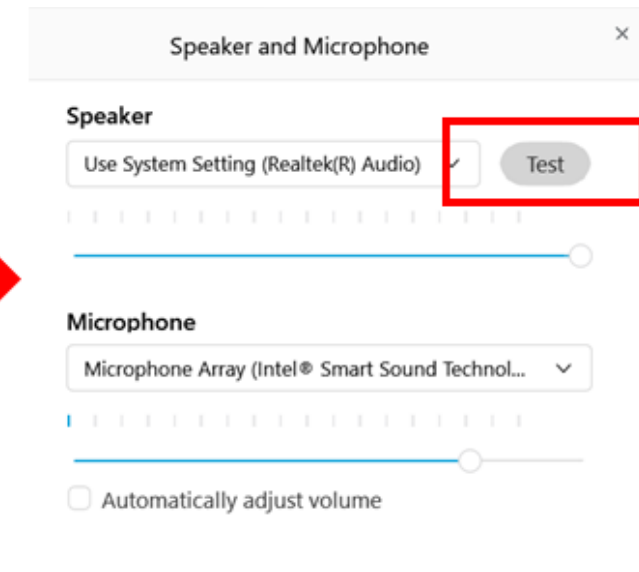
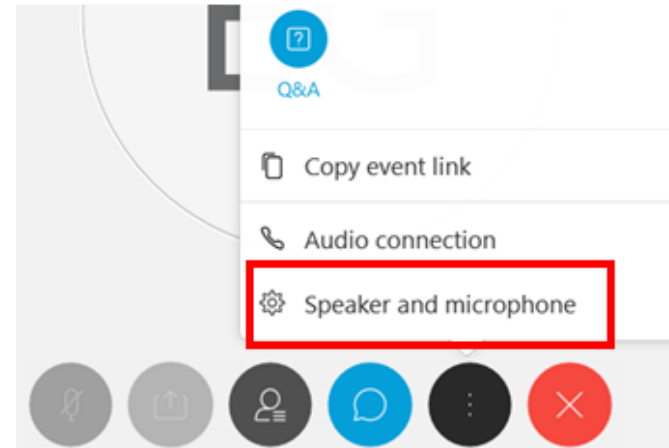


If you are having audio issues, please check your audio configurations or join by phone

To join by phone:

Event number (access code): 714 542 221

Event password: H5Xsg2X2r22



Join the audio conference only

To receive a call back, provide your phone number when you join the event, or call the number below and enter the access code.

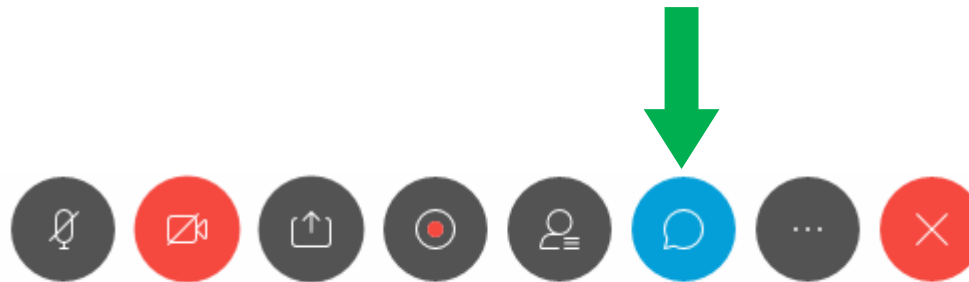
+14043971516 US Toll

8773093457 US Toll Free

[Global call-in numbers](#) | [Toll-free dialing restrictions](#)

If you have questions/participation to the polls

- Please use “**Q&A**” or “**Chat**” and direct your questions to “**Panelists**”
- Please **participate in the polls**, presenter will adjust the presentation to the responses



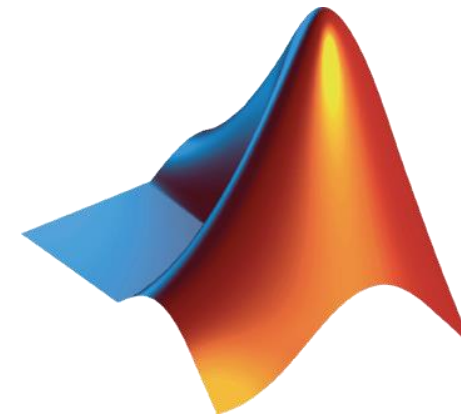
Poll Time



- Have you used MATLAB before?
- Which programming languages do you use?

Data Analysis and Visualization with MATLAB for Beginners

Aycan Hacıoglu, Ph.D. ahaciogl@mathworks.com



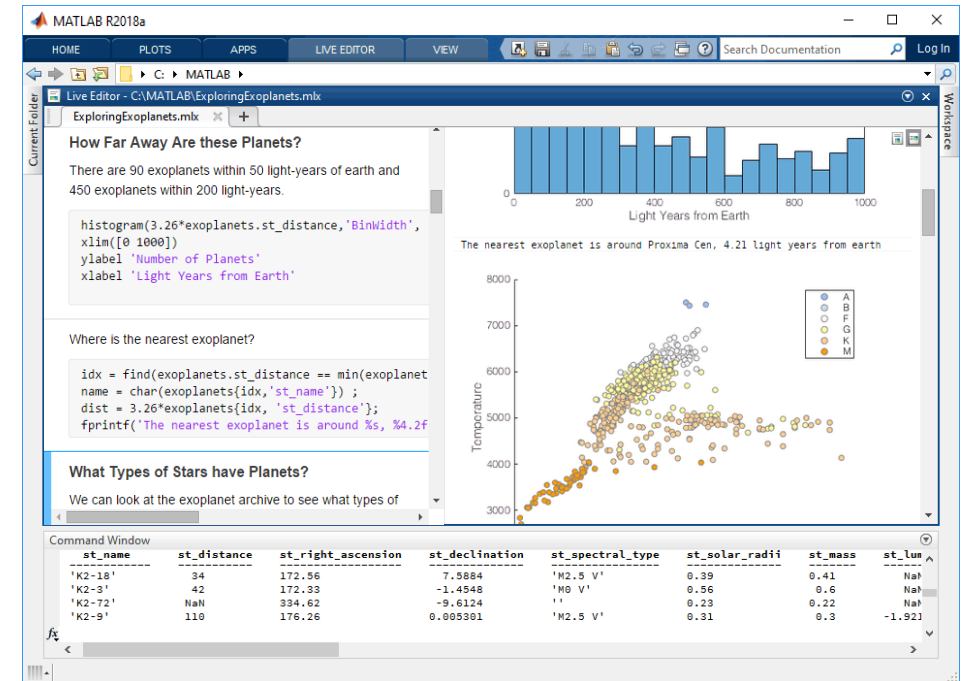
06/18/2020

Core MathWorks Products

MATLAB®

Math. Graphics. Programming.

- Designed for engineers and scientists
- Professionally developed, tested, and documented
- Toolboxes for:
 - Machine learning, data analytics, deep learning, image processing and computer vision, signal processing and communications, computational finance, robotics and control systems
- Interactive apps that automatically generate programs
- Easily scales to clusters, GPUs, and clouds
- Direct deployment to production enterprise applications
- Automatic conversion to embeddable C and CUDA code
- Integrates with Simulink to support Model-Based Design



Core MathWorks Products

SIMULINK®

Simulation and Model-Based Design

Model and simulate your system

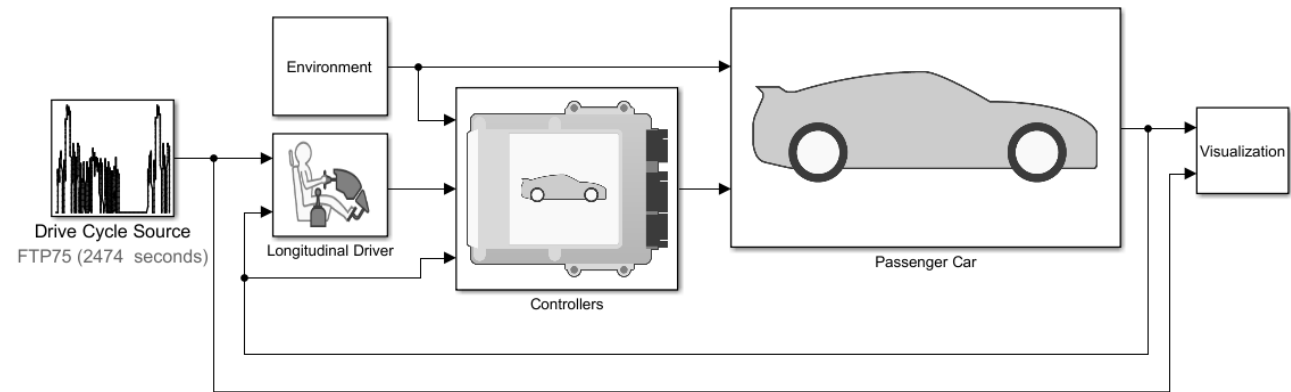
- Use one multi-domain environment
- Model the system under test and the plant
- Simulate closed-loop system behavior

Test early and often

- Test your system under all conditions
- Validate your design with real-time testing
- Trace from requirements to design to code

Automatically generate code

- Generate production-quality C and HDL code
- Deploy directly to embedded processors or FPGA's/ASIC's



BMW Uses Machine Learning to Detect Oversteering

Challenge

Develop automated software for detecting oversteering, an unsafe condition in which rear tires lose their grip during a turn

Solution

Use MATLAB to develop, train, and evaluate a variety of supervised machine learning classifier types, including KNN, SVM, and decision trees

Results

- Oversteering identified with greater than 98% accuracy
- Multiple machine learning classifiers trained automatically
- Code generated and deployed to an ECU for real-time, in-vehicle testing



A BMW M4 oversteering on a test track.

“Working in MATLAB, we developed a supervised machine learning model as a proof of concept. Despite having little previous experience with machine learning, in just three weeks we completed a working ECU prototype capable of detecting oversteering with over 98% accuracy.”

- Tobias Freudling, BMW Group

Where are MathWorks' products used...

<https://www.mathworks.com/solutions.html>

By Capability

Data Acquisition
Data Analysis
Mathematical Modeling
Algorithm Development
Parallel Computing
Desktop and Web Deployment
Machine Learning
System Design and Simulation
Physical Modeling
Discrete-Event Simulation
Rapid Prototyping
Embedded Code Generation
HDL Code Generation and Verification
Verification, Validation, and Test

By Application

Embedded Systems
Control Systems
Digital Signal Processing
Wireless Communications
Image Processing and Computer Vision
Internet of Things
FPGA Design and Codesign
Mechatronics
Test and Measurement
Computational Biology
Computational Finance
Robotics
Data Analytics
Motor and Power Control
Deep Learning

By Industry

Aerospace and Defense
Automotive
Biological Sciences
Biotech and Pharmaceutical
Communications
Electronics
Earth, Ocean, and Atmospheric Sciences
Energy Production
Financial Services
Industrial Automation and Machinery
Medical Devices
Metals, Materials, and Mining
Neuroscience
Railway Systems
Semiconductors
Software and Internet
See More Industries

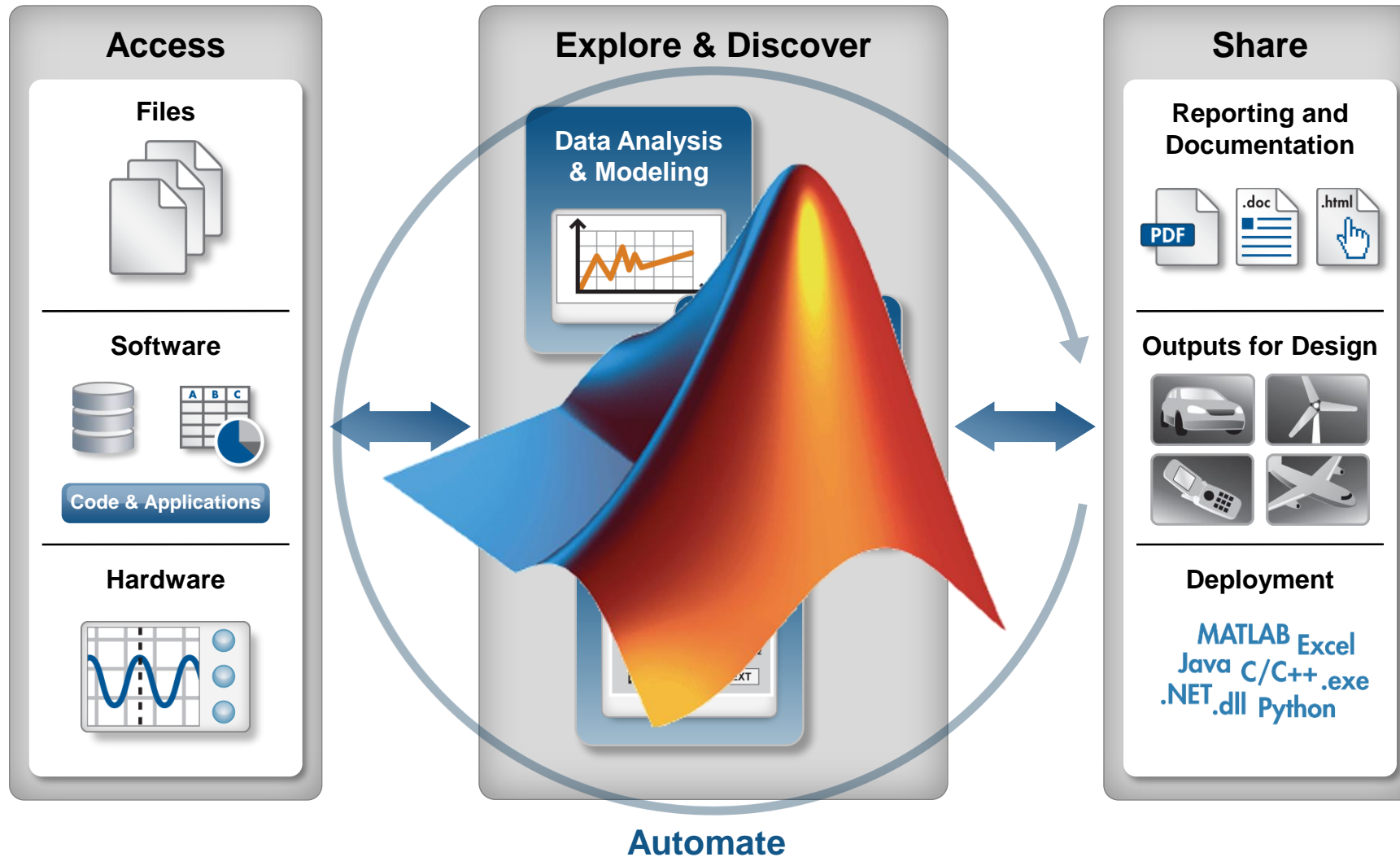
Why MATLAB?

- Easy to use, many resources to support teaching and learning
- Designed for engineers and scientists and widely used
- MATLAB saves time, increases productivity

Agenda

- Data Analysis with MATLAB
- Demo
 - Introduction to MATLAB environment
 - Building analysis routines
 - Creating documentation
 - Building applications
- Resources

Data Analysis Workflow



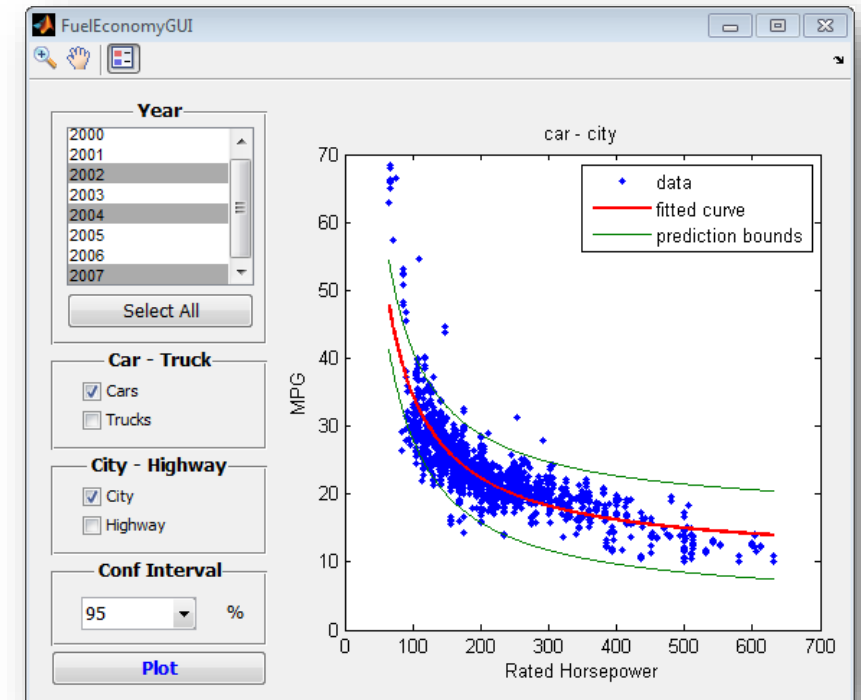
Demo: Fuel Economy

Data Analysis with MATLAB

Products Used

- MATLAB
- Curve Fitting Toolbox

- **Objective:**
 - Study the relationships between fuel economy, horsepower, and type of vehicle
- **Inputs:**
 - Historical fuel economy data for cars manufactured between 2000 and 2012 from Excel
- **Approach:**
 - Access data from Excel
 - Interactively visualize and explore trends
 - Create a model
 - Document results



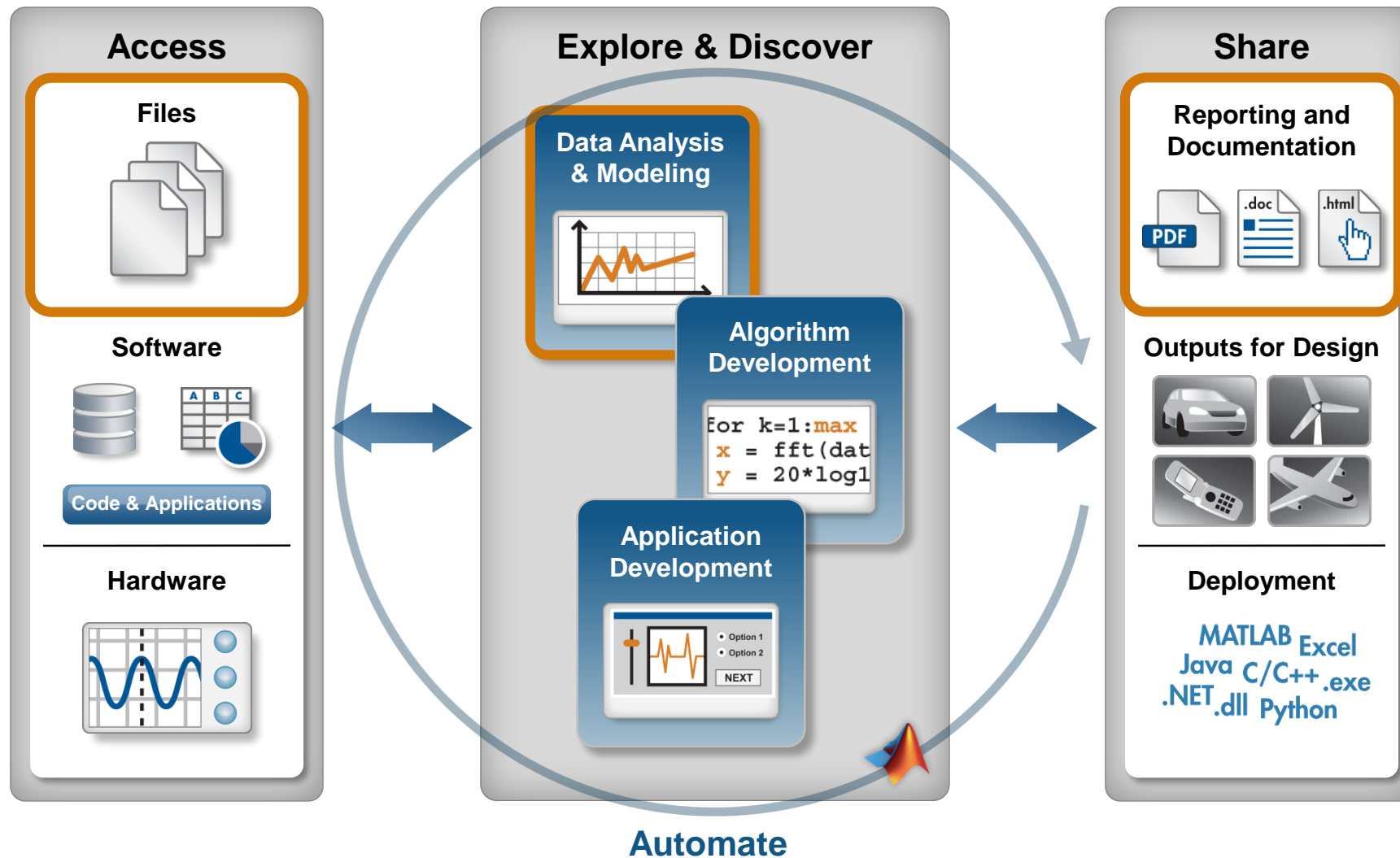
$$MPG = b_1 + b_2/RatedHP$$

Demo Summary

Fuel Economy

Products Used

- MATLAB
- Curve Fitting Toolbox



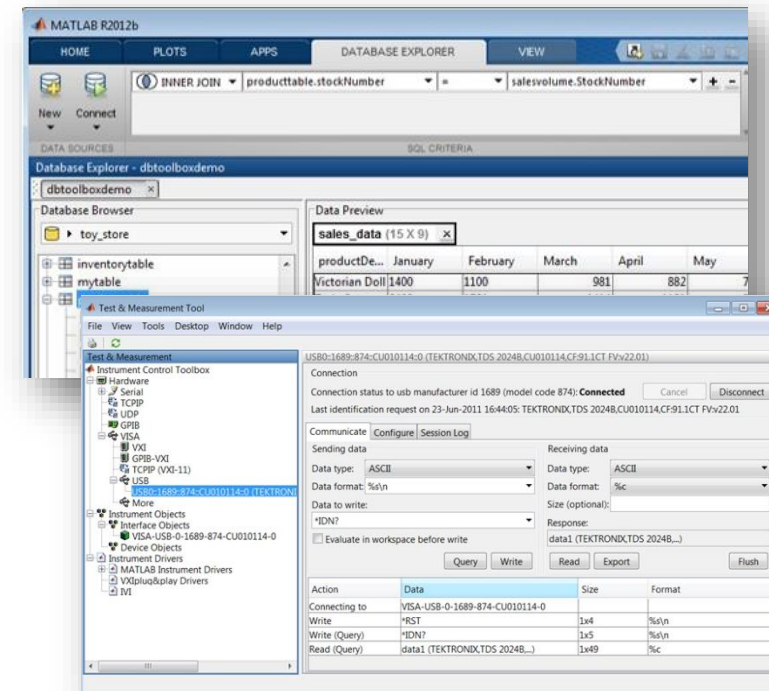
Accessing Data from MATLAB

Access

Explore & Discover

Share

- Files
 - Excel, text, or binary
 - Audio and video, image
 - Scientific formats and XML
- Web Services
 - JSON, CSV, and image data
- Applications and languages
 - C/C++, Java, FORTRAN, Python
 - COM, .NET, shared libraries
 - Databases (*Database Toolbox*)
- Measurement hardware
 - Data acquisition hardware (*Data Acquisition Toolbox*)
 - Stand-alone instruments and devices (*Instrument Control Toolbox*)



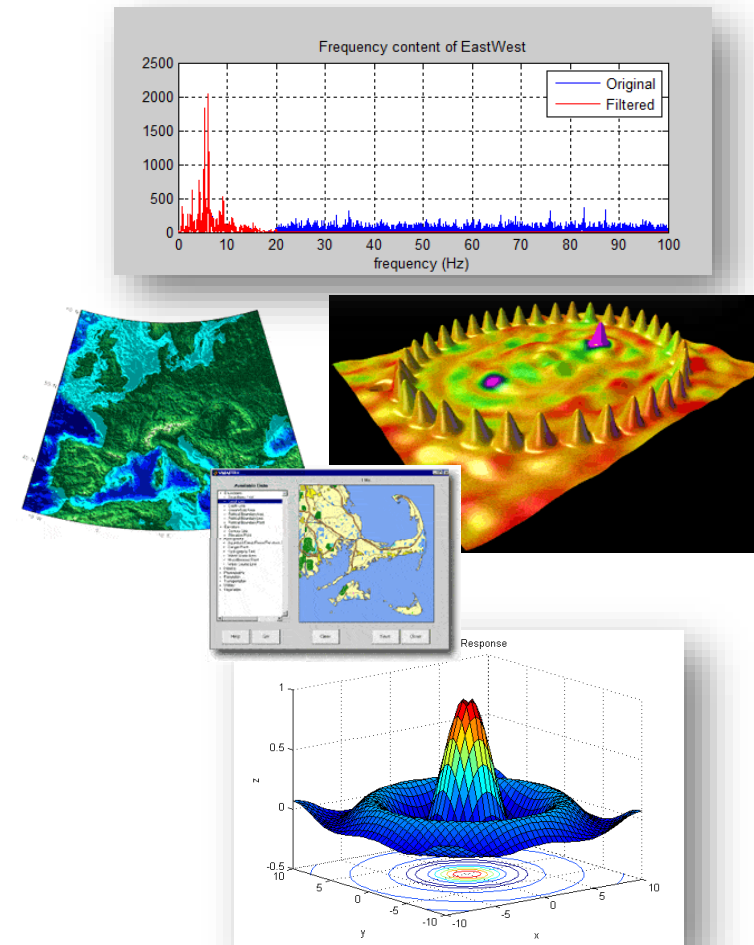
Data Analysis and Visualization in MATLAB

Access

Explore & Discover

Share

- Data analysis
 - Manipulate, preprocess, and manage data
 - Fast, accurate analysis with pre-built math and engineering functions
- Visualization
 - Built in graphics functions for engineering and science (2D, 3D, volume visualization)
 - Interactive tools to annotate and customize graphics



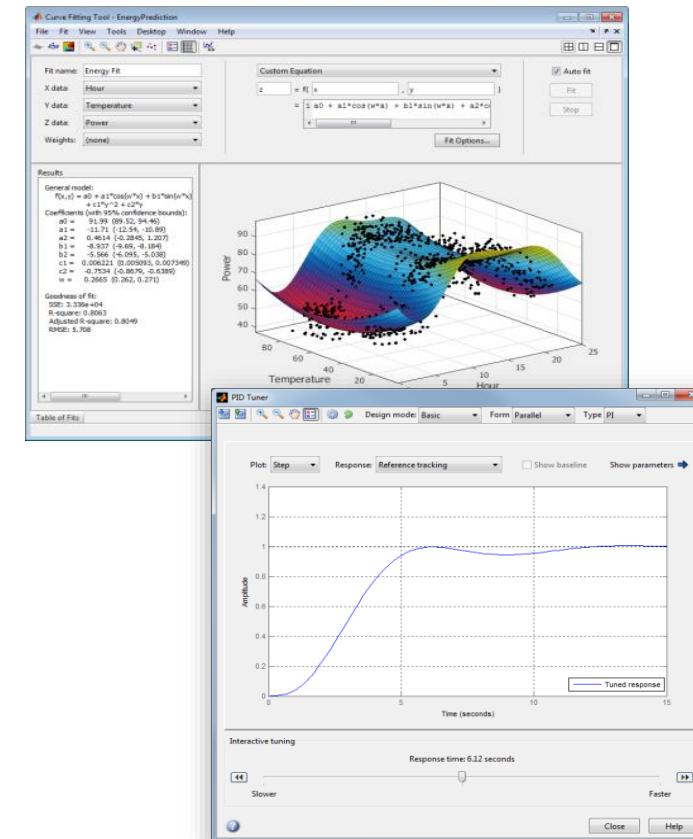
Expanding the Capabilities of MATLAB

Access

Explore & Discover

Share

- MathWorks add-on tools for:
 - Math, statistics, and optimization
 - Control system design and analysis
 - Signal processing and communications
 - Image processing and computer vision
 - Parallel computing and more...
- Partner products provide:
 - Additional interfaces
 - Domain-specific analysis
 - Support for niche applications



Sharing Results from MATLAB

Access

Explore & Discover

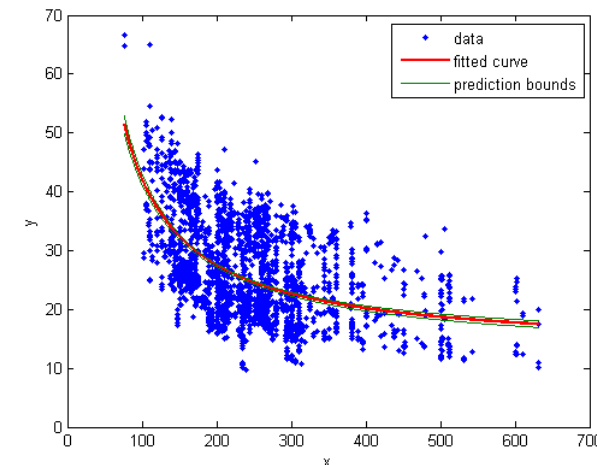
Share

- Automatically generate reports
 - Publish MATLAB files
 - Customize reports using MATLAB Report Generator
- Package as an app
- Deploy applications to other environments

Plot Data and Model

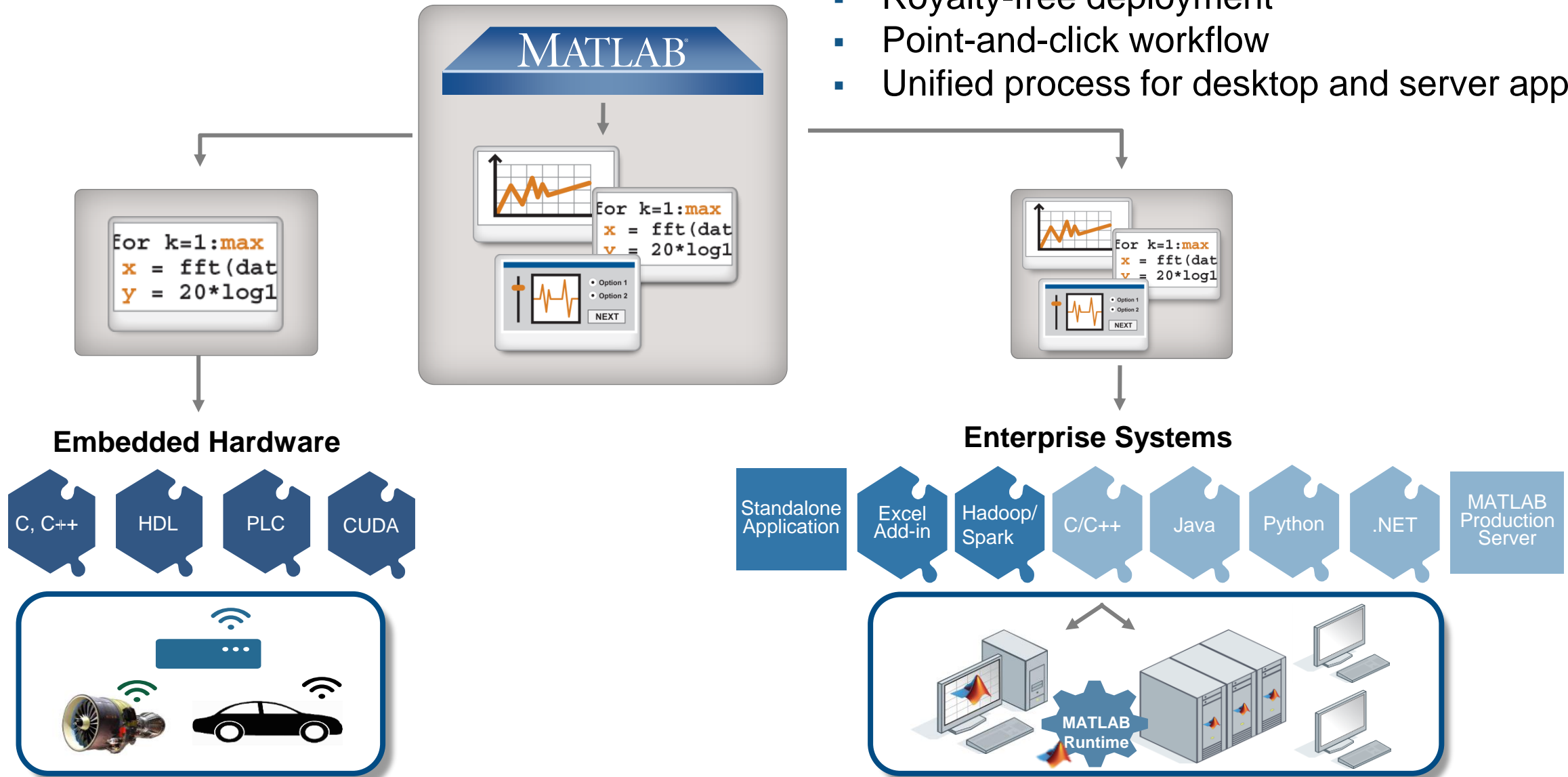
The result from the Curve Fitting Toolbox has a `plot` method for displaying the result graphically. We can choose to display the prediction bounds for the fit.

```
figure;  
hh = plot(cf, 'r', carDataDS.RatedHP, carDataDS.MPG, 'predfunc', 0.95);  
set(hh(2), 'LineWidth', 2);  
set(hh(3:4), 'LineStyle', '-', 'Color', [0 .5 0]);
```

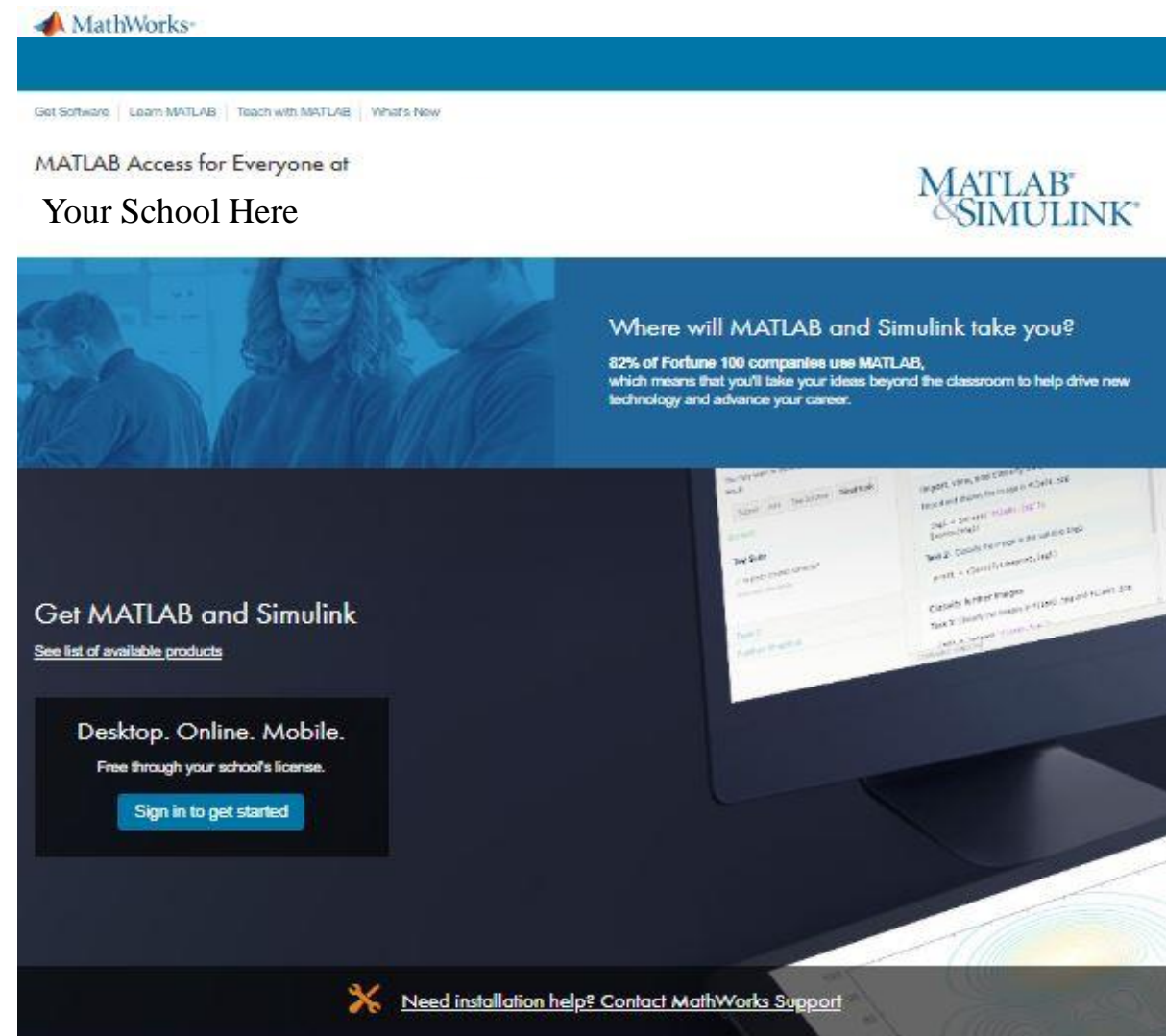


Deployment Highlights

- Royalty-free deployment
- Point-and-click workflow
- Unified process for desktop and server apps



Campus-wide access



The screenshot shows the MathWorks website with a blue header. Below the header is a navigation bar with links: Get Software, Learn MATLAB, Teach with MATLAB, and What's New. The main heading reads "MATLAB Access for Everyone at Your School Here" with the MATLAB & SIMULINK logo to the right. A blue banner features a photo of students and the text: "Where will MATLAB and Simulink take you? 82% of Fortune 100 companies use MATLAB, which means that you'll take your ideas beyond the classroom to help drive new technology and advance your career." Below this, a dark section titled "Get MATLAB and Simulink" includes a link to "See list of available products". A box on the left states "Desktop. Online. Mobile. Free through your school's license." with a "Sign in to get started" button. On the right, a computer monitor displays MATLAB code. At the bottom, a dark bar contains a wrench icon and the text "Need installation help? Contact MathWorks Support".

MathWorks®

Get Software | Learn MATLAB | Teach with MATLAB | What's New


MATLAB Access for Everyone at
Your School Here

MATLAB®
& SIMULINK®

Where will MATLAB and Simulink take you?
82% of Fortune 100 companies use MATLAB,
which means that you'll take your ideas beyond the classroom to help drive new
technology and advance your career.

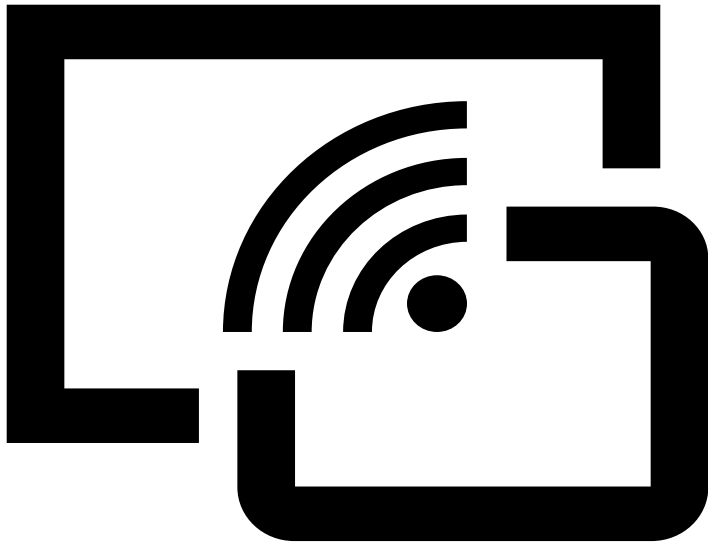
Get MATLAB and Simulink
[See list of available products](#)

Desktop. Online. Mobile.
Free through your school's license.
[Sign in to get started](#)

 [Need installation help? Contact MathWorks Support](#)

Access for universities without campus licenses

If available, access secure connection




For immediate needs, download 30 day trial


MathWorks®


Free MATLAB Trial

Get Started Now with Your Free 30-Day Trial

Join the millions of engineers and scientists who use MATLAB, Simulink, and other add-on products to solve complex design challenges.


Log in or create account


Choose your trial package


Download and install

Are you a student?

Your school may provide MATLAB without the 30-day limitation of a trial.

[Check for campus license](#)

Download Trial Software

*Work or university email

*By clicking 'I agree', I confirm that I will use the products only to evaluate them for possible purchase as an end user.

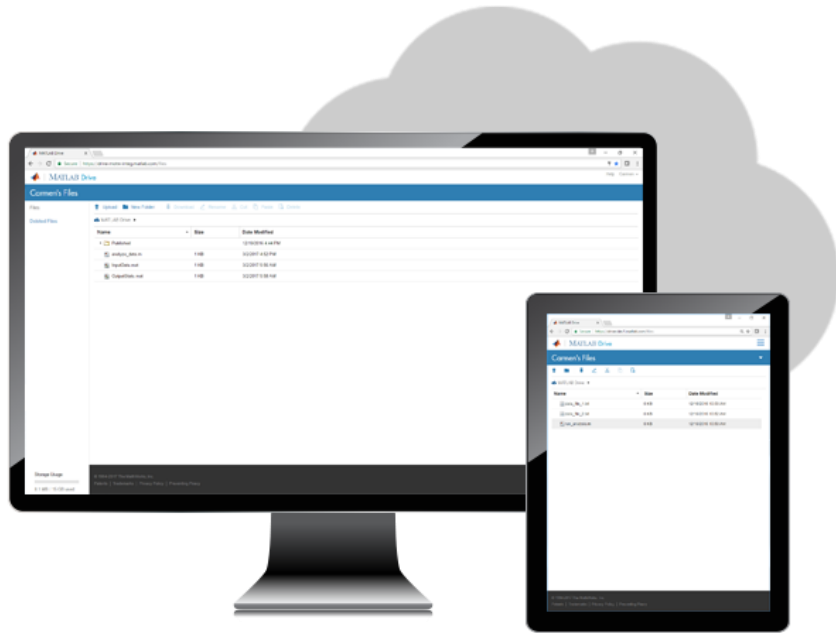
☒ I agree.

[Submit](#)

We will not sell or rent your personal contact information. [See our privacy policy for details.](#)

Convenient, lightweight access directly through the web:
www.mathworks.com/products/matlab-online.html

MATLAB Online



No download or installation required
Always running the latest version



Synchronize across all devices

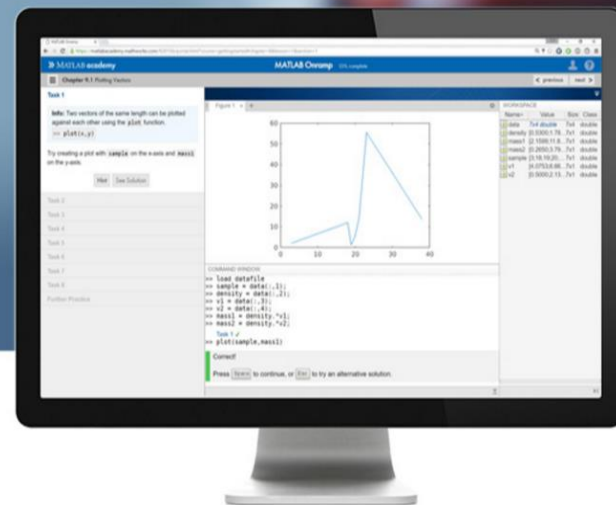
Self-paced courses



Products Solutions Academia Support Community Events Company

MATLAB Academy

Search MathWorks.com



Learn MATLAB for Free

Launch MATLAB Onramp now

FREE COURSES (2-3 hours)

- ★ MATLAB Onramp
- ★ Simulink Onramp
- Stateflow Onramp
- Deep Learning Onramp
- Machine Learning Onramp

FOCUSED COURSES (17-21 hours)

FOUNDATIONAL COURSES

- MATLAB Fundamentals
- MATLAB Programming Techniques
- MATLAB for Financial Applications
- MATLAB for Data Processing and Viz
- Machine Learning with MATLAB
- Deep Learning with MATLAB

COMPUTATIONAL MATH COURSES

- Introduction to Linear Algebra
- Solving Ordinary Differential Equations
- Introduction to Statistical Methods
- Solving Non-Linear Equations
- Introduction to Symbolic Math

<https://matlabacademy.mathworks.com/>

Teaching with MATLAB

Engage your students and scale your instruction with online learning tools from MathWorks

Launch the course



Access to MATLAB through your web browser



MATLAB integrated file sharing

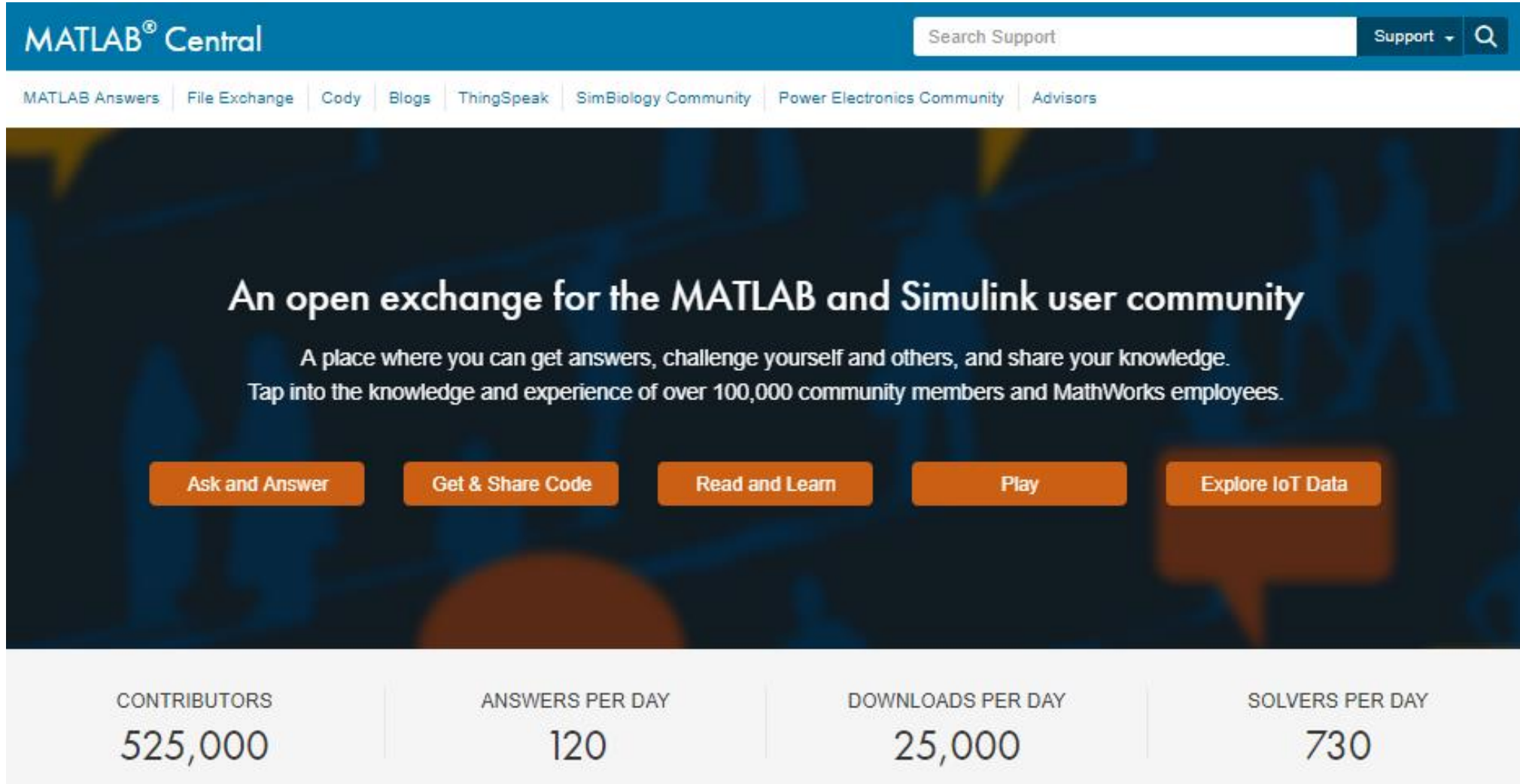


Hands-on exercises with automated assessments and feedback



Ready-to-use resources to enhance your instruction

MATLAB Central

The image shows the MATLAB Central homepage. At the top is a blue header with the MATLAB Central logo on the left, a search bar labeled "Search Support" in the center, and a "Support" dropdown menu with a magnifying glass icon on the right. Below the header is a navigation bar with links to "MATLAB Answers", "File Exchange", "Cody", "Blogs", "ThingSpeak", "SimBiology Community", "Power Electronics Community", and "Advisors". The main content area has a dark blue background with a pattern of faint MATLAB logos. It features a large white heading "An open exchange for the MATLAB and Simulink user community", followed by two lines of white text: "A place where you can get answers, challenge yourself and others, and share your knowledge." and "Tap into the knowledge and experience of over 100,000 community members and MathWorks employees." Below this text are five orange buttons with white text: "Ask and Answer", "Get & Share Code", "Read and Learn", "Play", and "Explore IoT Data". At the bottom is a white section with four columns, each containing a label and a large number: "CONTRIBUTORS 525,000", "ANSWERS PER DAY 120", "DOWNLOADS PER DAY 25,000", and "SOLVERS PER DAY 730".

MATLAB® Central

Search Support Support

MATLAB Answers File Exchange Cody Blogs ThingSpeak SimBiology Community Power Electronics Community Advisors

An open exchange for the MATLAB and Simulink user community

A place where you can get answers, challenge yourself and others, and share your knowledge.
Tap into the knowledge and experience of over 100,000 community members and MathWorks employees.

Ask and Answer Get & Share Code Read and Learn Play Explore IoT Data

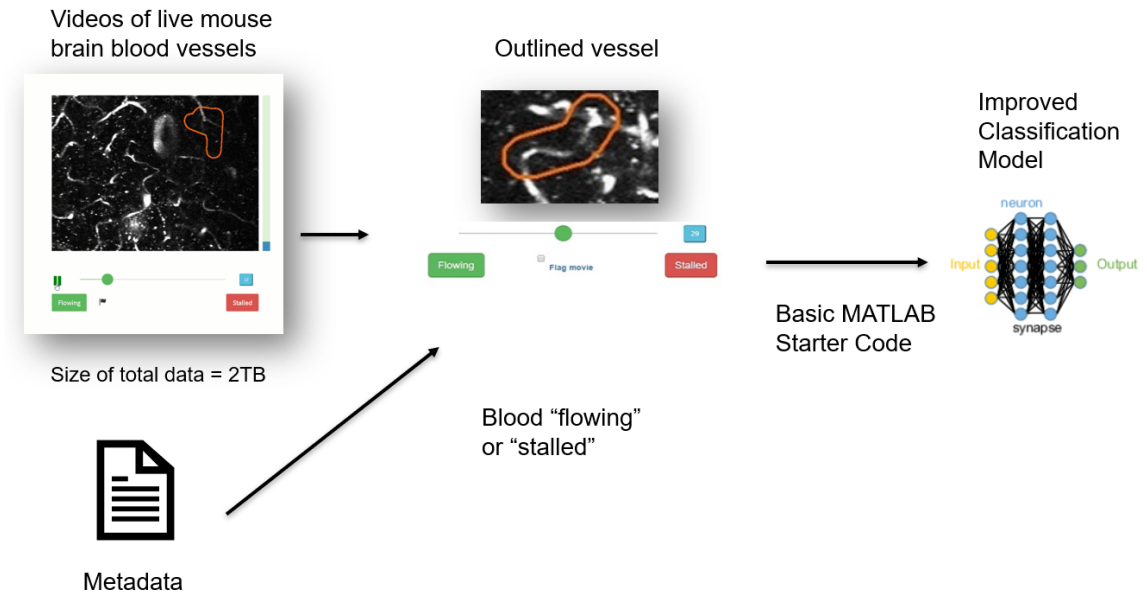
| | | | |
|--------------|-----------------|-------------------|-----------------|
| CONTRIBUTORS | ANSWERS PER DAY | DOWNLOADS PER DAY | SOLVERS PER DAY |
| 525,000 | 120 | 25,000 | 730 |

What if I need help?

- Explore product pages and documentation
- Leverage the MATLAB user community
- Contact Technical Support, Customer Success Engineer, or Account Manager

Advance Alzheimer's Research Data Science Challenge

- Online data science competition hosted by [DrivenData](https://www.drivendata.org) and supported by MathWorks
- No Eligibility Criteria
 - Open to students, professors, employers and at-home
 - Participate Individually or in a Team
 - Submit multiple entries
 - Online and around the globe
- Prizes worth \$10K
- MathWorks support:
 - [MATLAB benchmark code](#)
 - [Complimentary licenses](#)
 - [Technical assistance](#)



Open to all until **August 3, 2020**

Register at : <https://www.drivendata.org/competitions/65/clog-loss-alzheimers-research/>

Summary

- Easy to use, many resources to support teaching and learning
- Designed for engineers and scientists and widely used
- MATLAB saves time, increases productivity

Poll Time



- For which applications are you using/planning to use MATLAB?
- How do you access MATLAB?

MathWorks Customer Success Engineers education@mathworks.com

consult with faculty and researchers to support them with their STEM initiatives,
including integrating computational or systems thinking into their curriculum.



