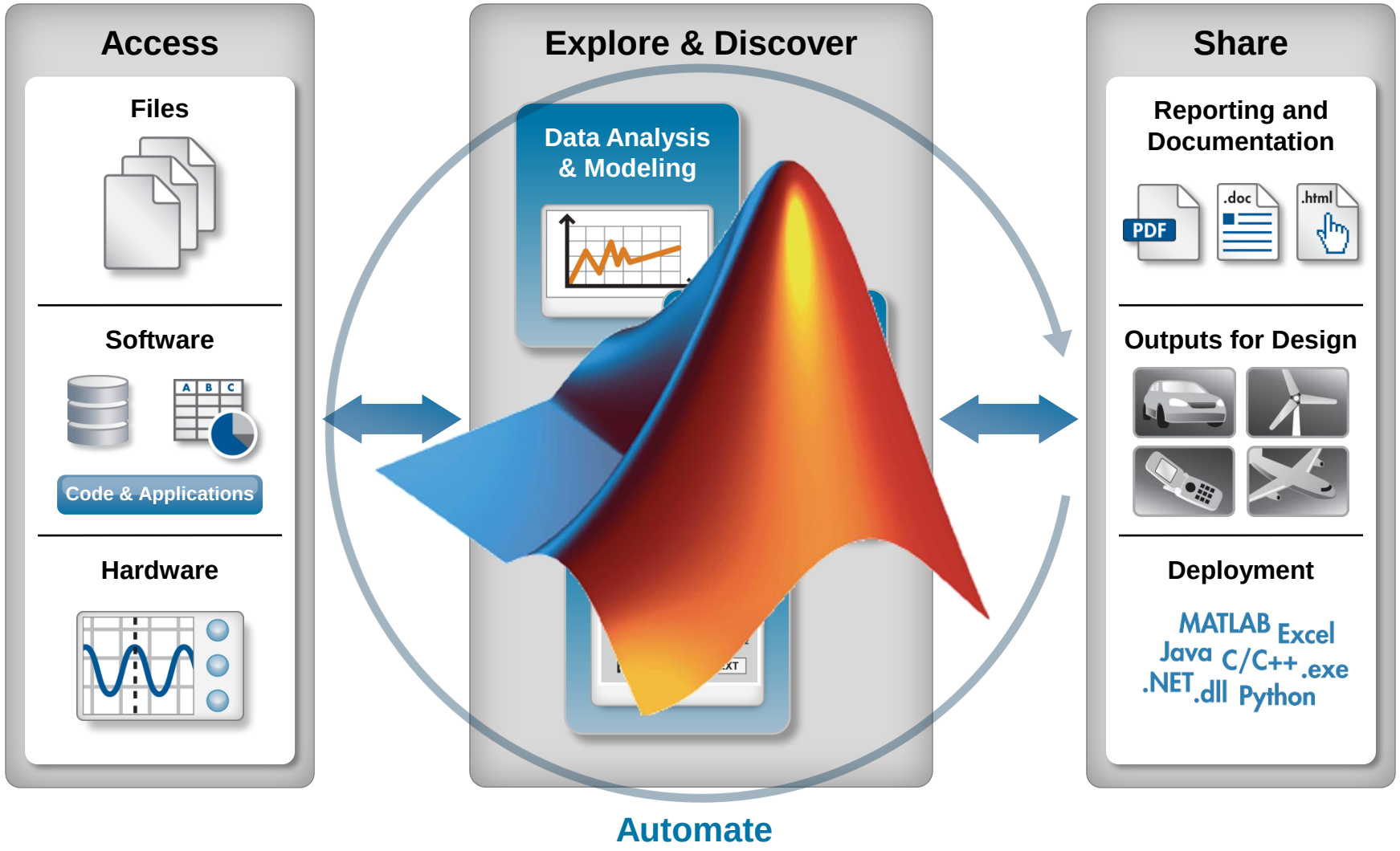
Introduction to MATLAB: Low Code Data Analysis

Armando Garcia

Customer Success Engineer

- **Low Code Data Analysis**
- **Demo –Flight Sensor Data**
  - ✓ **Import → Clean → Model → Share**
- **Learning Resources**

MATLAB simplifies the data analysis workflow with low code tools



What are “low code” tools?

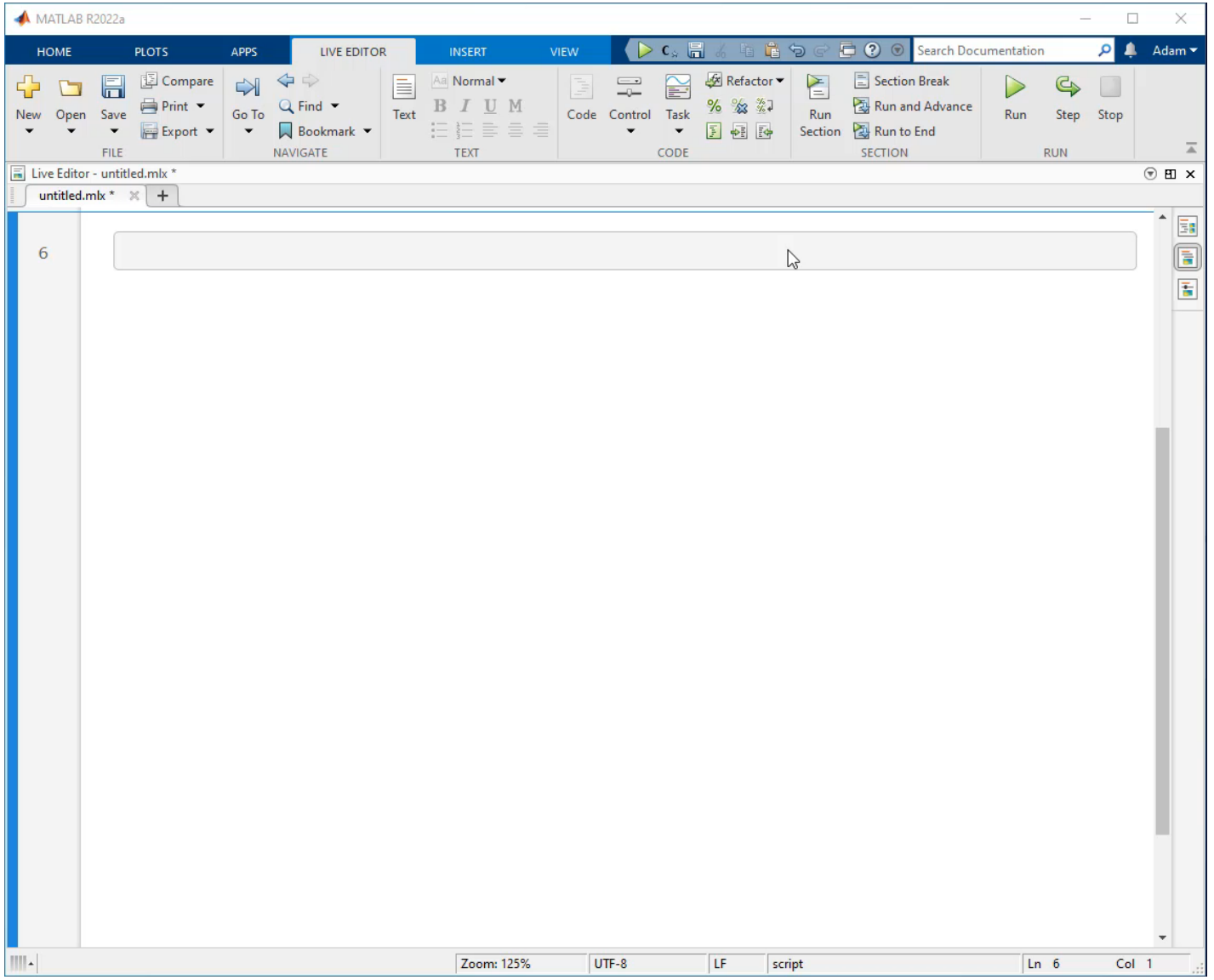
Low code tools enable:

- rapid software development
- minimal manual coding

Benefits of low code tools:

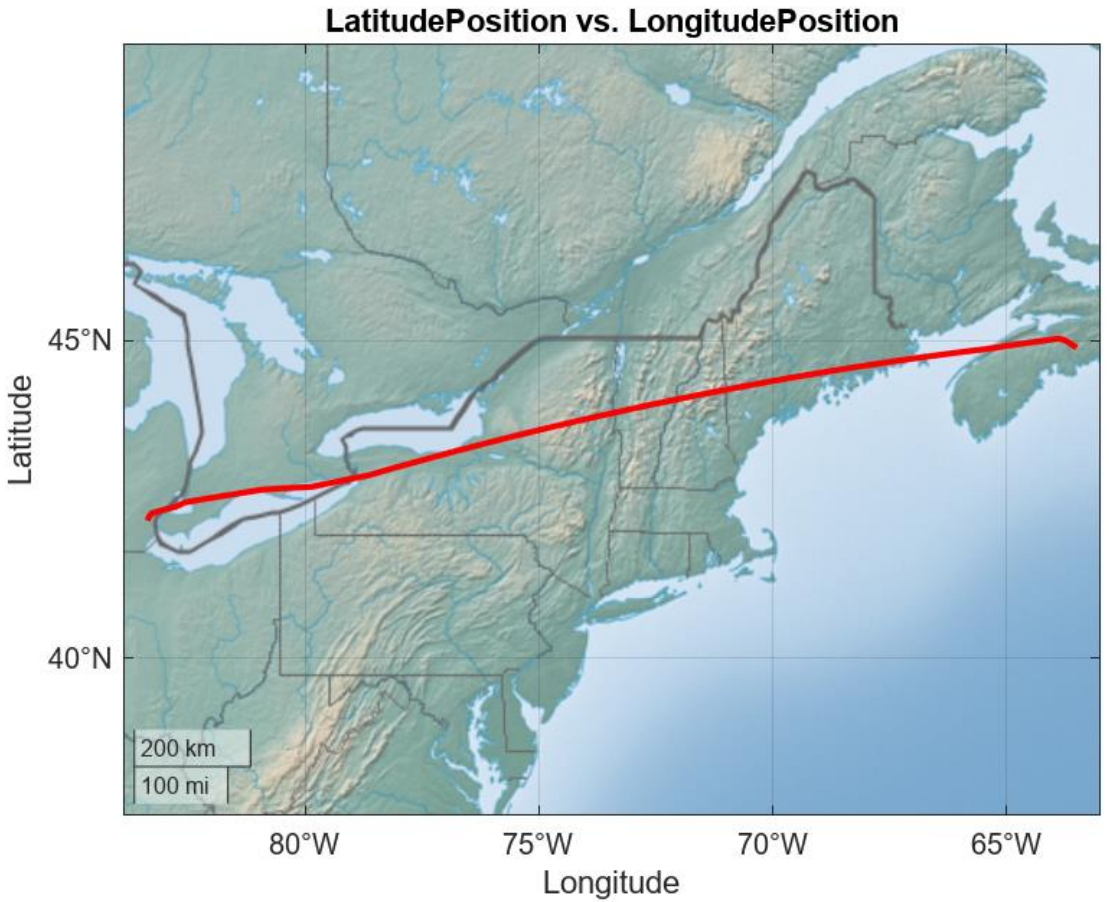
- Easier
- Teaches you *how* to code
- Solve task first, code later

Not just for beginners

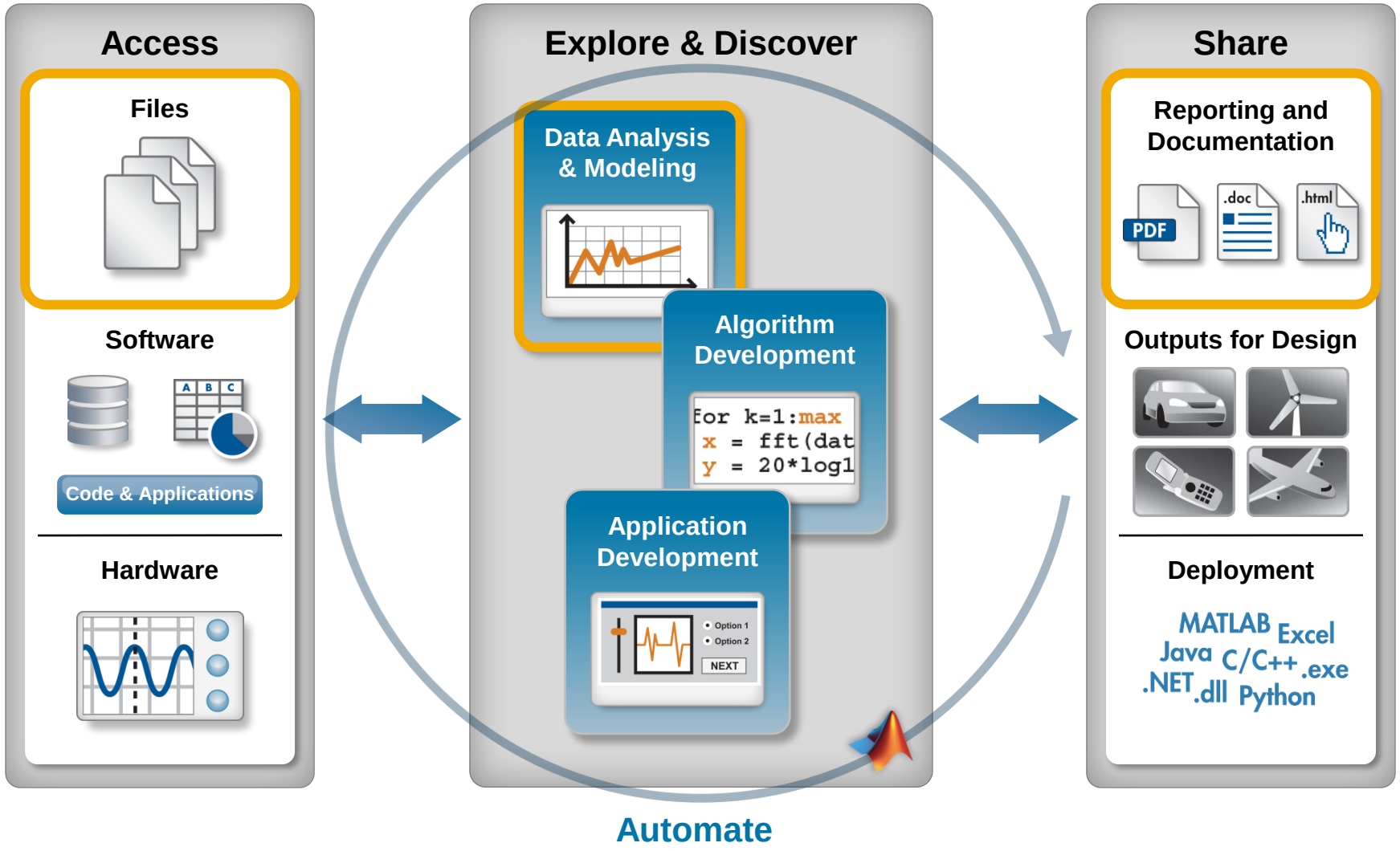


Case Study: Modeling Flight Sensor Data

- **Objective:**
  - Create a virtual sensor model for non-observable or costly-to-observe states
- **Inputs:**
  - Excel file with 13 sensors from 1 flight
- **Approach:**
  - Visualize and explore data
  - Clean sensor anomalies
  - Train regression model to predict state
  - Share results in a report
- **Source:**
  - NASA Dash Link: Sample Flight Data



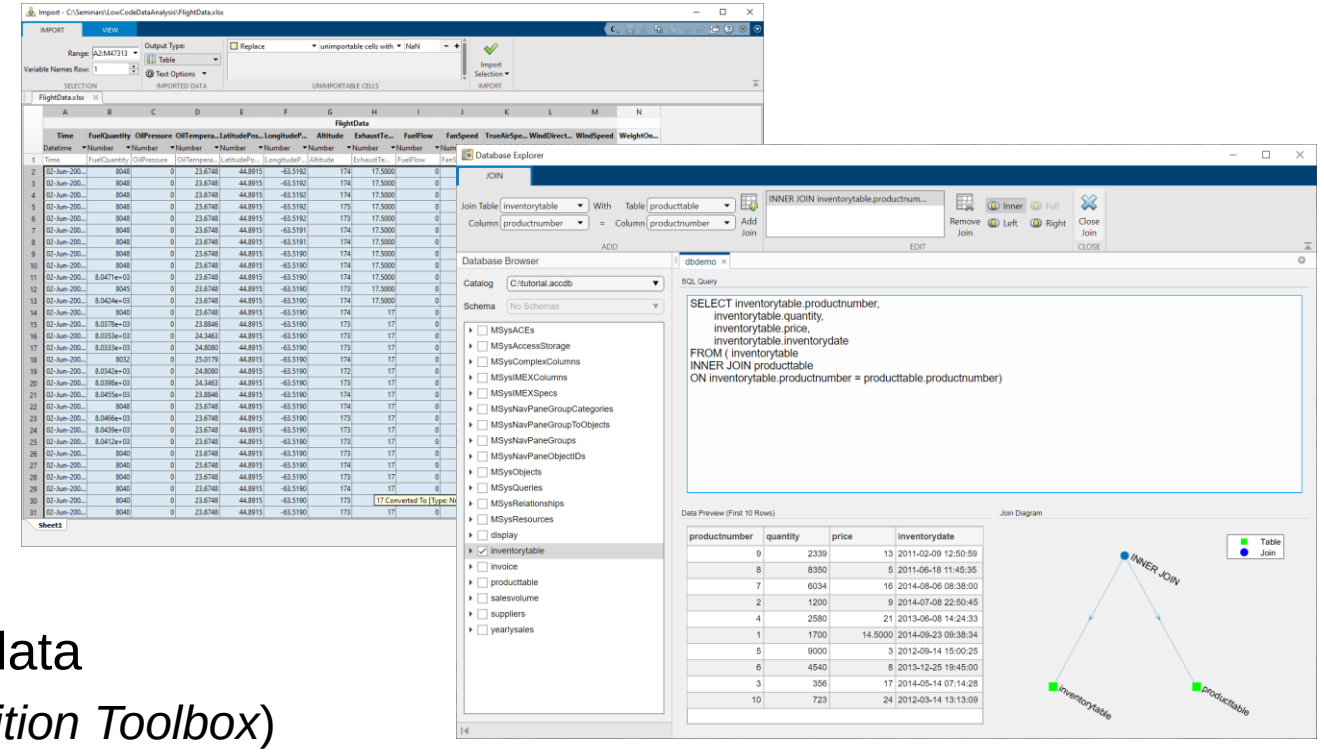
MATLAB simplifies the data analysis workflow with low code tools



Use low code tools for easy access to files, databases, and hardware

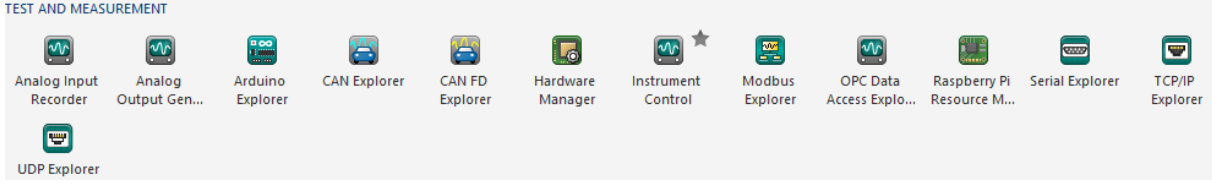
Access Explore & Discover Share

- Import Tool
  - Text, CSV, and Excel files



- Database Explorer (*Database Toolbox*)
  - ODBC & JDBC SQL Databases

- Measurement hardware and industrial data
  - Data acquisition hardware (*Data Acquisition Toolbox*)
  - Stand-alone instruments and hardware (*Instrument Control Toolbox*)
  - OPC UA and Aveva PI Server, Modbus devices (*Industrial Communication Toolbox*)
  - CAN, J1939, and XCP (*Vehicle Network Toolbox*)



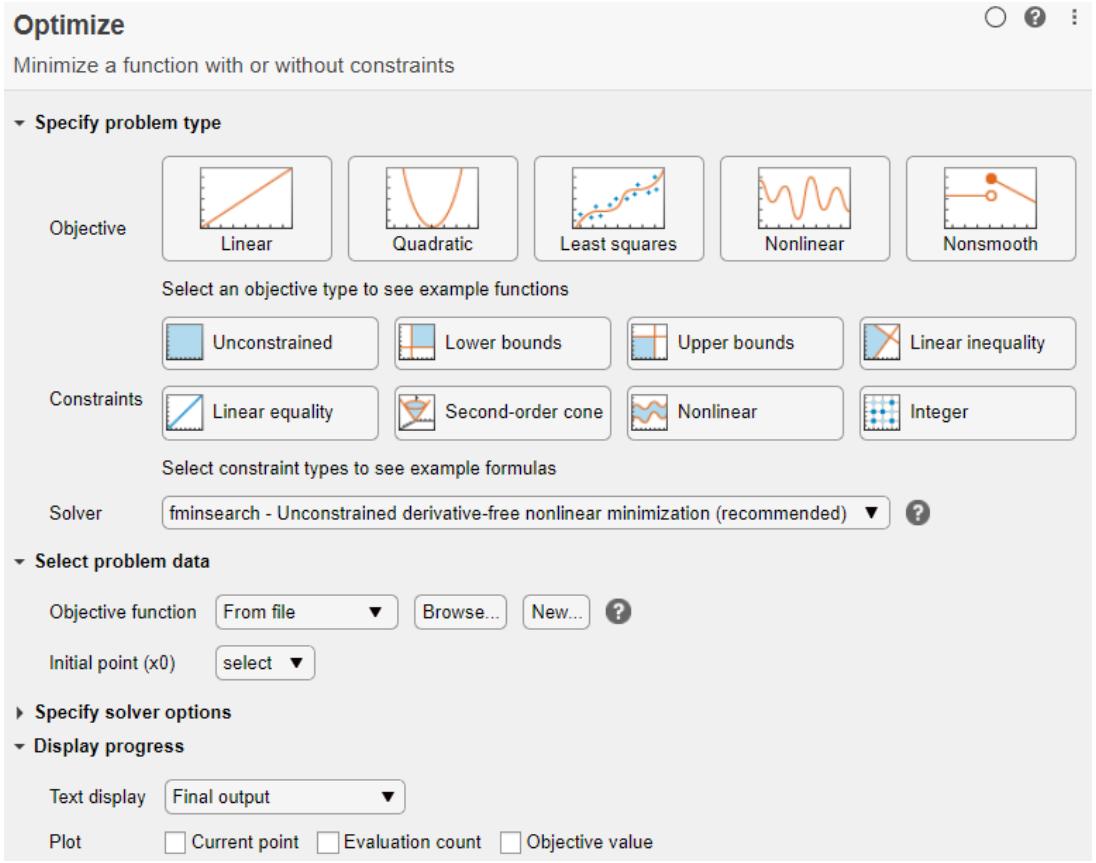
Access data in many formats from many locations

- Type of data
  - Observational
  - Timeseries
  - Image & video
  - N-D
- Location of data
  - SQL & NoSQL databases
  - HDFS
  - AWS S3
  - Azure Blob Storage

Over 100 low code tools for data analysis, engineering, and AI

Access | **Explore & Discover** | Share

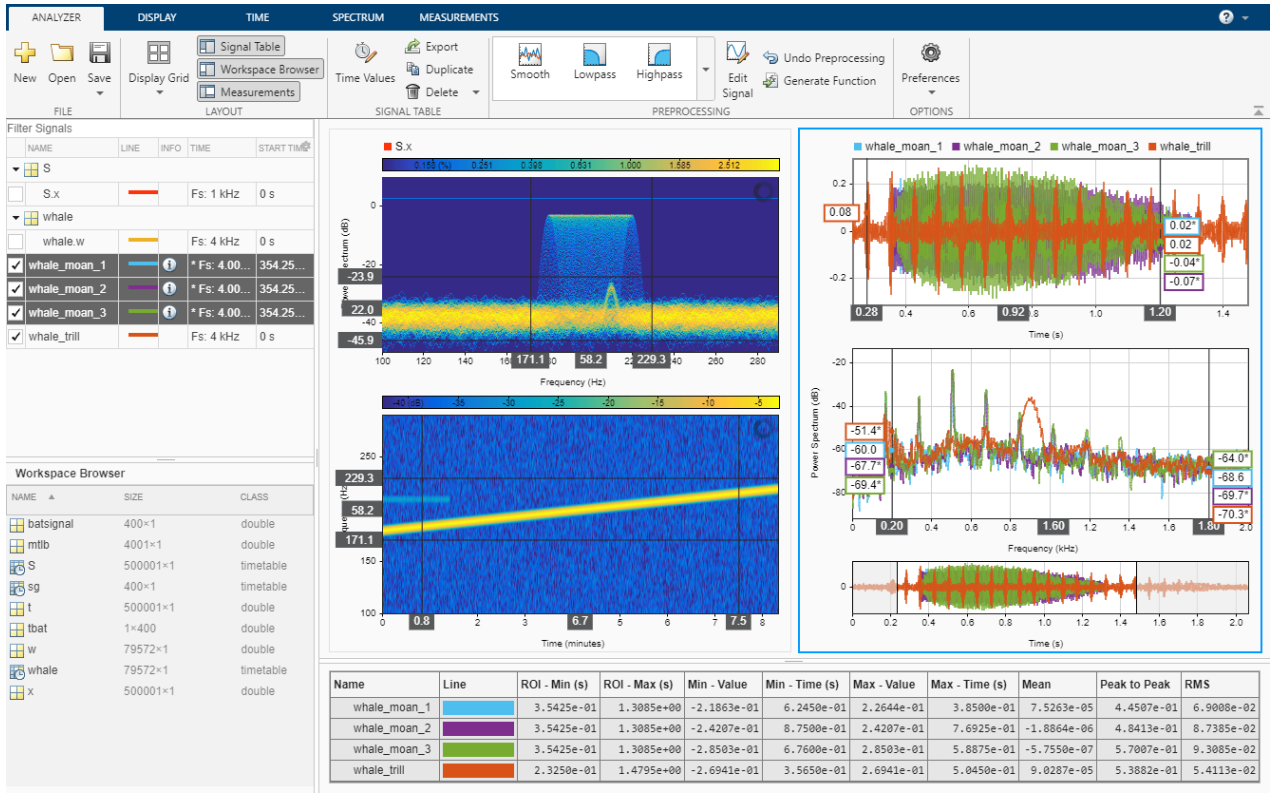
- Data Analysis
  - Visualize, manipulate, and preprocess
  - Math, statistics, and optimization



Over 100 low code tools for data analysis, engineering, and AI

Access | **Explore & Discover** | Share

- Data Analysis
  - Visualize, manipulate, and preprocess
  - Math, statistics, and optimization
- Engineering
  - Control system design and analysis
  - Signal processing and communications
  - Image processing and computer vision

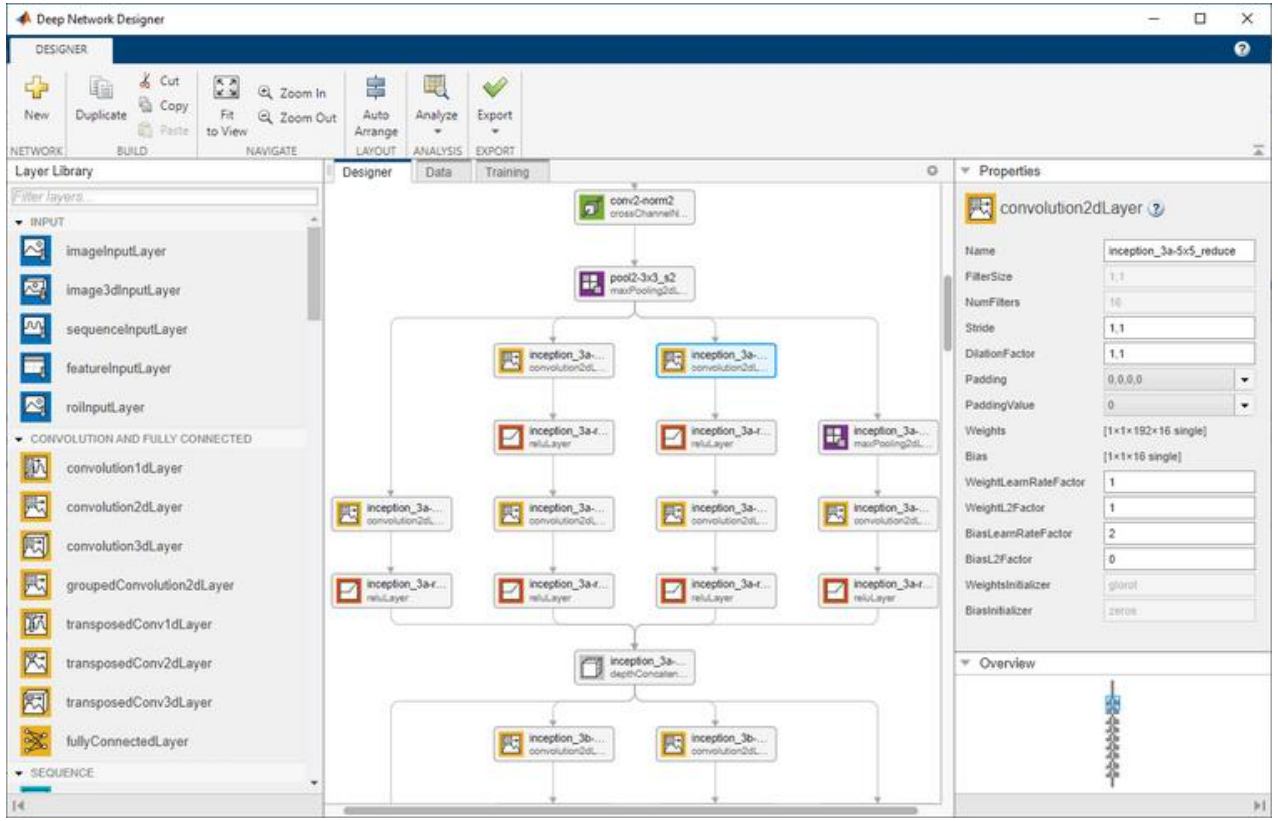


Name	Line	ROI - Min (s)	ROI - Max (s)	Min - Value	Min - Time (s)	Max - Value	Max - Time (s)	Mean	Peak to Peak	RMS
whale_moan_1		3.5425e-01	1.3085e+00	-2.1863e-01	6.2450e-01	2.2644e-01	3.8500e-01	7.5263e-05	4.4507e-01	6.9008e-02
whale_moan_2		3.5425e-01	1.3085e+00	-2.4207e-01	8.7500e-01	2.4207e-01	7.6925e-01	-1.8864e-06	4.8413e-01	8.7385e-02
whale_moan_3		3.5425e-01	1.3085e+00	-2.8503e-01	6.7600e-01	2.8503e-01	5.8875e-01	-5.7550e-07	5.7007e-01	9.3085e-02
whale_trill		2.3250e-01	1.4795e+00	-2.6941e-01	3.5650e-01	2.6941e-01	5.0450e-01	9.0287e-05	5.3882e-01	5.4113e-02

Over 100 low code tools for data analysis, engineering, and AI

Access | **Explore & Discover** | Share

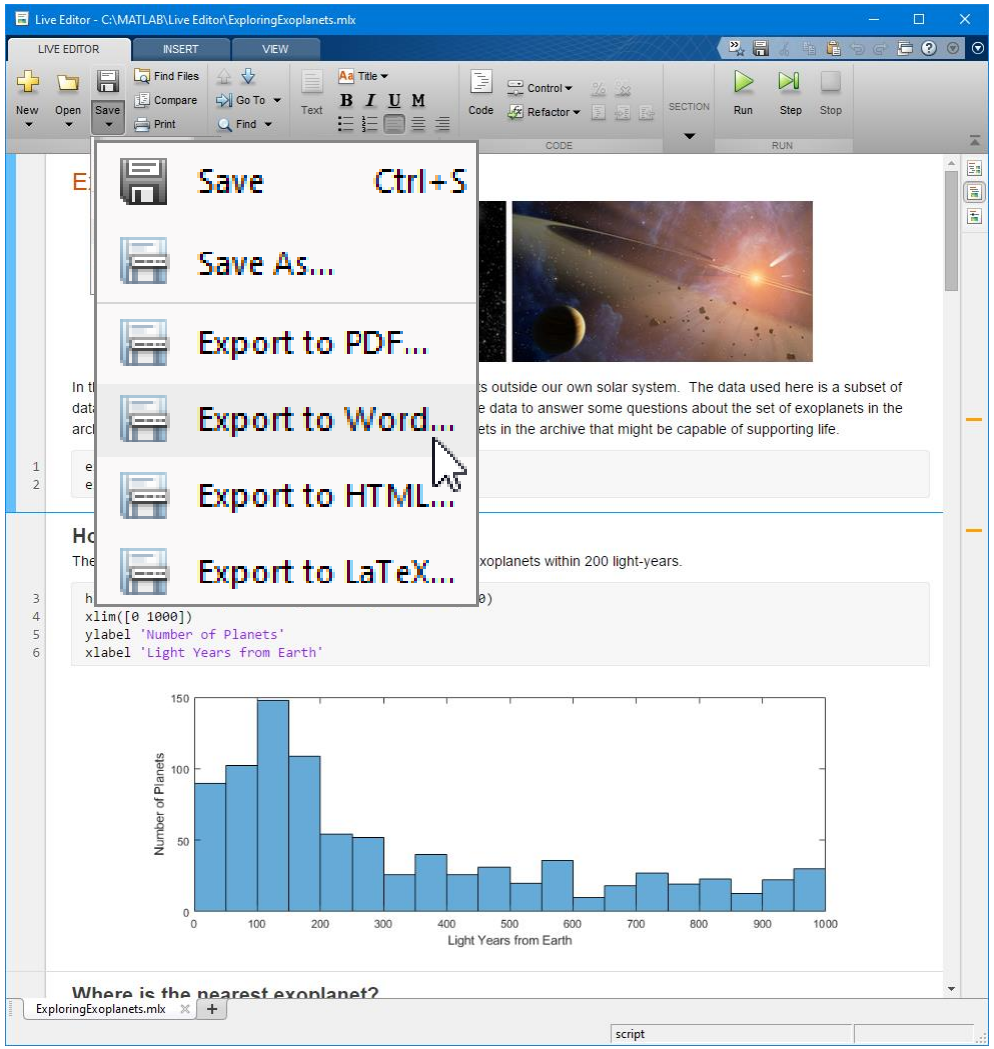
- Data Analysis
  - Visualize, manipulate, and preprocess
  - Math, statistics, and optimization
- Engineering
  - Control system design and analysis
  - Signal processing and communications
  - Image processing and computer vision
- Artificial Intelligence
  - Ground truth labeling
  - Network design, training, and validation
  - Quantization and deployment



Document as you go – *your script is your report*

Access | Explore & Discover | **Share**

- Divide code into sections
- Embed outputs next to the code
- Add rich text formatting, equations, images, and hyperlinks
- Include animations with embedded controls, and export
- Programmatically control fonts
- Save directly to PDF, HTML, Word, and LaTeX



As your needs grow, the MATLAB language grows with you.

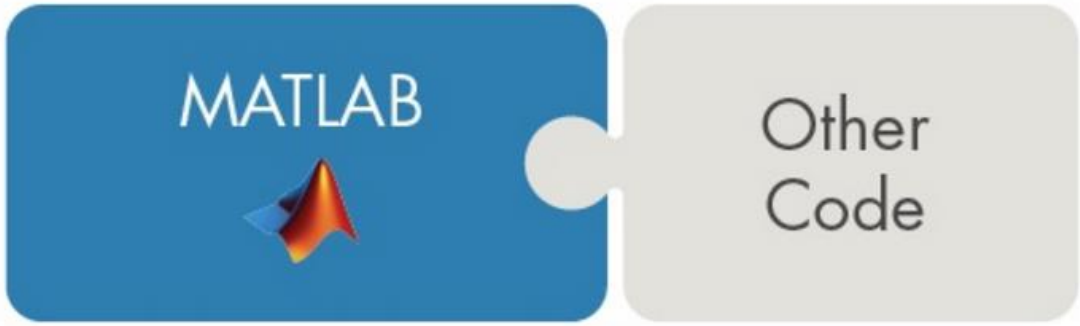
- Start simple
- Create scripts
- Write reusable functions
- Author robust applications

```
classdef movingBlip < blip
    %MOVINGBLIP Summary of this class goes
    %   Detailed explanation goes here

    % Copyright The MathWorks, Inc. 2008,

    properties
        deltaAoA
    end

    methods
        function obj = movingBlip(deltaAoA
            % assign the superclass portio
            obj = obj@blip(varargin{:}) ;

            if nargin >= 1
                % assign the movingBlip's
                obj.deltaAoA = deltaAoA ;
            end
```

Grow from coding by yourself to coding in a team

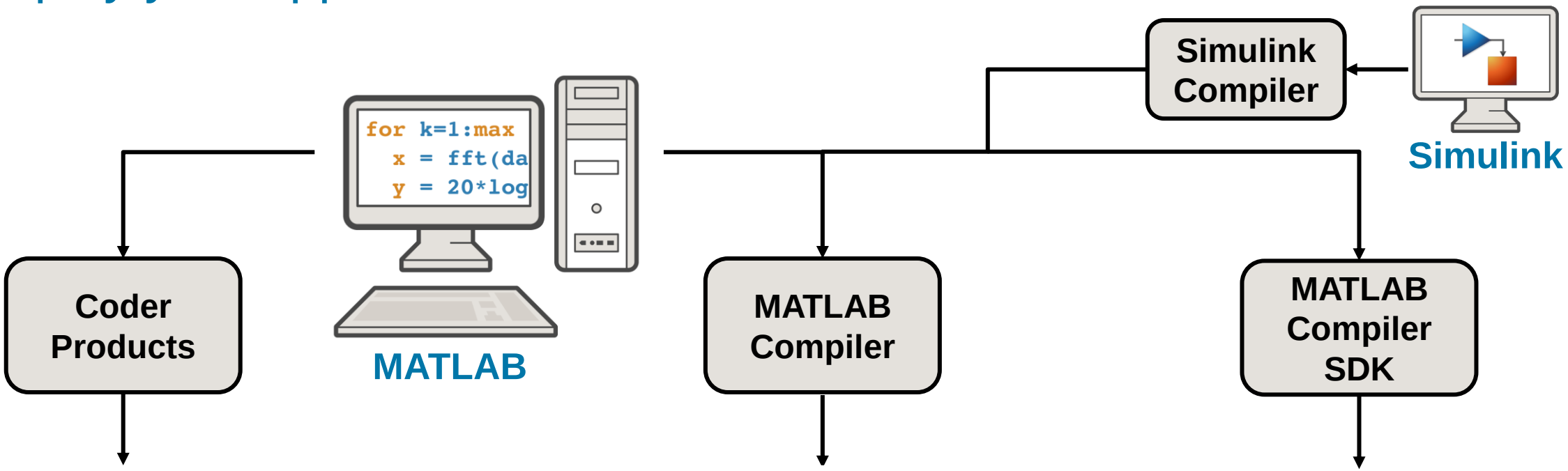
- Projects
- Source control
- Testing & CI
- External interfaces

Call Libraries Written in Another Language



Call MATLAB from Another Language

Deploy your applications to non-MATLAB users



Embedded Hardware

C, C++ | HDL | PLC | CUDA

Desktop and Web Deployment

.exe | MATLAB Web App | Docker Container | Excel Add-in | Hadoop/ Spark

MATLAB Web App Server

Enterprise Systems

C/C++ DLL | Java JAR | Python py | .NET DLL

Deployed Simulation

MATLAB Production Server

Agenda

- Low Code Data Analysis
- Demo – Modeling Flight Sensor Data
- Learning Resources

How can I get started?

tinyurl.com/yrctym2f

Technology

August 16, 2024

Campus wide access to MATLAB available now

Wichita State now offers a Campus-Wide License that provides unlimited use of MATLAB, Simulink and over 100 additional toolboxes to all students, faculty, staff and researchers, on and off campus, on any device.

Users will have access to the software and associated documentation as well as immediate access to new releases. The Campus-Wide License permits the installation of MATLAB and Simulink on campus-managed and user-owned computers. **Note: For lab and classroom installation, submit a ticket to Desktop Support – Help Me Set up.**

For additional information including how to access MATLAB and associated software, visit the MATLAB webpage.

See Also

This news item is in these publications:

- Shocker Blast: Monday, Aug. 26, 2024
- WSU Today: Monday, Aug. 26, 2024
- Shocker Blast: Wednesday, Aug. 21, 2024
- WSU Today: Monday, Aug. 19, 2024

Get Started for Free with Onramp Courses

MATLAB Onramp

Get started quickly with the basics of MATLAB®.

Details and launch

Simulink Onramp

Get started quickly with the basics of Simulink®.

Details and launch

Image Processing Onramp

Learn the basics of practical image processing techniques in MATLAB.

Details and launch

Signal Processing Onramp

An interactive introduction to practical signal processing methods for spectral analysis.

Details and launch

Machine Learning Onramp

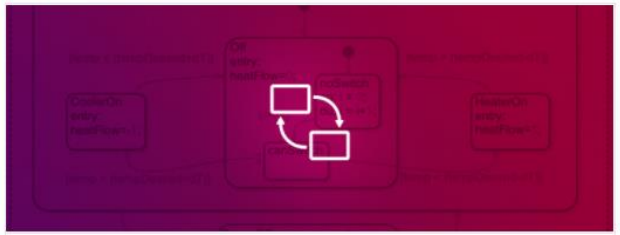
An interactive introduction to practical machine learning methods for classification problems.

Details and launch

Deep Learning Onramp

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

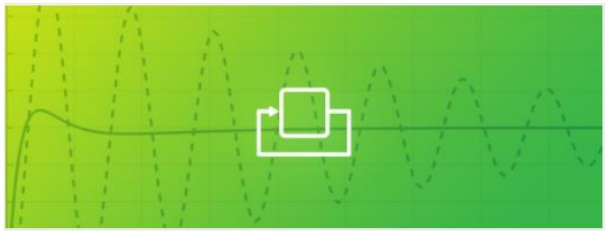
Details and launch



Stateflow Onramp

Learn the basics of creating, editing, and simulating state machines in Stateflow®.

Details and launch



Control Design Onramp with Simulink

Get started quickly with the basics of feedback control design in Simulink.

Details and launch

https://matlabacademy.mathworks.com/

MATLAB Central Community

Every month, over **2 million** MATLAB & Simulink users visit MATLAB Central to get questions answered, download code and improve programming skills.

MATLAB Central

Learn | Contribute | Connect

MATLAB Answers: Q&A forum; most questions get answered in only **60 minutes**

File Exchange: Download code from a huge repository of free code including **tens of thousands** of open source community files

Cody: Sharpen programming skills while having fun

Blogs: Get the inside view from Engineers who build and support MATLAB & Simulink

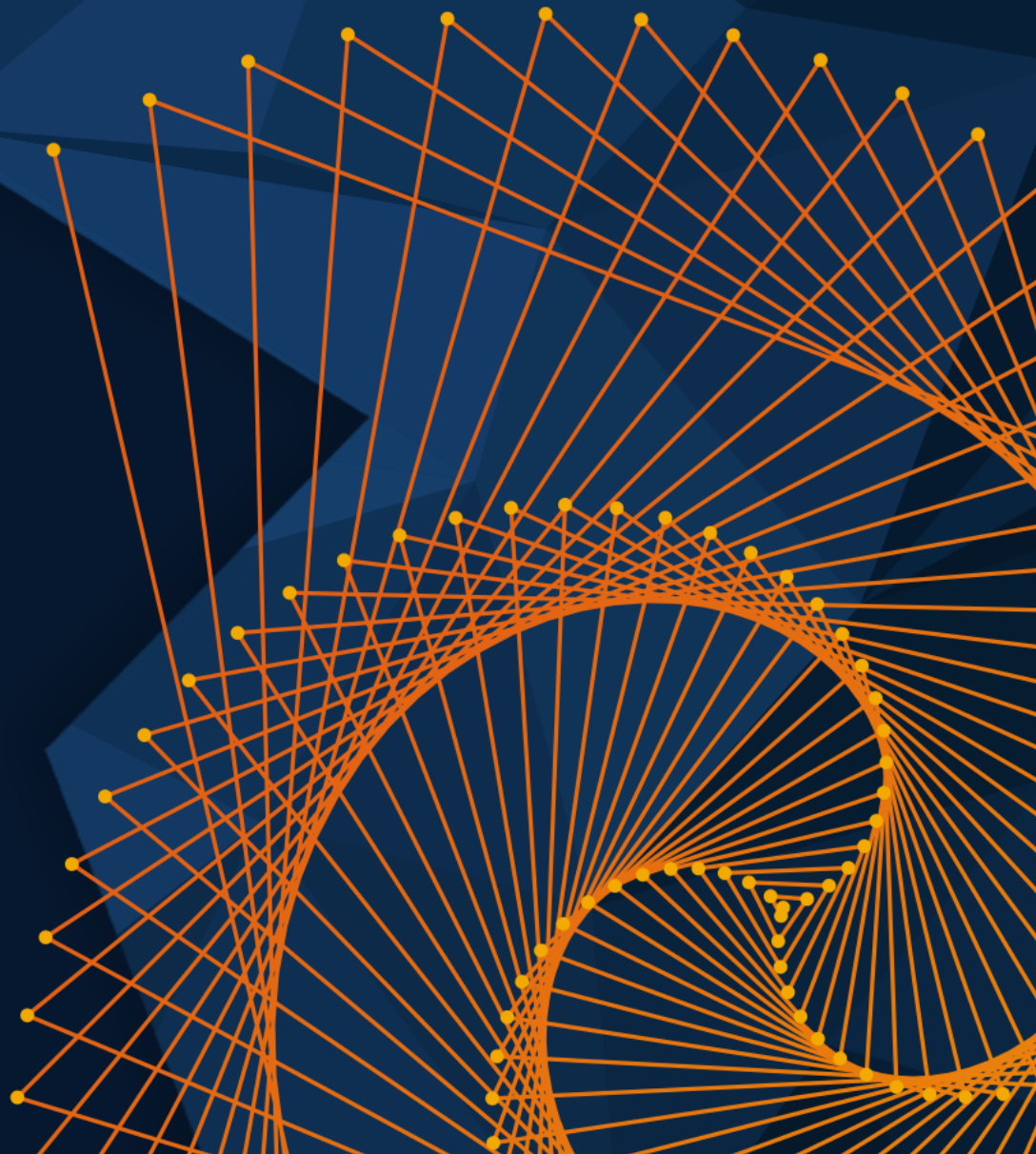
ThingSpeak: Explore IoT Data

And more for you to explore…

MATLAB EXPO

November 13–14, 2024 | Online

Register at **matlabexpo.com/online**



MathWorks®