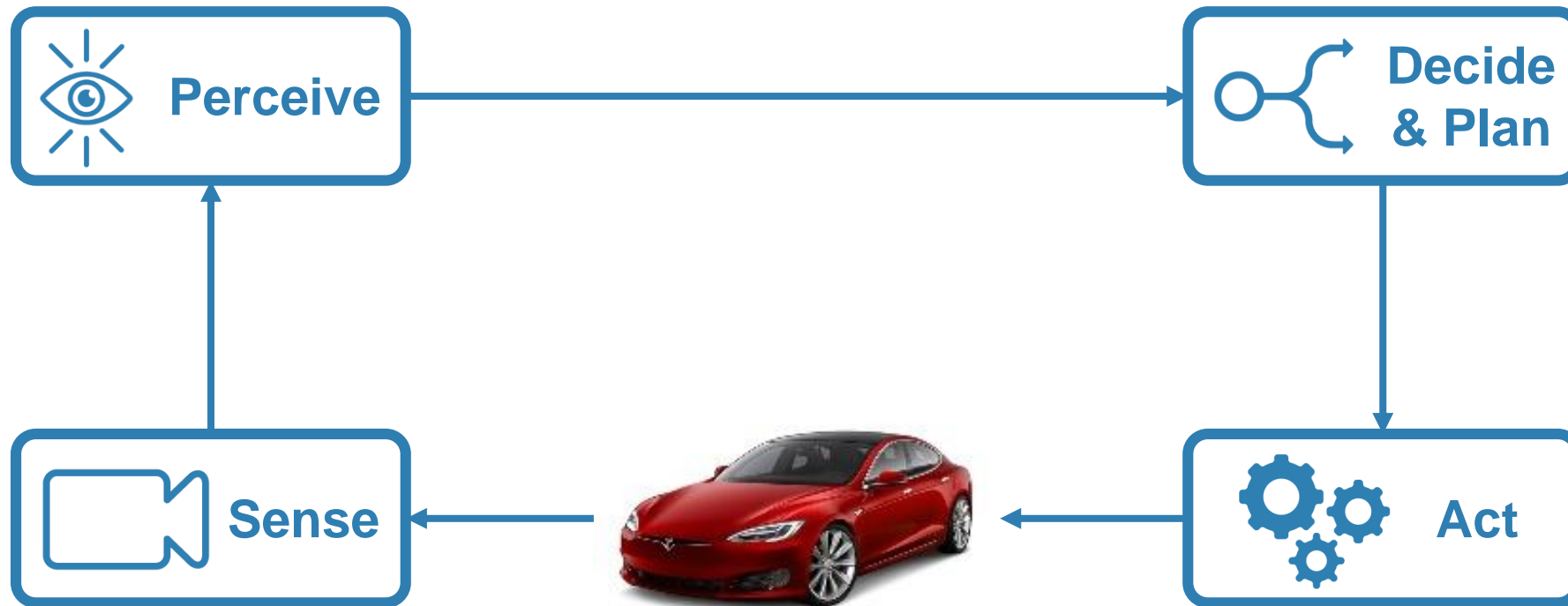


Application Breadth



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

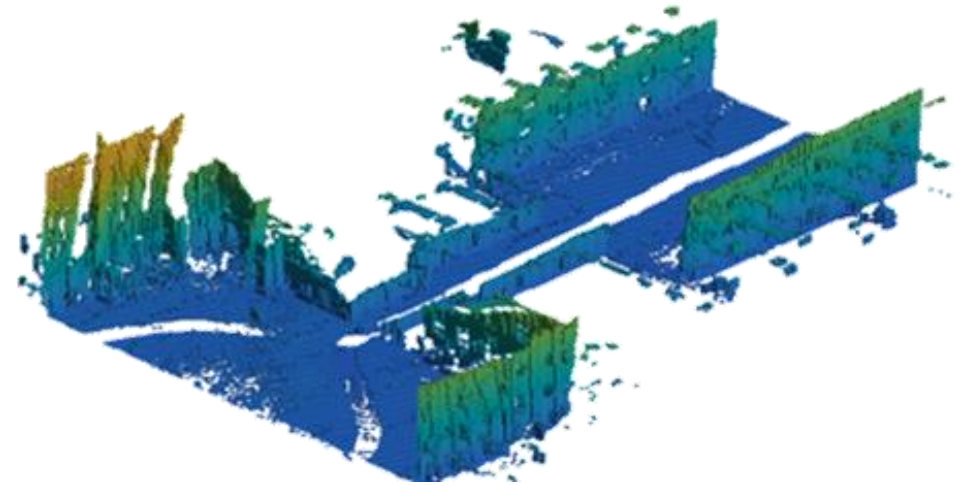
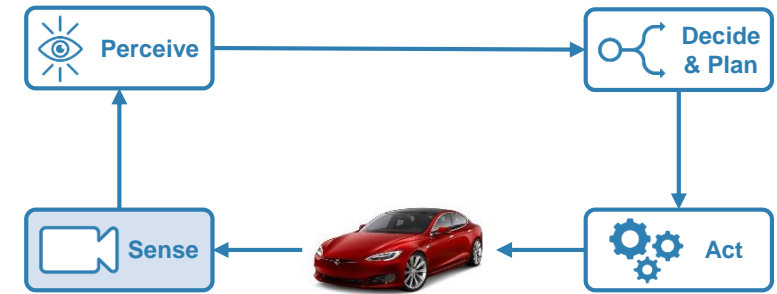
Designing Autonomous Systems



Designing Autonomous Systems

Mapping of environments using sensor data

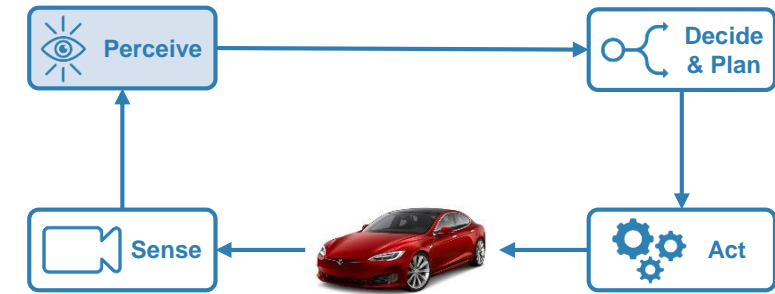
- Segment and register lidar point clouds
- Lidar-Based SLAM: Localize robots and build map environments using lidar sensors



Designing Autonomous Systems

Understanding the environment using computer vision and deep learning techniques

- Object detection and tracking
- Semantic segmentation using deep learning

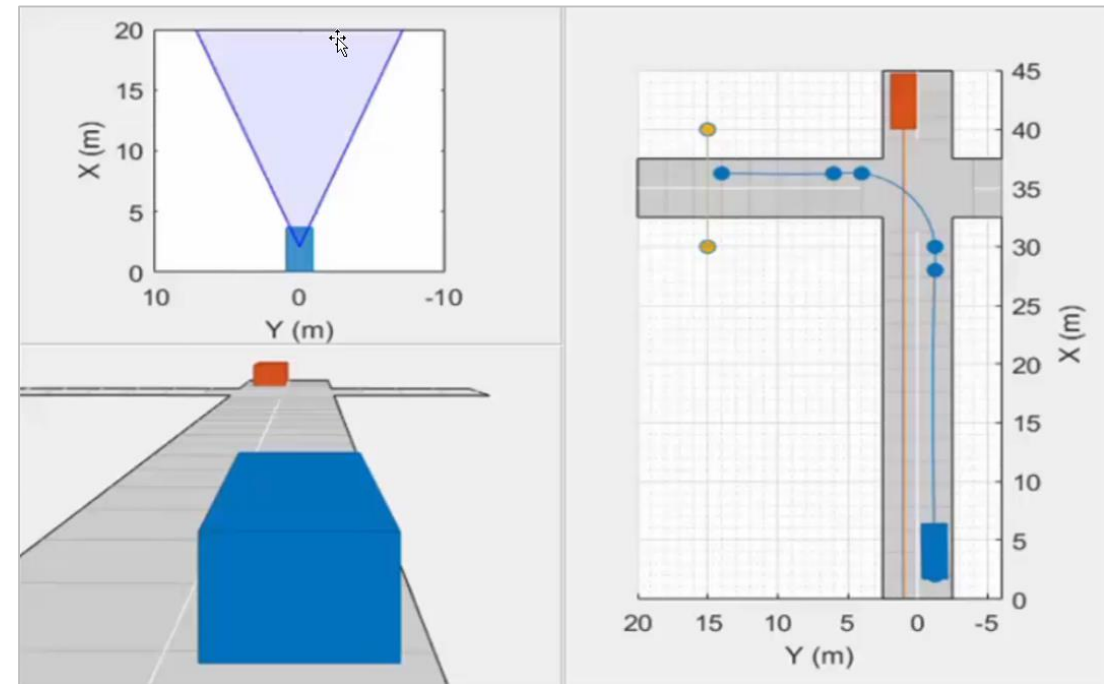
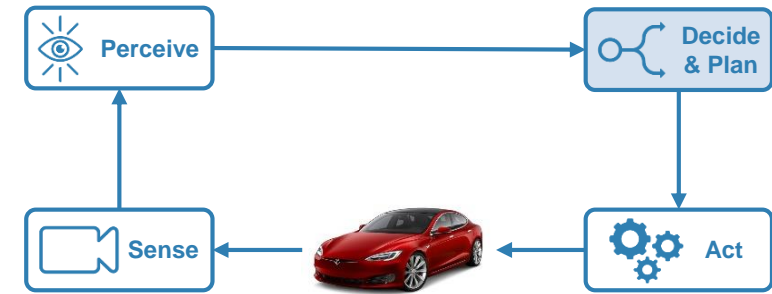


CamVid Database: Brostow, Gabriel J., Julien Fauqueur, and Roberto Cipolla. "Semantic object classes in video: A high-definition ground truth database." *Pattern Recognition Letters* Vol 30, Issue 2, 2009, pp 88-97.

Designing Autonomous Systems

Design synthetic driving scenarios to test controllers and sensor fusion algorithms

- Interactively design synthetic driving scenarios composed of roads and actors (*vehicles, pedestrians, etc.*)
- Generate visual and radar detections of actors



Driving Scenario Designer App

[Automated Driving Development with
MATLAB and Simulink](#)

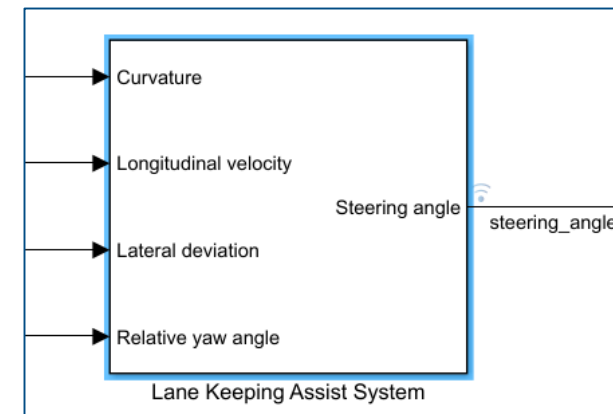
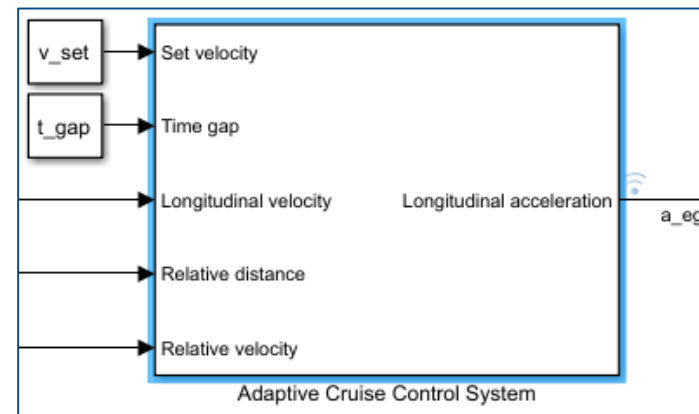
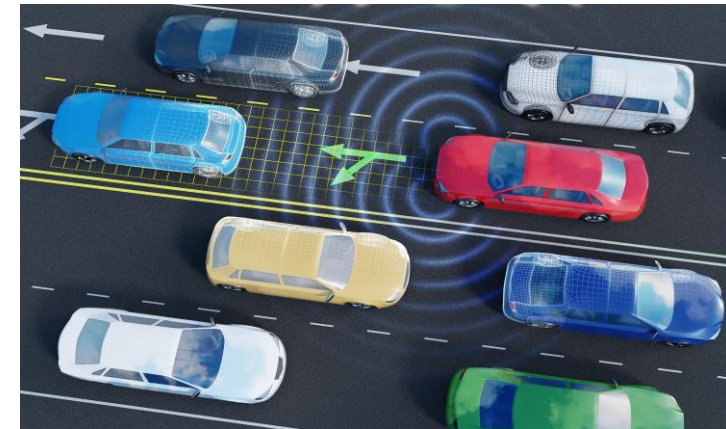
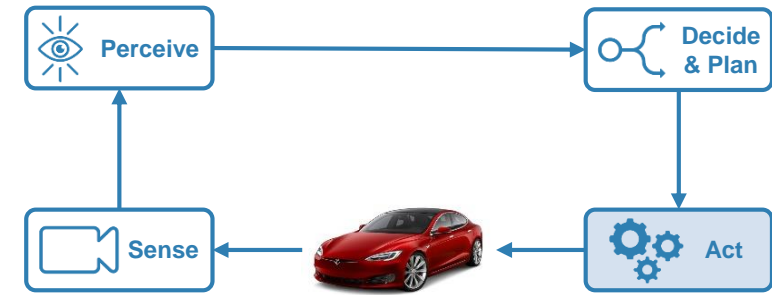
Manohar Reddy



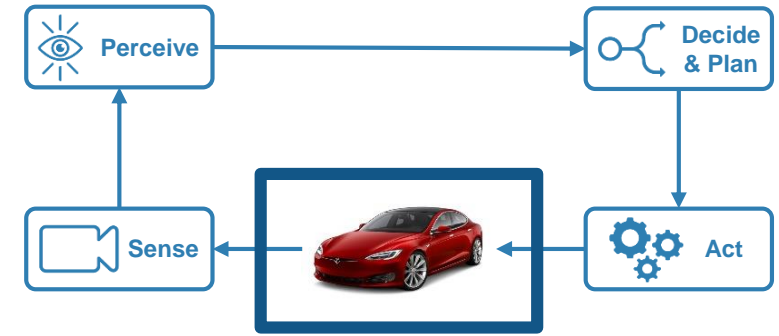
Designing Autonomous Systems

Model predictive control for adaptive cruise control and lane-keeping algorithms

- Use prebuilt blocks instead of starting from scratch
- Simplified application-specific interfaces for configuring model predictive controllers
- Flexibility to customize for your application



Full Vehicle Simulation



Ride & handling



Chassis controls



Automated Driving



Design with the Latest Wireless Standards



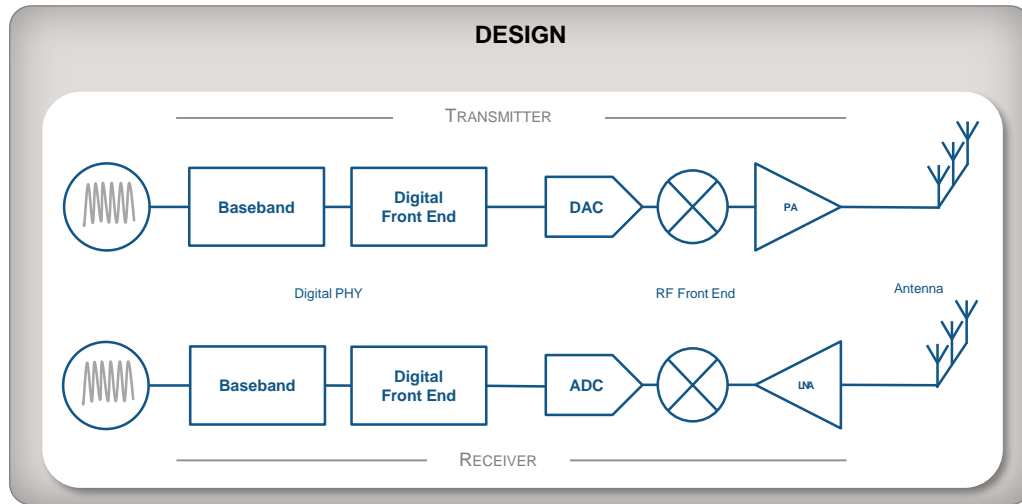
NB-IoT

[5G: What's Behind the Next Generation of Mobile Communications?](#)

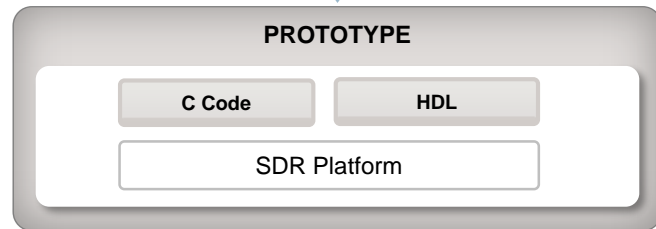
Tabrez Khan



Model-Based Design for Wireless Communications



- Algorithm Design and Verification
- RF, Digital and Antenna Co-Design
- System Verification and Testing
- Rapid Prototyping and Production

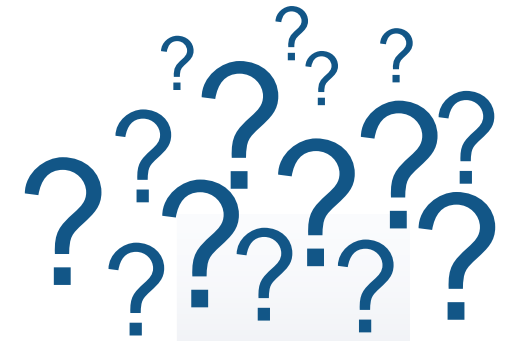


Code Generation and Verification
 Fixed-Point Designer
 HDL Coder
 HDL Verifier
 LTE HDL Toolbox **R2017b**
 Embedded Coder

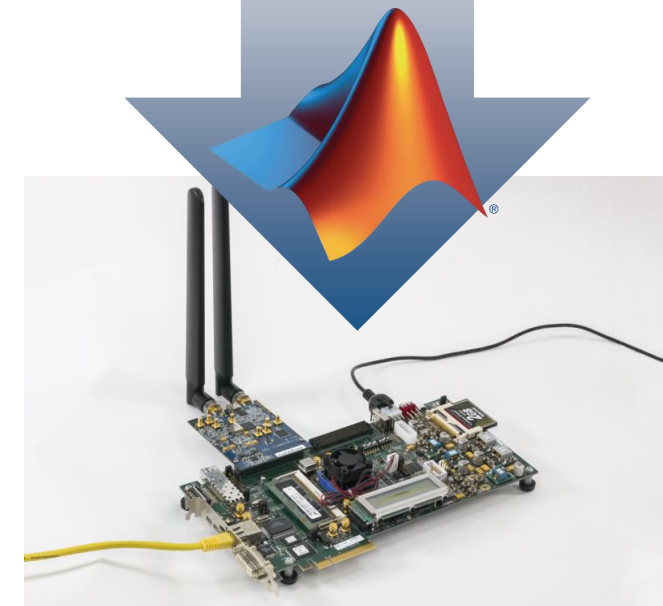
RF and Antenna Design and Prototyping

Use RF and Antenna models through your entire development cycle

- RF top-down design with RF Budget Analyzer app
- Adaptive hybrid beamforming and MIMO system modeling
- RF Power Amplifier modeling and DPD linearization
- RF propagation and 3D terrain visualization
- Design and fabrication of printed (PCB) antennas



From idea ...



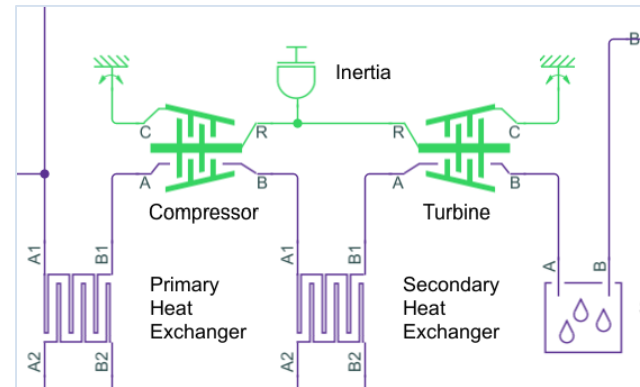
... to implementation



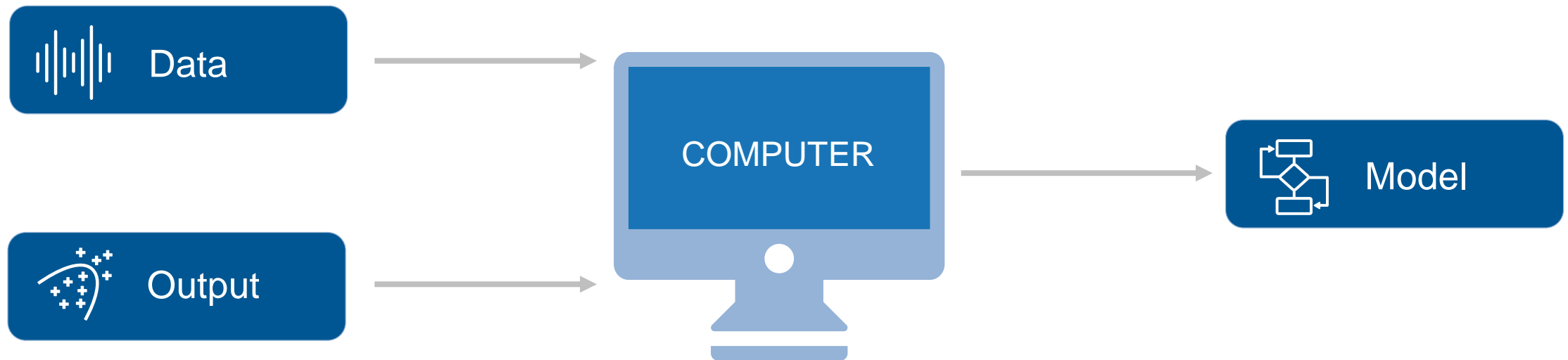
Model Moist Air Systems

Model HVAC and environmental control systems

- Model and simulate HVAC systems for a plant, such as a building, automobile, aircraft
- New library contains chambers, reservoirs, local restrictions, energy converters, sources and sensors
- Ensure acceptable temperature, pressure, humidity, condensation within the environment
- Note for Simscape in general: Run simulations about 5x faster with local solver option



Artificial Intelligence



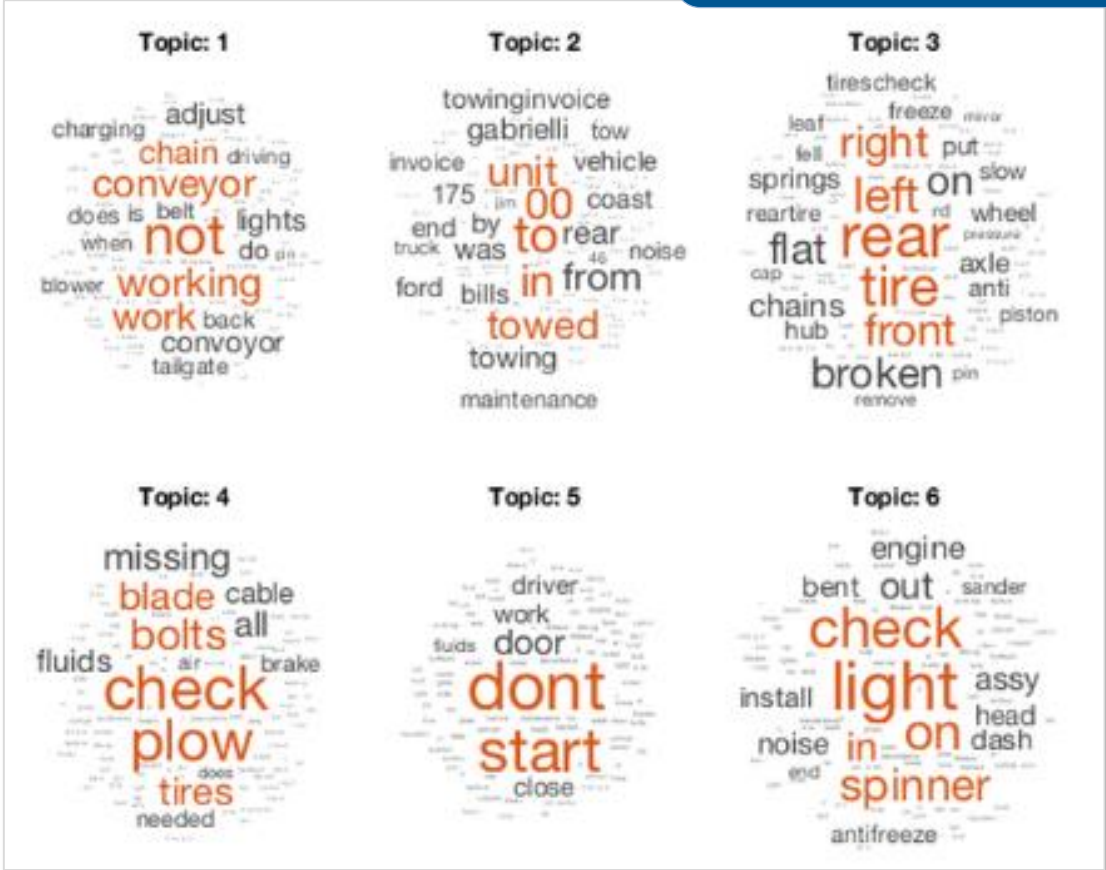
Text Analytics

Data

```
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 B"
"HANDLES IN CAB LOOSE"
"NO PLOW LIGHTS"
"WILL NOT START"
```

Output

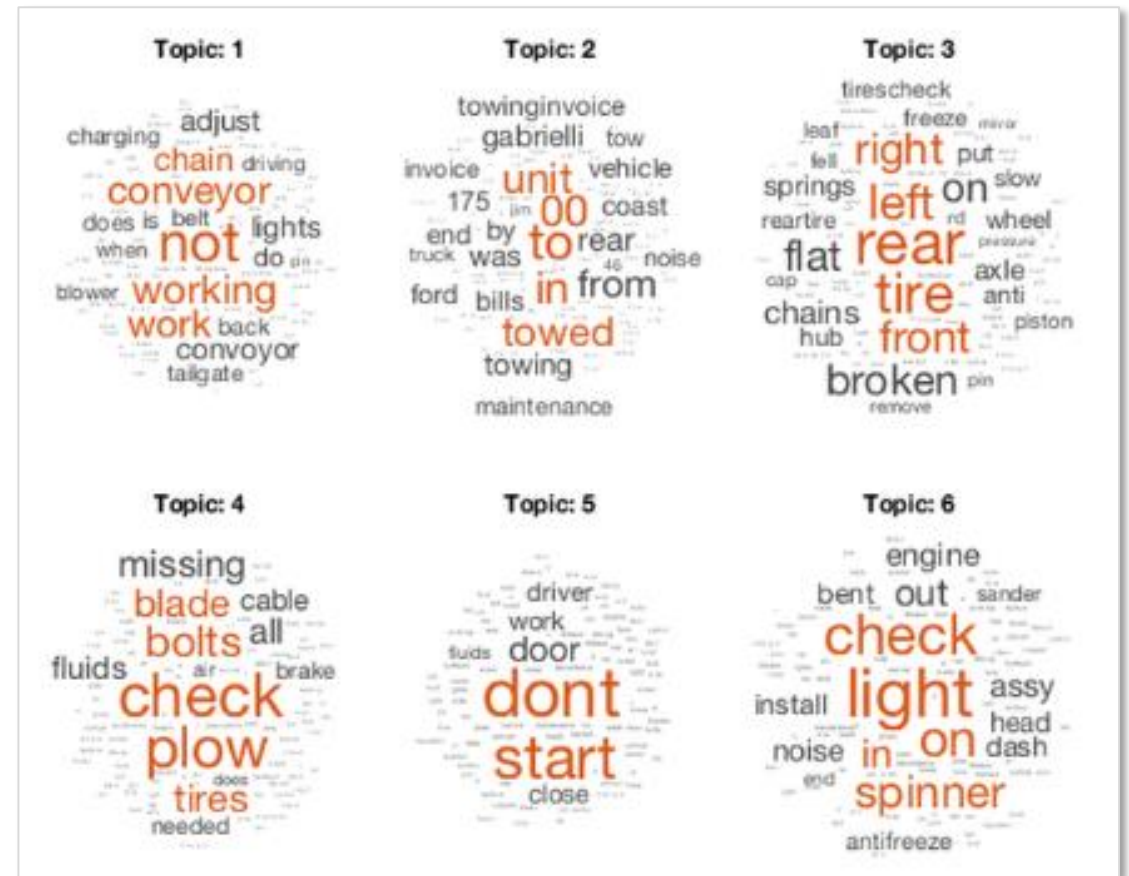
Model



Text Analytics

Work with text from equipment logs and operator reports

- **Preprocess** raw text data by extracting, filtering, and splitting
- **Visualize** text using word clouds and text scatter plots
- **Develop** predictive models using built-in machine learning algorithms (LDA, LSA, word2vec)

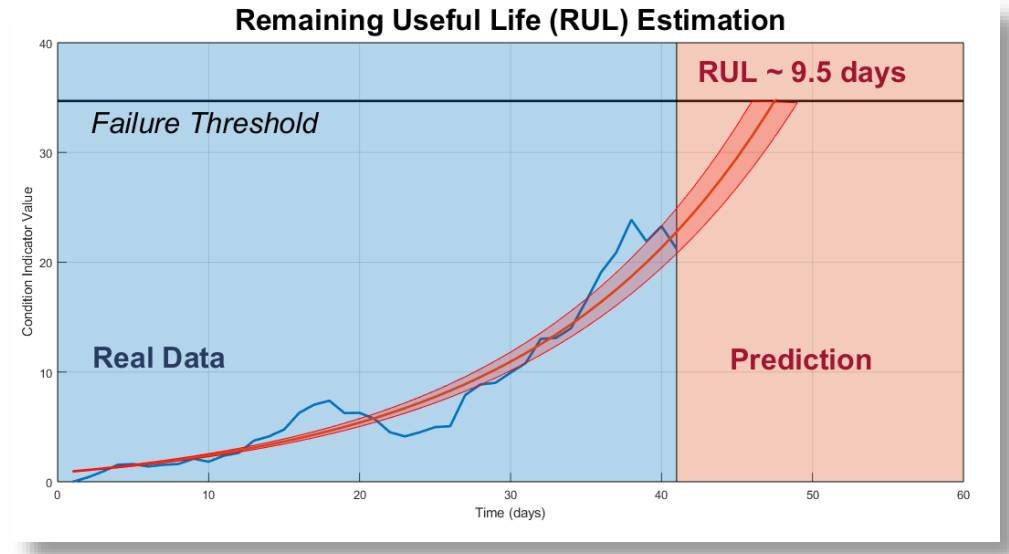
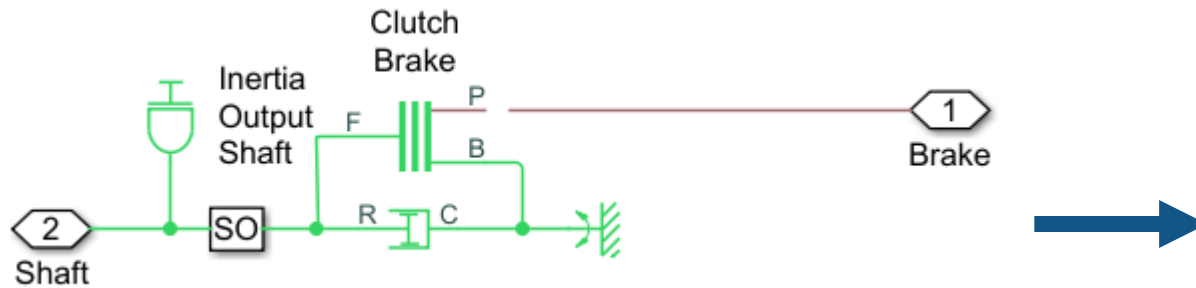


Predictive Maintenance

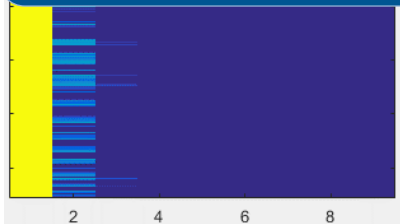
Data

Sensors

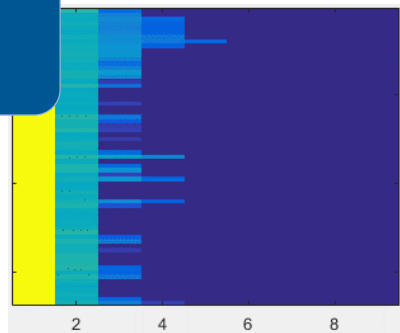
Model



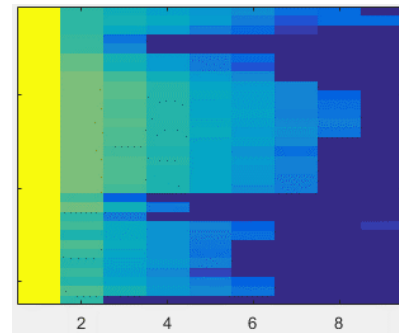
Output



Normal Operation



Monitor Closely

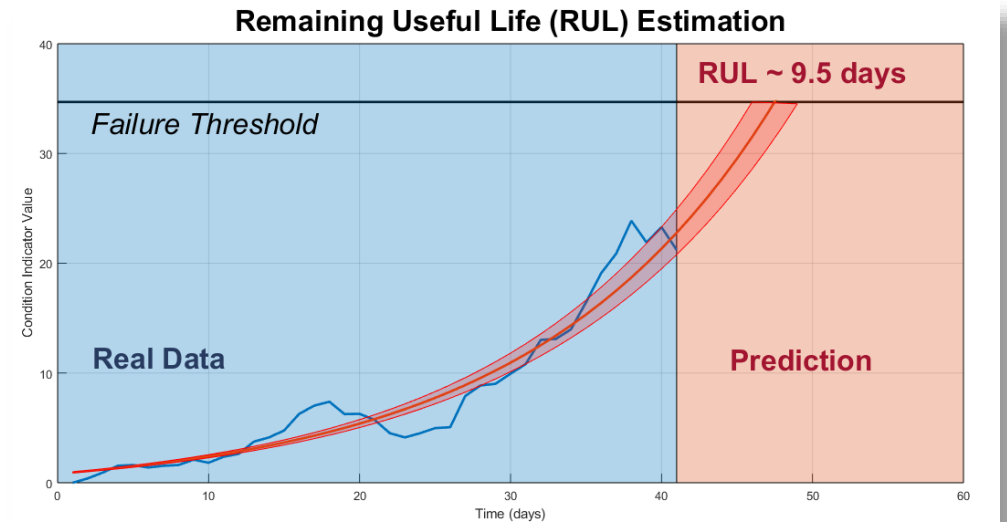


Maintenance Needed

Predictive Maintenance

Design and test condition monitoring and predictive maintenance algorithms

- Import sensor data from local files and cloud storage (*Amazon S3, Windows Azure Blob Storage, and Hadoop HDFS*)
- Use simulated failure data from Simulink models
- Estimate remaining useful life (RUL)
- Get started with examples (*motors, gearboxes, batteries, and other machines*)



Deep Learning

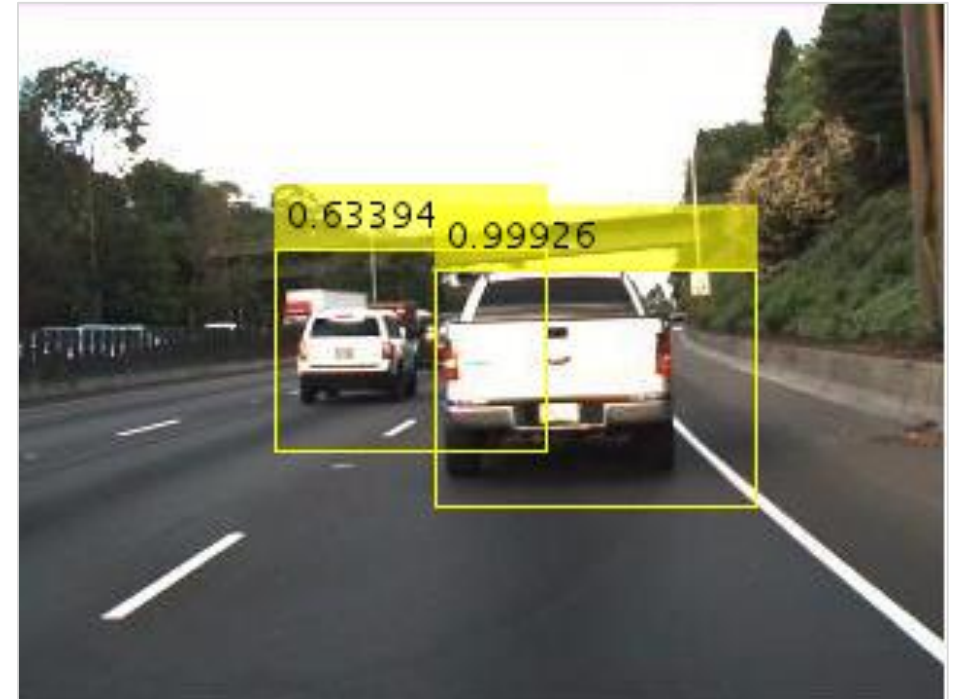
Data



Model



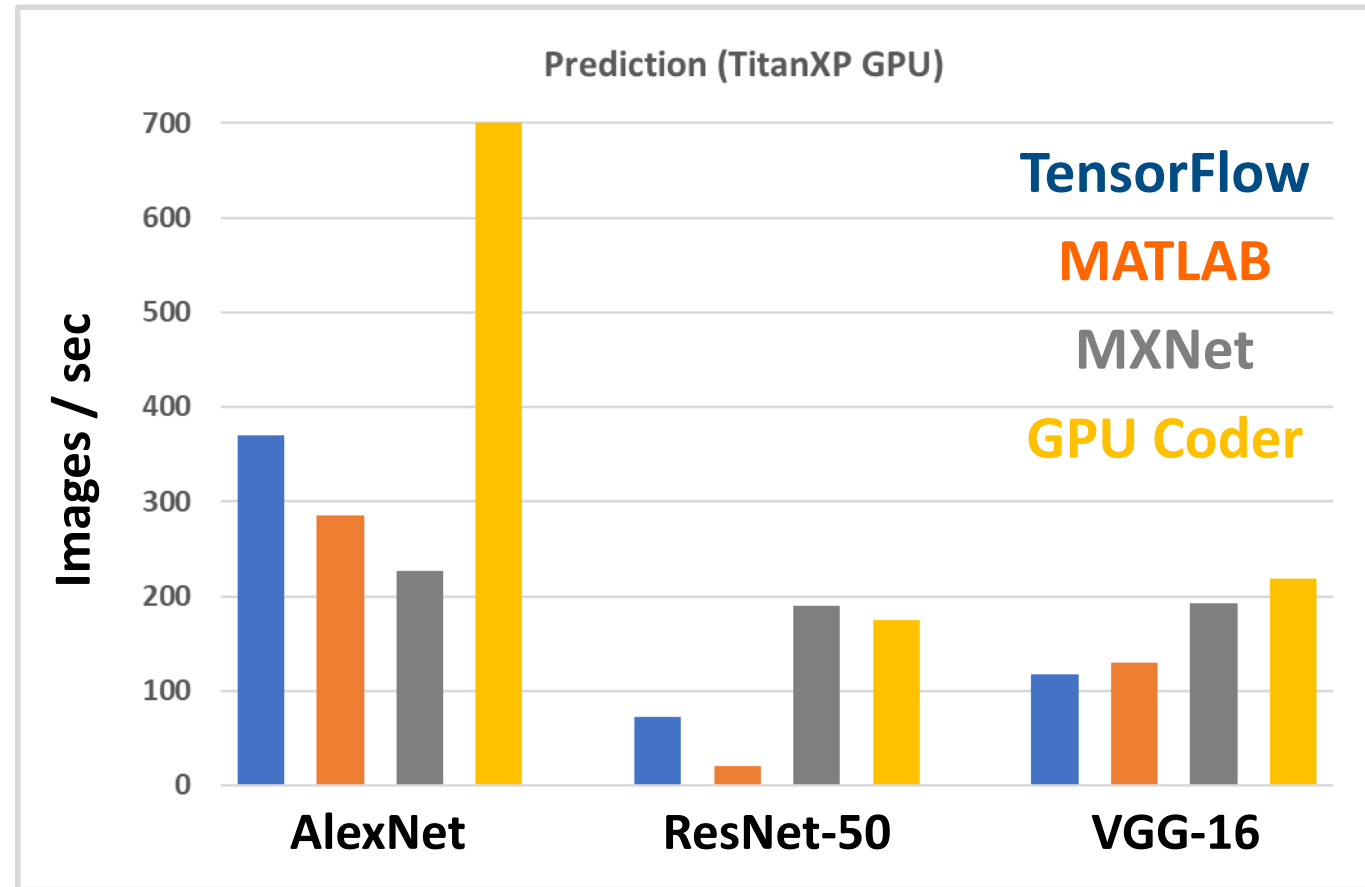
Output



Deep Learning

Design, build, and visualize convolutional neural networks

- Access the latest models
- Import pretrained models and use transfer learning
- Automate ground-truth labeling using apps
- Design and build your own models
- 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



The screenshot shows the MATLAB Deep Learning Onramp interface. The course title is "Deep Learning Onramp" with a progress indicator of "51% complete". The current task is "2.2 Making Predictions: (1/2) Make a prediction".

Task 2 (Reset):

Info: You can use the `classify` function to make a prediction on an image.

```
pred = classify(net,img);
```

Use the `classify` function with the pretrained AlexNet network to predict the subject of the image stored in the variable `img1`. Store the network's prediction in a variable called `pred1`.

You may want to leave off the semicolon to see the result.

Buttons: Submit, Hint, See Solution, Next task

Correct!

Test Suite

- ✓ Is `pred1` created correctly?
 - Show test suite details

Task 1

Load pretrained network

Task 1: Use the `alexnet` function to load a pretrained network.

```
deepnet = alexnet;
```

Import, view, and classify an image

Import and display the image in `file01.jpg`.

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

Task 2: Classify the image in the variable `img1`.

```
pred1 = classify(deepnet,img1)
```

Classify further images

Task 3: Classify the images in `file02.jpg` and `file03.jpg`.

```
img2 = imread('file02.jpg');
```

The workspace on the right shows the result of the classification: `pred1 = categorical seashore`. An image of a seashore is displayed in the workspace.

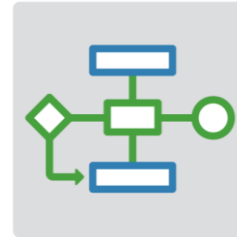
What's New in MATLAB and Simulink?

Platform Productivity



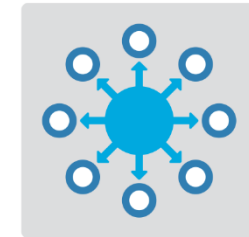
- Design Creation
- Analysis
- Simulation, Scaling
- Collaboration

Workflow Depth



- Deployment
- Code Generation
- Verification and Validation

Application Breadth



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

Experiential Learning
Online Learning
Collaborative Learning



MATLAB Enabled Campus

Experiential Learning

- Interactive Live Editor and App Designer
- Hardware Connectivity and Internet of Things

Online Learning

- MATLAB Online and MATLAB Mobile
- Cody Coursework
- MATLAB Online Self-paced Training
- MATLAB Courseware

Collaborative Learning

- Student Competitions
- MOOCs

WHAT IF EVERYONE ON CAMPUS HAD MATLAB?



More than **1 million students and 700 universities** around the world—including the top 10 ranked universities—have unlimited access to MATLAB and Simulink with a Total Academic Headcount (TAH) license.



HANDS-ON LEARNING

42,000

Faculty and students using MATLAB to program hardware

“On multidisciplinary projects, students with quite different educational backgrounds can work together more easily because they are using the same tools.”

Professor Jakob Stoustrup, Aalborg University



JOB OPPORTUNITIES

82%

Fortune 100 companies with a MATLAB license

“If you want to work at Google, make sure you can use MATLAB.”

Jonathan Rosenberg, Senior Vice President of Products, Google



RESEARCH PRODUCTIVITY

1,970,000

Google Scholar results referencing MATLAB

“Our teams are here to do world-class research, and easy access to MATLAB enables them to be their most productive.”

Shailesh Shenoy, Director of Research Computing, Albert Einstein College of Medicine of Yeshiva University

MATLAB Online Self-paced Training



FREE

MATLAB Onramp

Get started quickly with the basics of MATLAB.

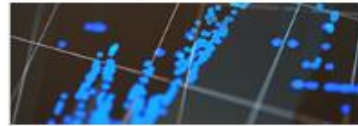


NEW

FREE

Deep Learning Onramp

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



MATLAB for Data Processing and Visualization



Machine Learning with MATLAB



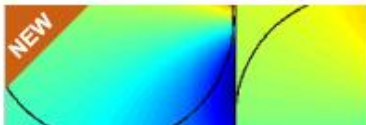
MATLAB Fundamentals



MATLAB Programming Techniques

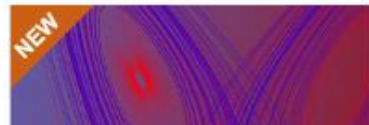


MATLAB for Financial Applications



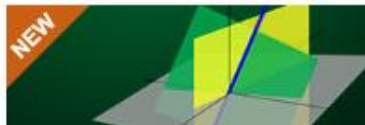
NEW

Solving Nonlinear Equations with MATLAB



NEW

Solving Ordinary Differential Equations with MATLAB



NEW

Introduction to Linear Algebra with MATLAB



NEW

Introduction to Statistical Methods with MATLAB

MATLAB Academic Online Training Suite (MAOTS)

- Includes all MATLAB Online Self-paced Training Courses
- Bundled with University Campus License
- Available to all registered University staff/students
- Access to course completion certificate

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	Z	RAND or RANDN with 'seed' is not recommended. Use RANDI or RANDJ instead.

Upgrade Advisor - sf_climate_control

File Edit Run Settings Help

Find:

Upgrade Project Report

100% Passed

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

Show:

Filename	Result
AnalogControl.mdl	Passed 27 checks
analyzeModelFiles.m	Passed with fixes 3 checks
billOfMaterials.m	Need attention -
checkCodeProblems.m	
DigitalControl.slx	
f14_airframe.slx	
f14_airframe_test.m	
find_top_models.m	
LinearActuator.slx	
NonLinearActuator.mdl	
rebuild_s_functions.m	
runUnitTest.m	
slproject_f14.slx	
upgrade_project.m	
vertical_channel.slx	
wind_gust_lib.slx	

Check model settings for migration to simplified initialization mode [Learn more](#)

Check for model level messages
This check finds and reports model level messages for migrating to simplified initialization mode.

See Also

- Check model settings for migration to simplified initialization mode
- Underspecified initialization detection

Checks run on 02/01/2018 10:44

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.

Result: ✔ Passed

Identify Variant Model blocks at model level.

Passed
No Variant Model blocks found.

MATLAB EXPO 2018

Thank You!

