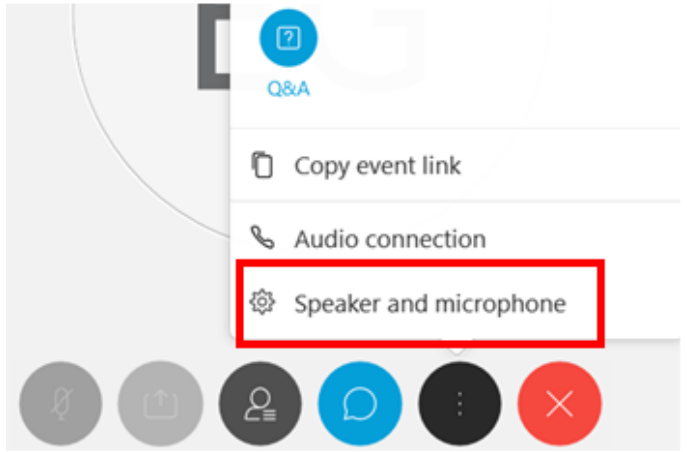
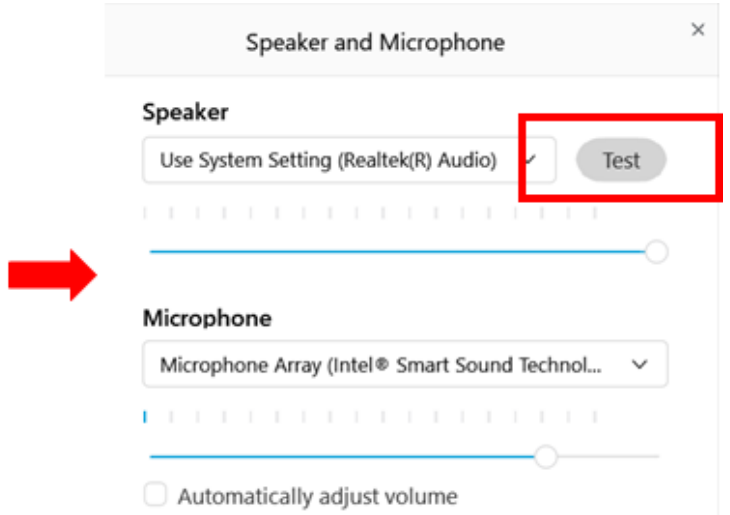
If you are having audio issues, please check your audio configurations or join by phone

To join by phone:

Event number (access code): 714 542 221

Event password: H5Xsg2X2r22



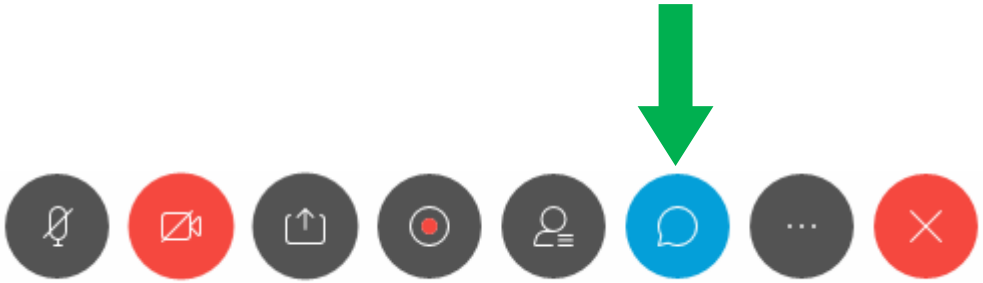


Join the audio conference only

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

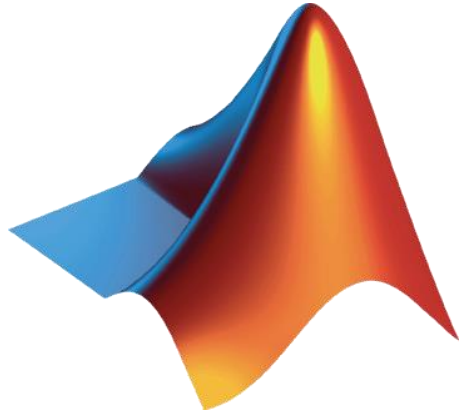


Poll Time

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

Data Analysis and Visualization with MATLAB for Beginners

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



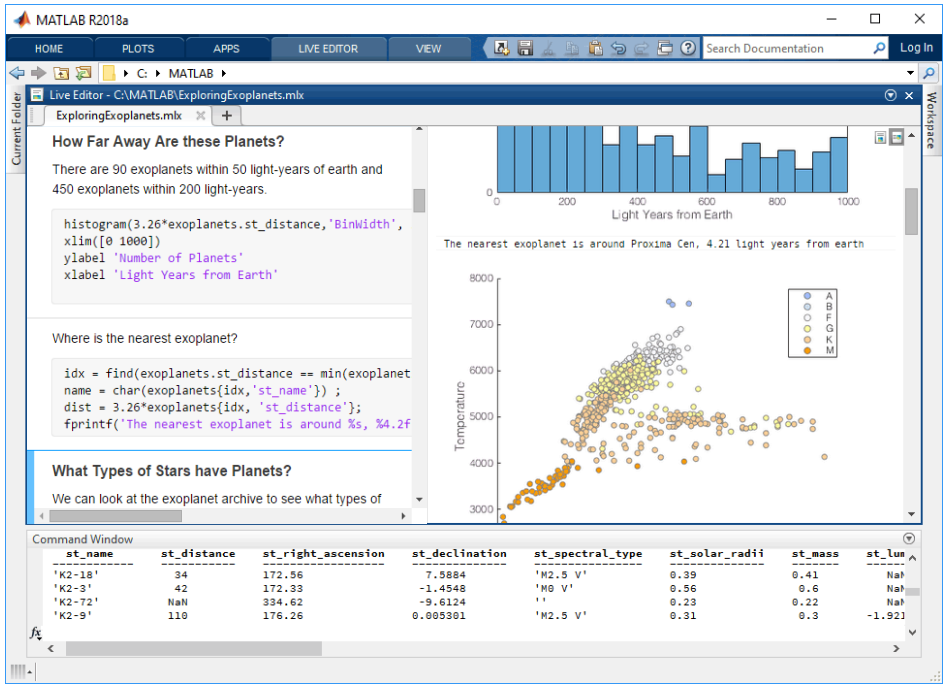
06/18/2020

Core MathWorks Products

MATLAB®

Math. Graphics. Programming.

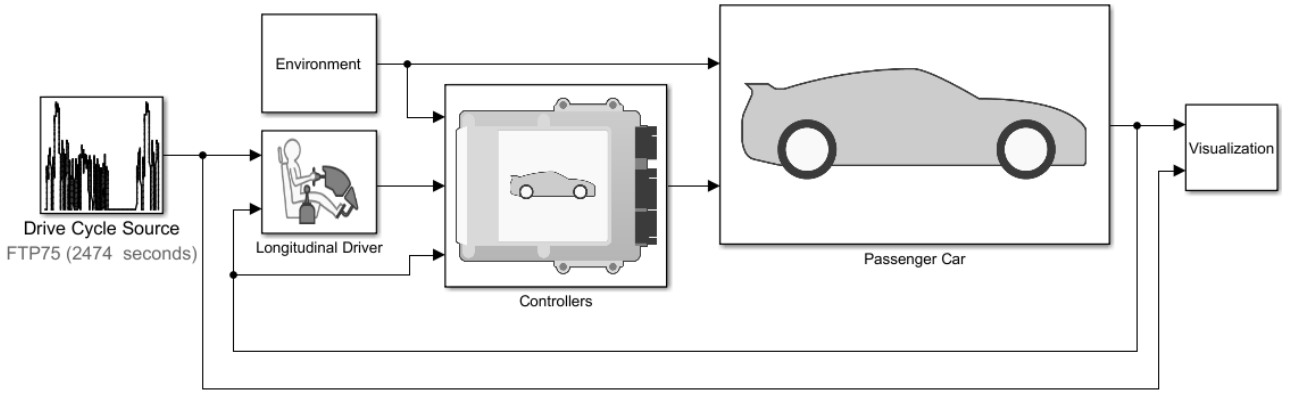
- Designed for engineers and scientists
- Professionally developed, tested, and documented
- Toolboxes for:
  - Machine learning, data analytics, deep learning, image processing and computer vision, signal processing and communications, computational finance, robotics and control systems
- Interactive 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

Link to article

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?

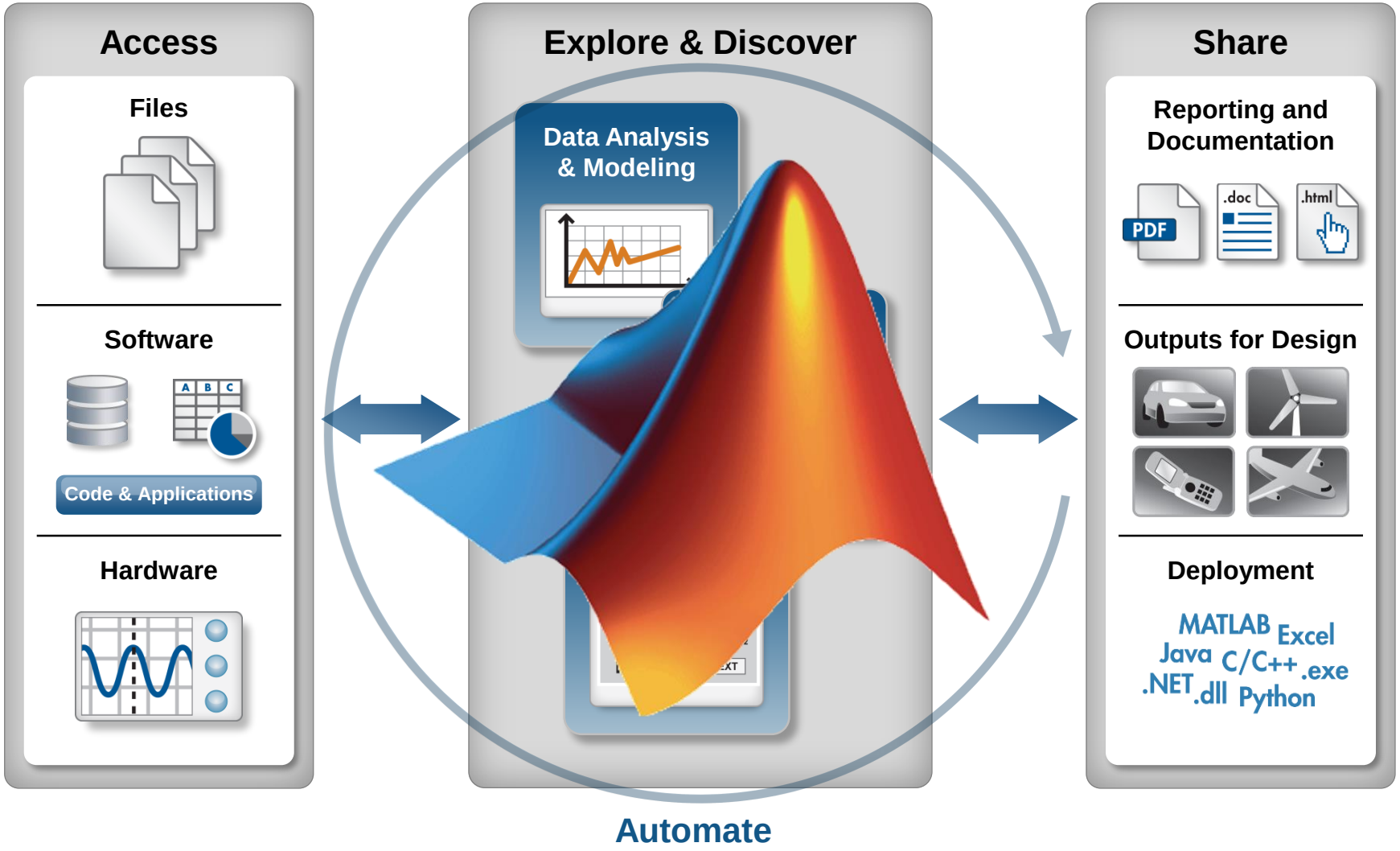
- Easy to use, many resources to support teaching and learning
- Designed for engineers and scientists and widely used
- MATLAB saves time, increases productivity

Agenda

- Data Analysis with MATLAB

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

Data Analysis Workflow

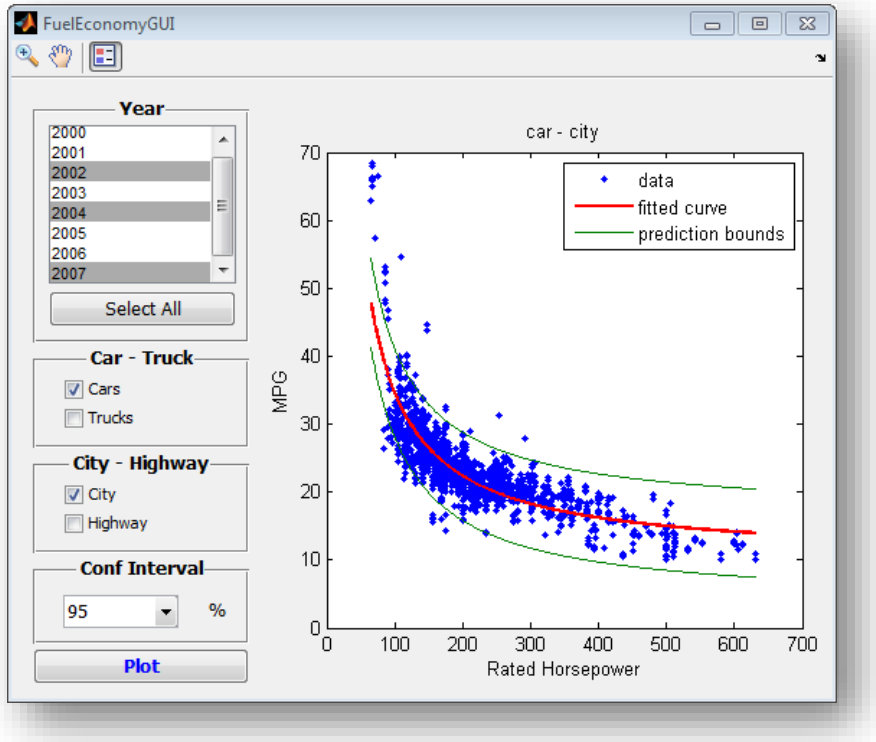


Demo: Fuel Economy

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

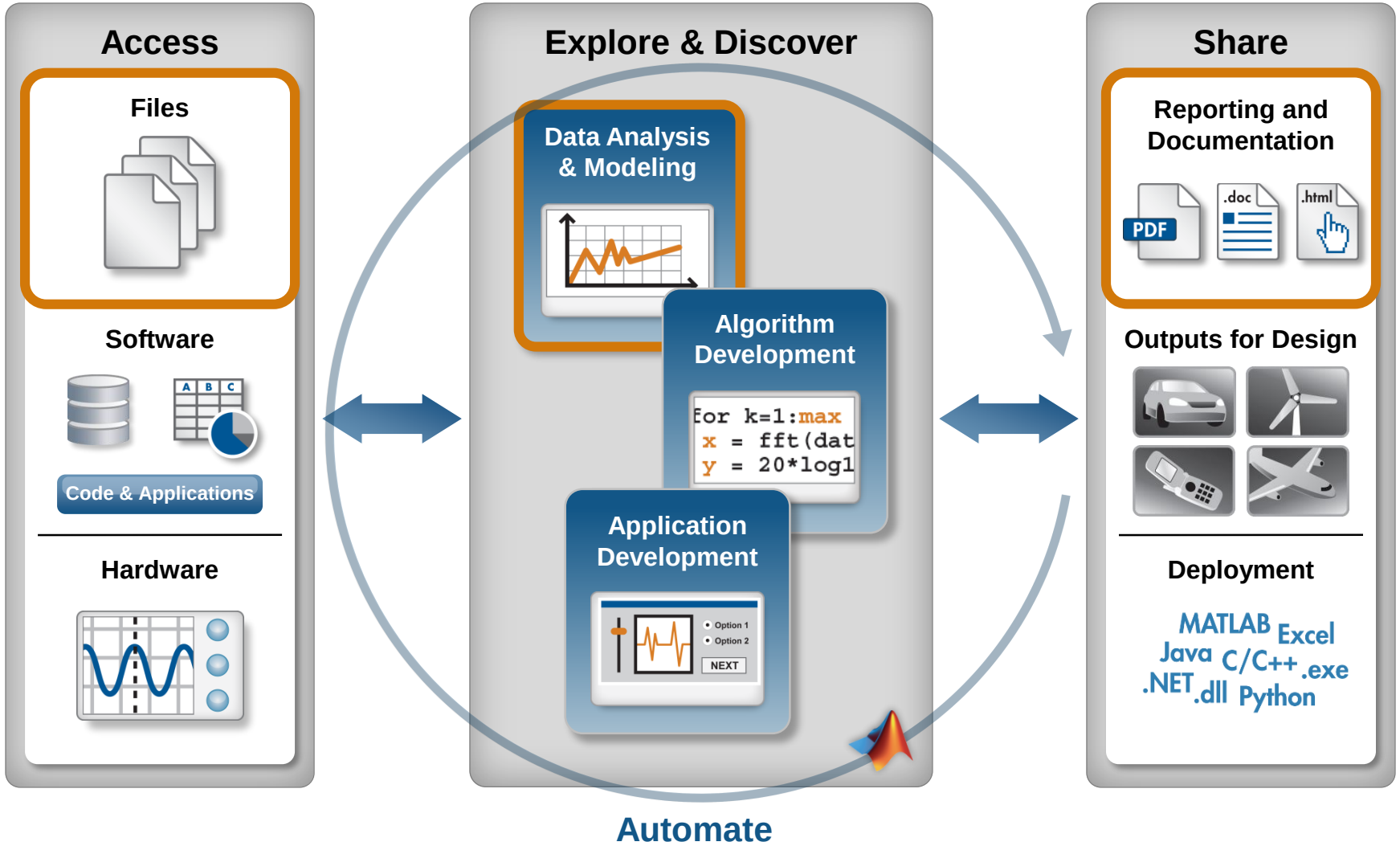


$$MPG = b_1 + b_2/RatedHP$$

Demo Summary

Fuel Economy

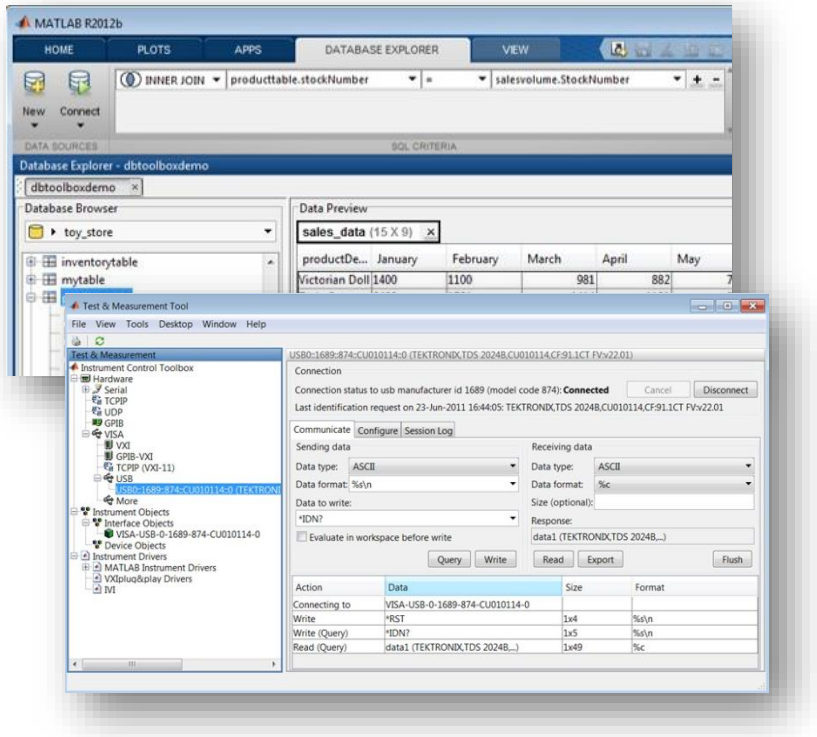
Products Used
- MATLAB
- Curve Fitting Toolbox



Accessing Data from MATLAB

Access | Explore & Discover | Share

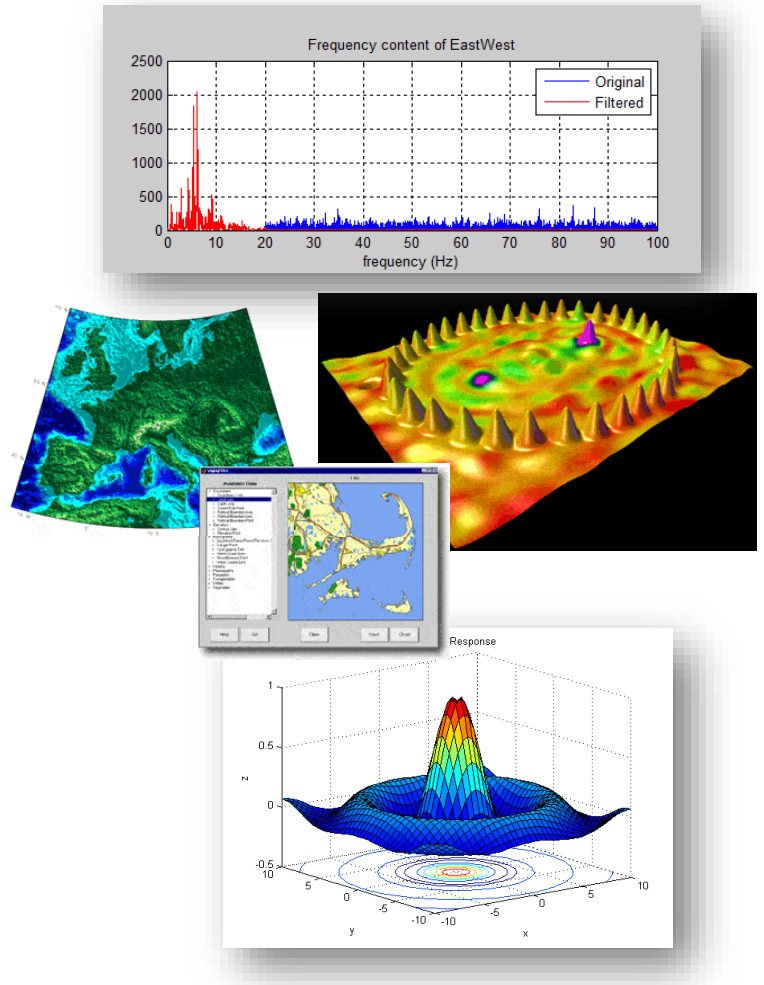
- Files
  - Excel, text, or binary
  - Audio and video, image
  - Scientific formats and XML
- Web Services
  - JSON, CSV, and image data
- Applications and languages
  - C/C++, Java, FORTRAN, Python
  - COM, .NET, shared libraries
  - Databases (*Database Toolbox*)
- Measurement hardware
  - Data acquisition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



Data Analysis and Visualization in MATLAB

Access | **Explore & Discover** | Share

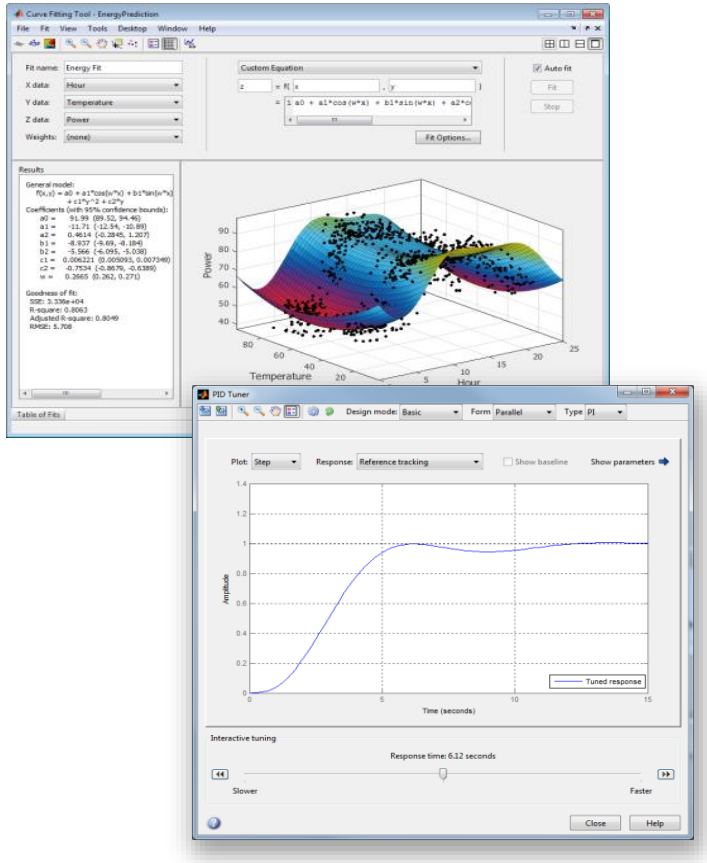
- Data analysis
  - Manipulate, preprocess, and manage data
  - Fast, accurate analysis with pre-built math and engineering functions
- Visualization
  - Built in graphics functions for engineering and science (2D, 3D, volume visualization)
  - Interactive tools to annotate and customize graphics



Expanding the Capabilities of MATLAB

Access **Explore & Discover** Share

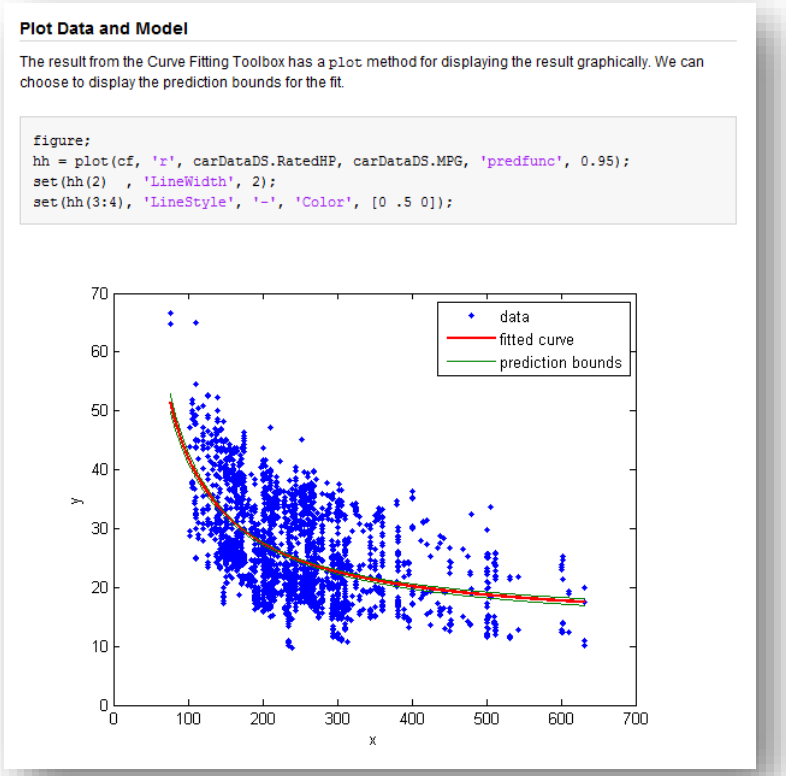
- MathWorks add-on tools for:
  - Math, statistics, and optimization
  - Control system design and analysis
  - Signal processing and communications
  - Image processing and computer vision
  - Parallel computing and more…
- Partner products provide:
  - Additional interfaces
  - Domain-specific analysis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



Sharing Results from MATLAB

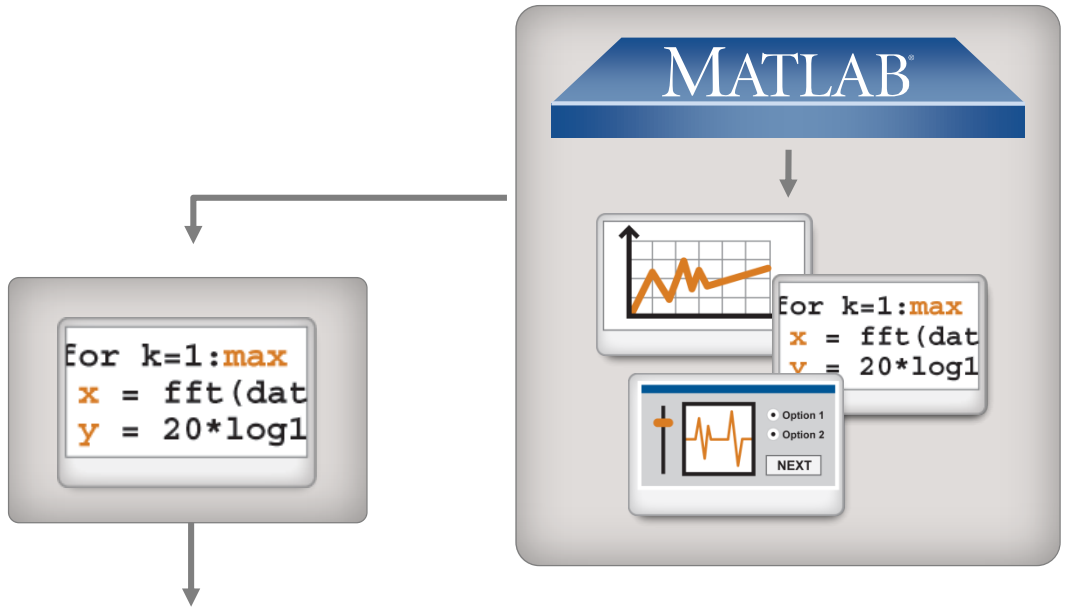
Access | Explore & Discover | **Share**

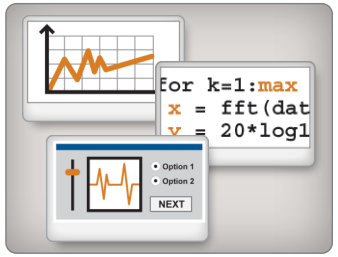
- Automatically generate reports
  - Publish MATLAB files
  - Customize reports using MATLAB Report Generator
- Package as an app
- Deploy applications to other environments



Deployment Highlights

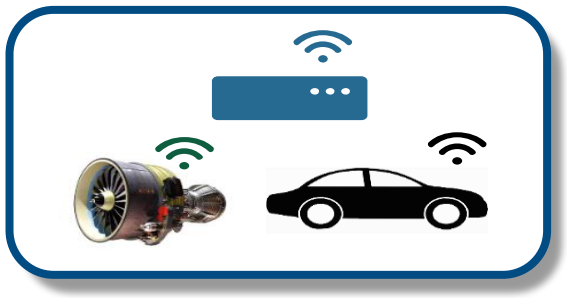
- Royalty-free deployment
- Point-and-click workflow
- Unified process for desktop and server apps





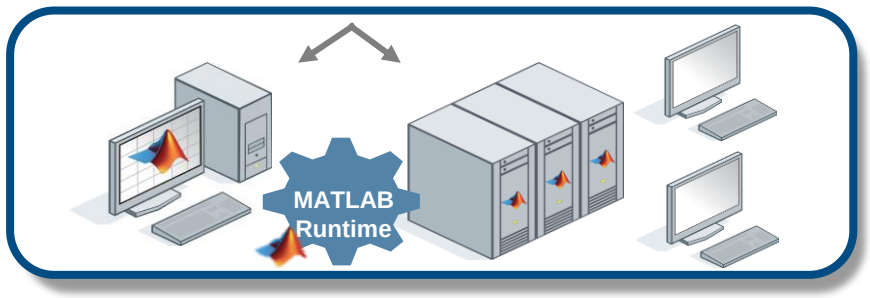
Embedded Hardware

C, C++ | HDL | PLC | CUDA

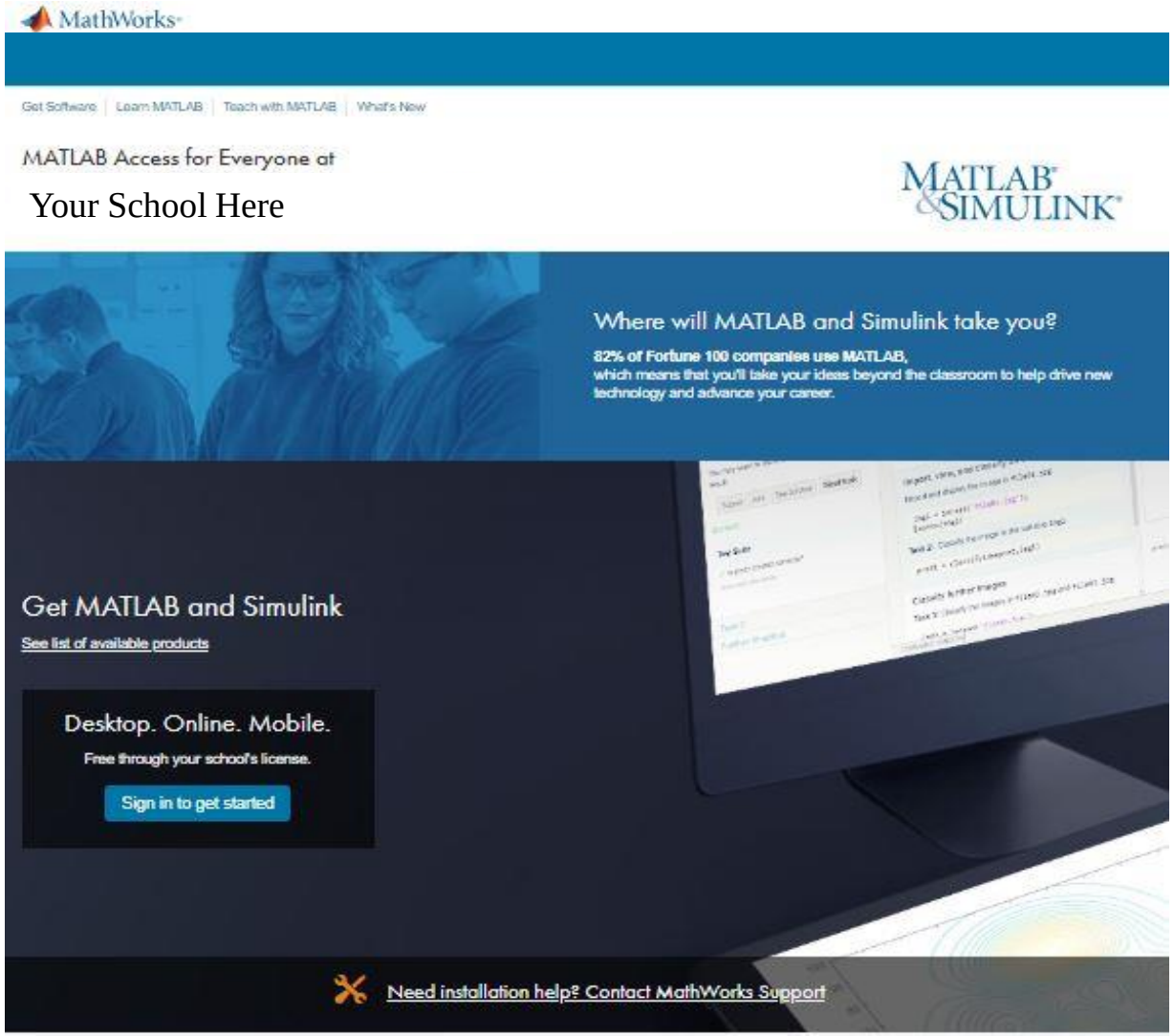


Enterprise Systems

Standalone Application | Excel Add-in | Hadoop/ Spark | C/C++ | Java | Python | .NET | MATLAB Production Server



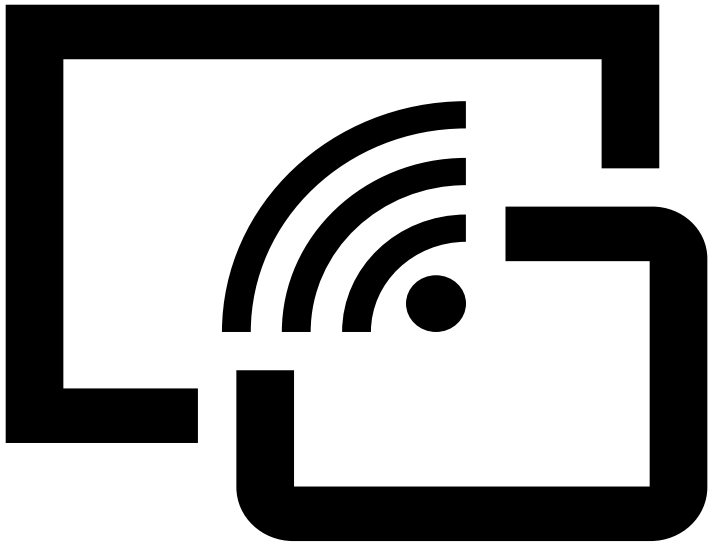
Campus-wide access



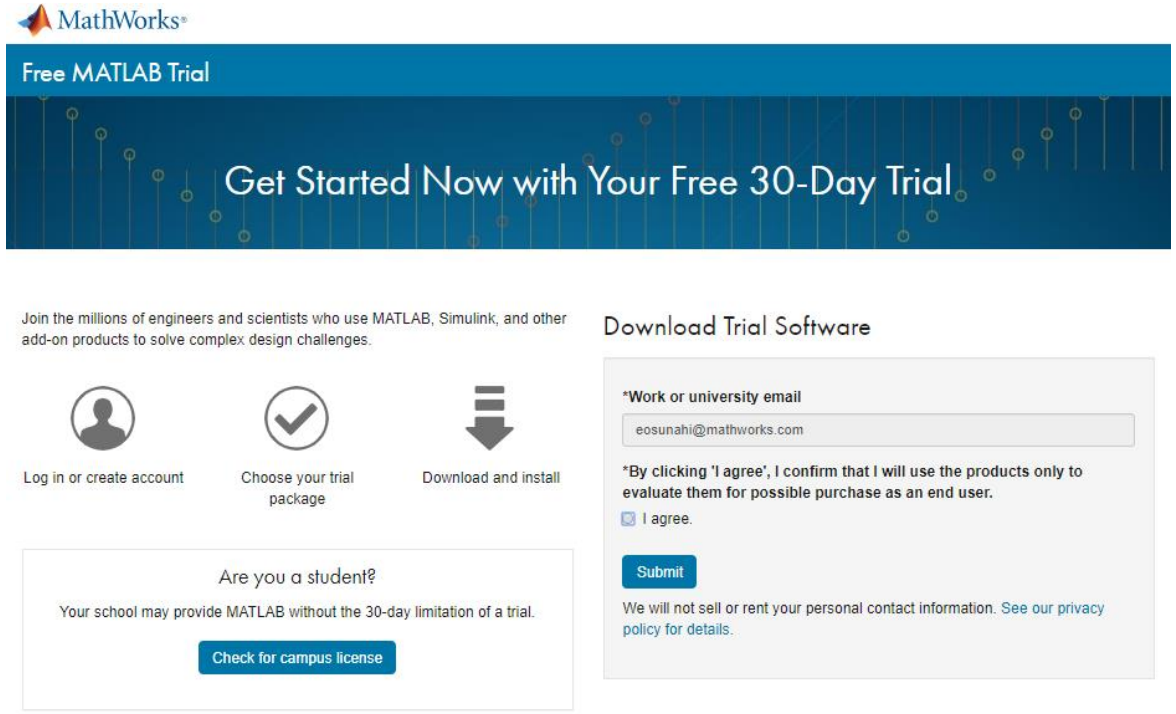
www.mathworks.com/products/matlab-campus.html

Access for universities without campus licenses

If available, access secure connection

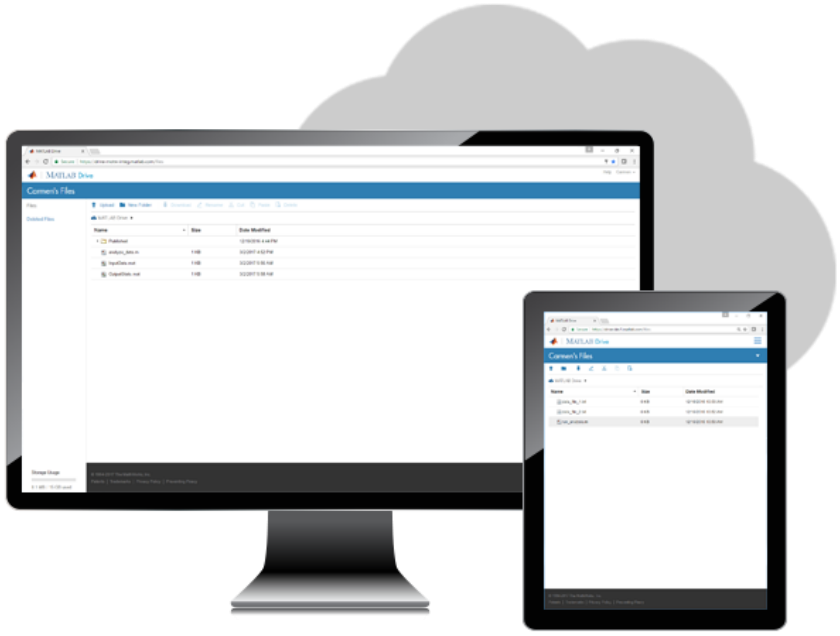


For immediate needs, download 30 day trial



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

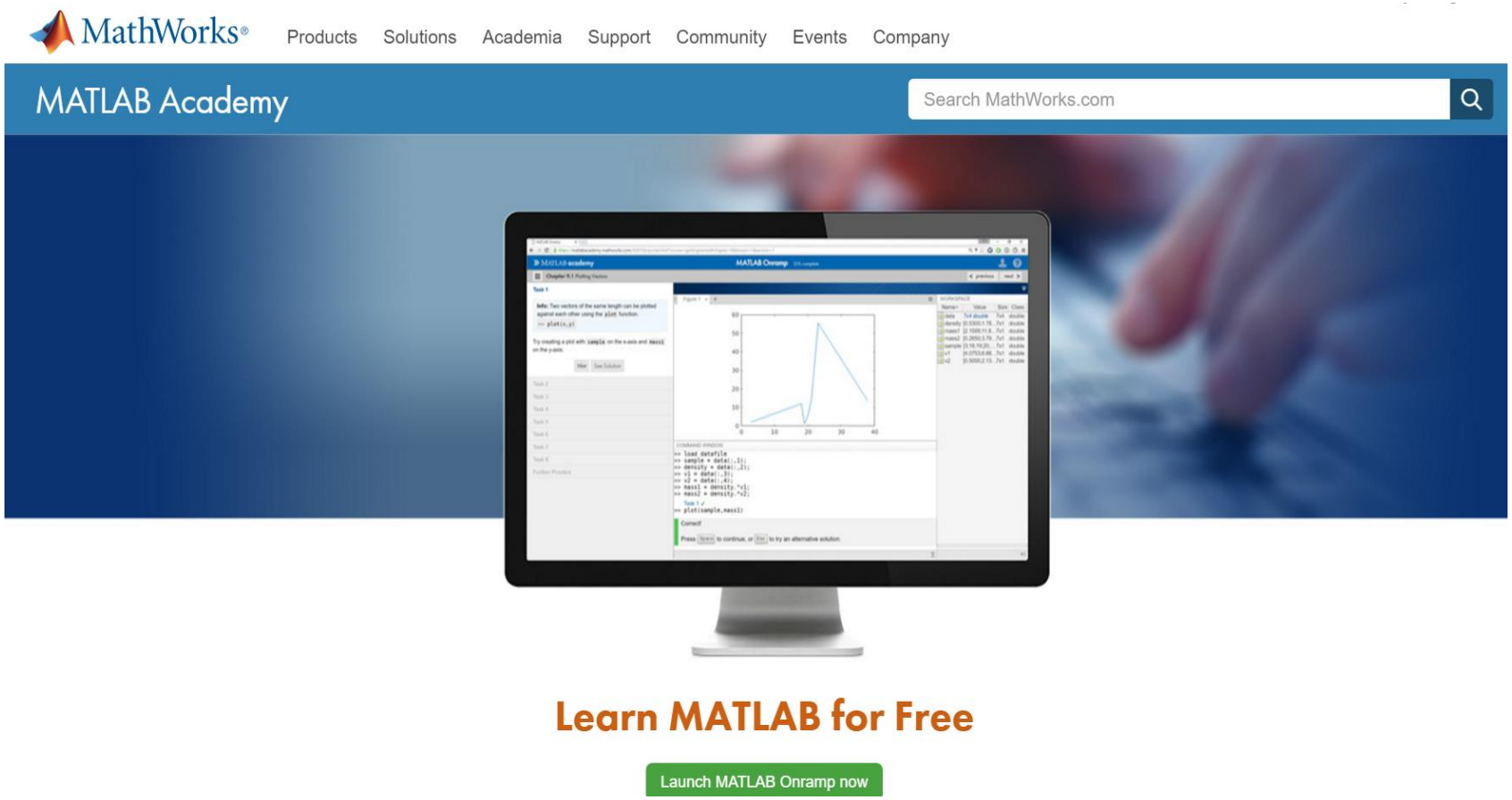
MATLAB Online



No download or installation required
Always running the latest version

Synchronize across all devices

Self-paced courses



https://matlabacademy.mathworks.com/

FREE COURSES (2-3 hours)

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

FOCUSED COURSES (17-21 hours)

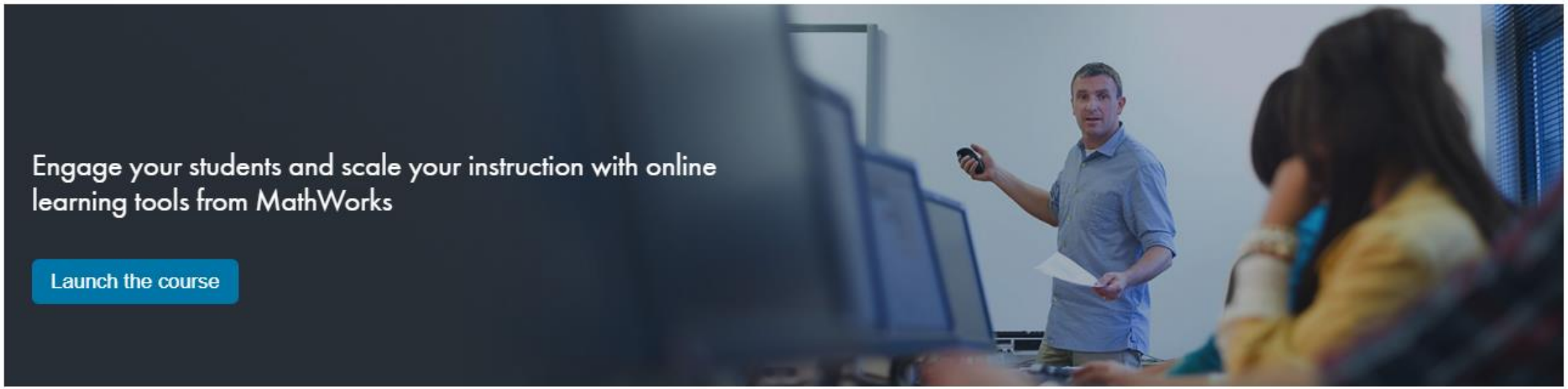
FOUNDATIONAL COURSES

- 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

Teaching with MATLAB



Access to MATLAB through your web browser

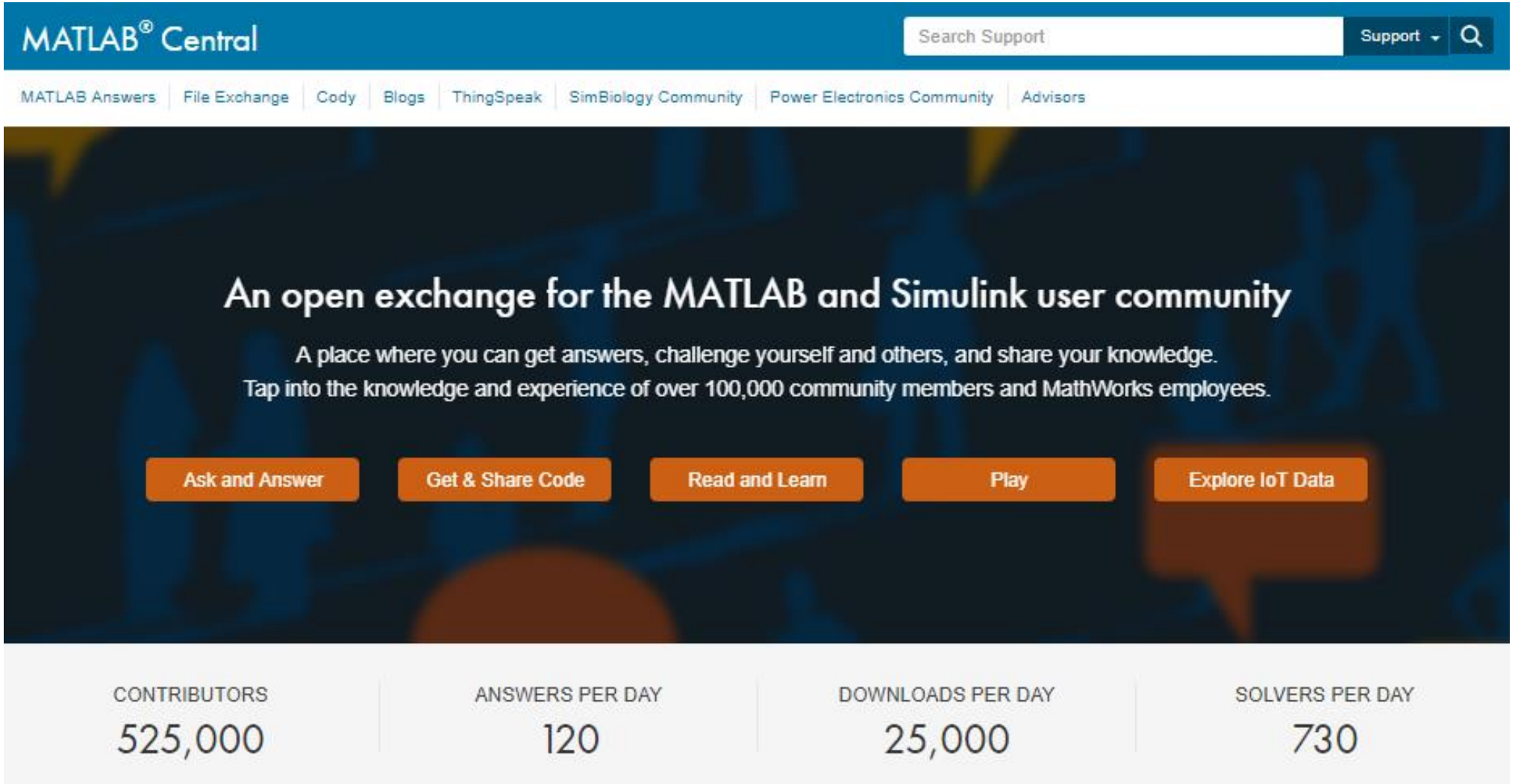
MATLAB integrated file sharing

Hands-on exercises with automated assessments and feedback

Ready-to-use resources to enhance your instruction

Get started: https://www.mathworks.com/learn/teaching-with-matlab.html

MATLAB Central

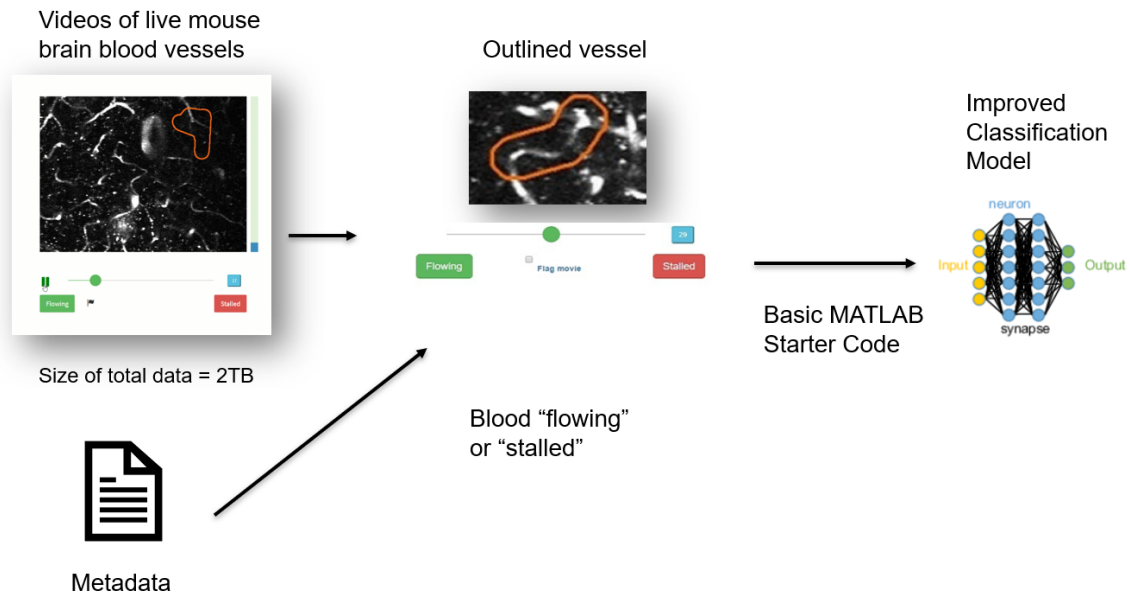


What if I need help?

- 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 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.