MATLAB EXPO

Low Code Data Analysis in MATLAB

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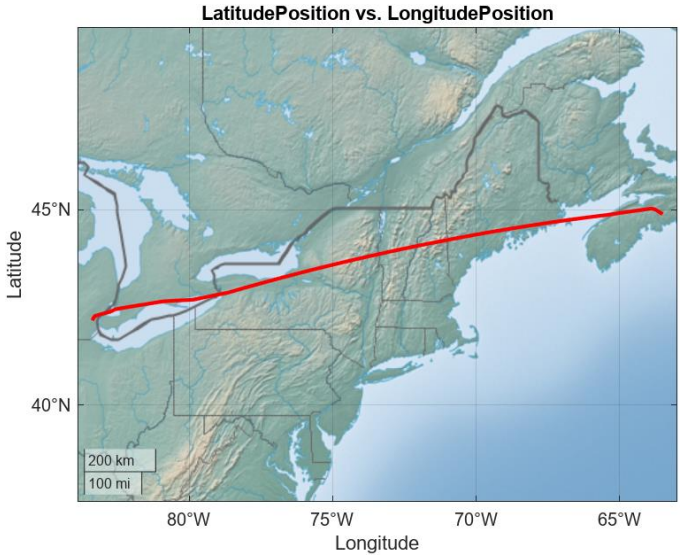
MathWorks®

Case Study: Get Flight Sensor Data ready for Modeling

- **Objective:**
  - Explore, analyze and prepare flight sensor data for modeling
- **Inputs:**
  - Excel file with raw flight sensor data
- **Output:**
  - Cleaned sensor data that can be trained to predict Air Speed
  - Reusable code
- **Source:**
  - [NASA Dash Link: Sample Flight Data]



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Time	FuelQuantity	Latitude	Longitude	OilPressure	OilTemperature	FlightPhaseFromACMS	WeightOnWheels	Altitude	ExhaustGasTemperature	FuelFlow	TrueAirSpeed	WindDirection
2	6/2/2001 5:41	8048	44.8915135	-63.519183	0	23.67477417	Planning	0	419	17.5	0	0	0
3	6/2/2001 5:41	8048	44.8915135	-63.519183	0	23.67477417	Planning	0	419	17.5	0	0	0
4	6/2/2001 5:41	8048	44.8915135	-63.519183	0	23.67477417	Planning	0	420	17.5	0	0	0
5	6/2/2001 5:41	8048	44.8915135	-63.519183	0	23.67477417	Planning	0	419	17.5	0	0	0
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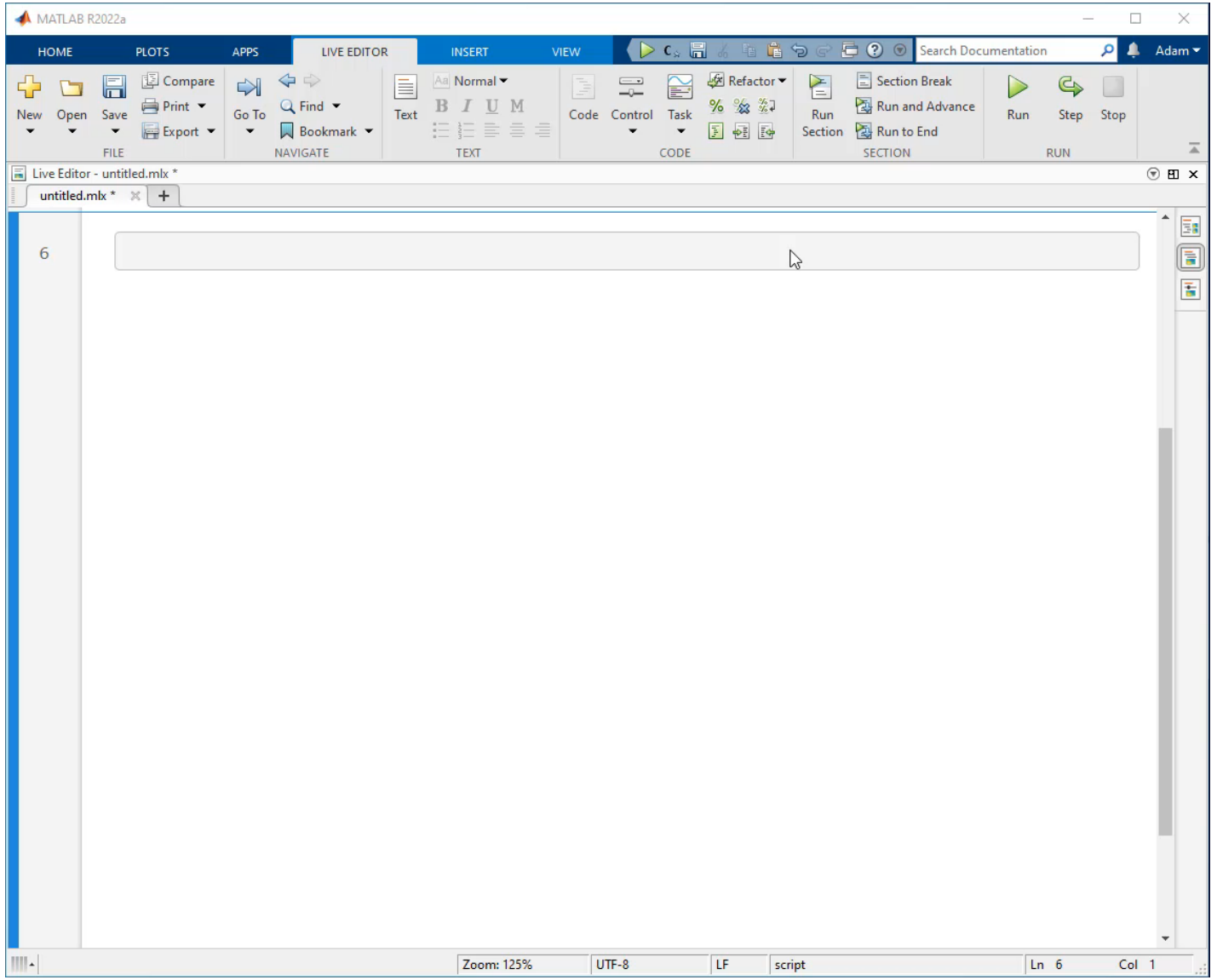
11	6/2/2001 5:41	8048	44.8915135	-63.5189992	0	23.67477417	Planning	0	418	17.5	0	0	0
12	6/2/2001 5:41	8048	44.8915135	-63.5189992	0	23.67477417	Planning	0	420	17.5	0	0	0
13	6/2/2001 5:41	8048	44.8915135	-63.5189992	0	23.67477417	Planning	0	419	17.5	0	0	0
14	6/2/2001 5:41	8040	44.8915135	-63.5189992	0	23.67477417	Planning	0	419	17	0	0	0
15	6/2/2001 5:41	8040	44.8915135	-63.5189992	0	23.67477417	Planning	0	419	17	0	0	0
16	6/2/2001 5:41	8040	44.8915135	-63.5189992	0	23.67477417	Planning	0	418	17	0	0	0
17	6/2/2001 5:41	8040	44.8915135	-63.5189992	0	23.67477417	Planning	0	419	17	0	0	0
18	6/2/2001 5:41	8032	44.8915135	-63.5189992	0	25.0178833	Plan	0	418			0	

[NASA Dash Link: Sample Flight Data]: #

What are “low code” tools?

Low code tools enable:

- rapid software development
- minimal manual coding



Benefits of low code tools:

- Shallow learning curve
- Teach *how* to code
- Solve task first, code later

Not just for beginners

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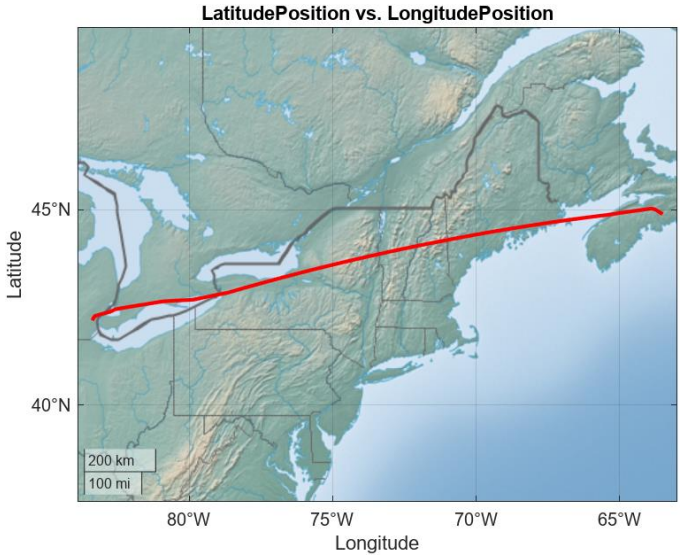

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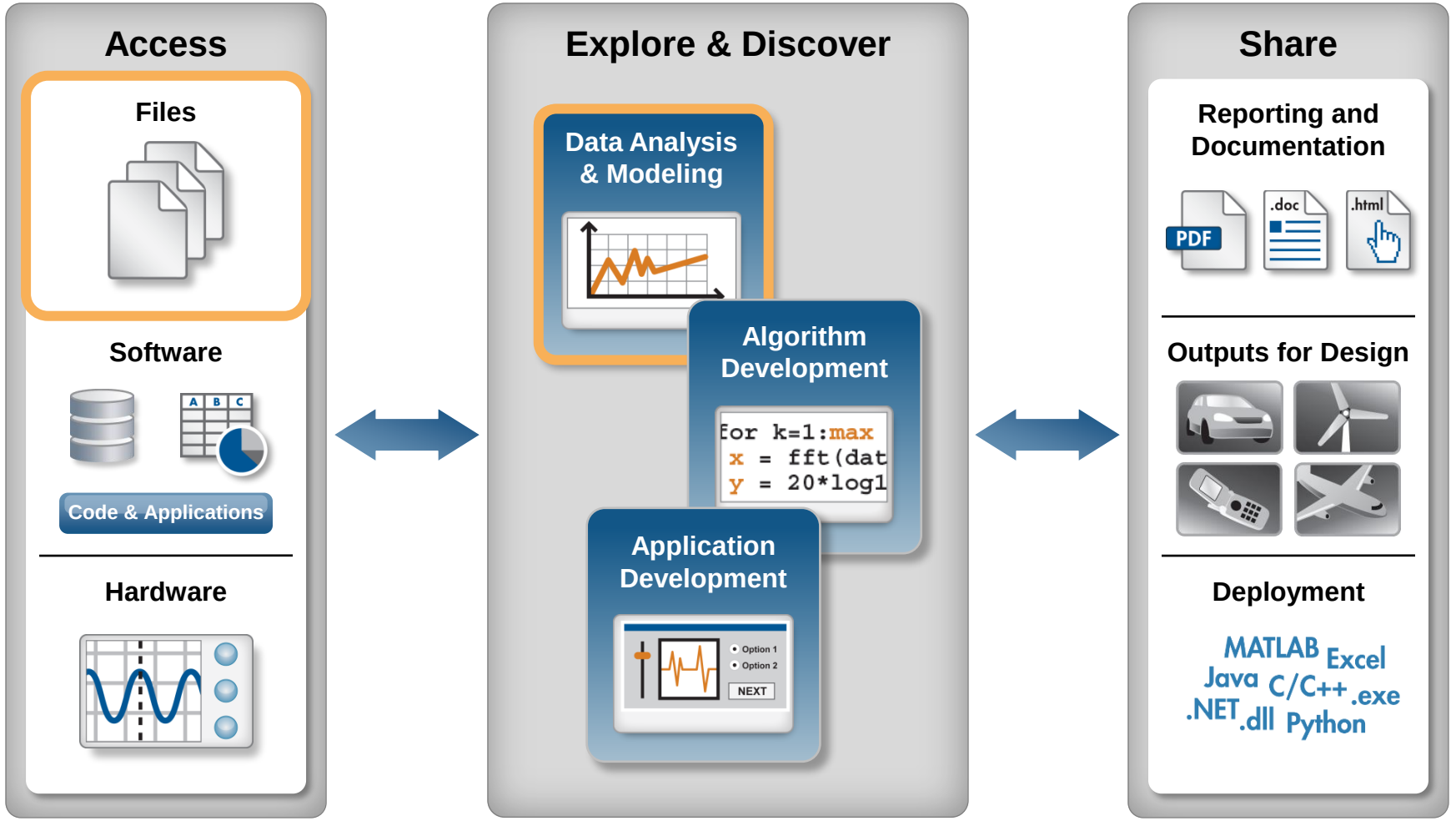
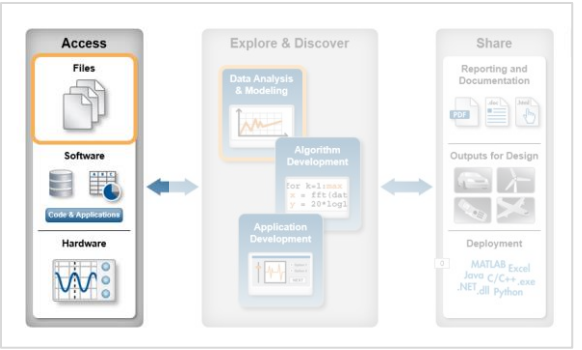
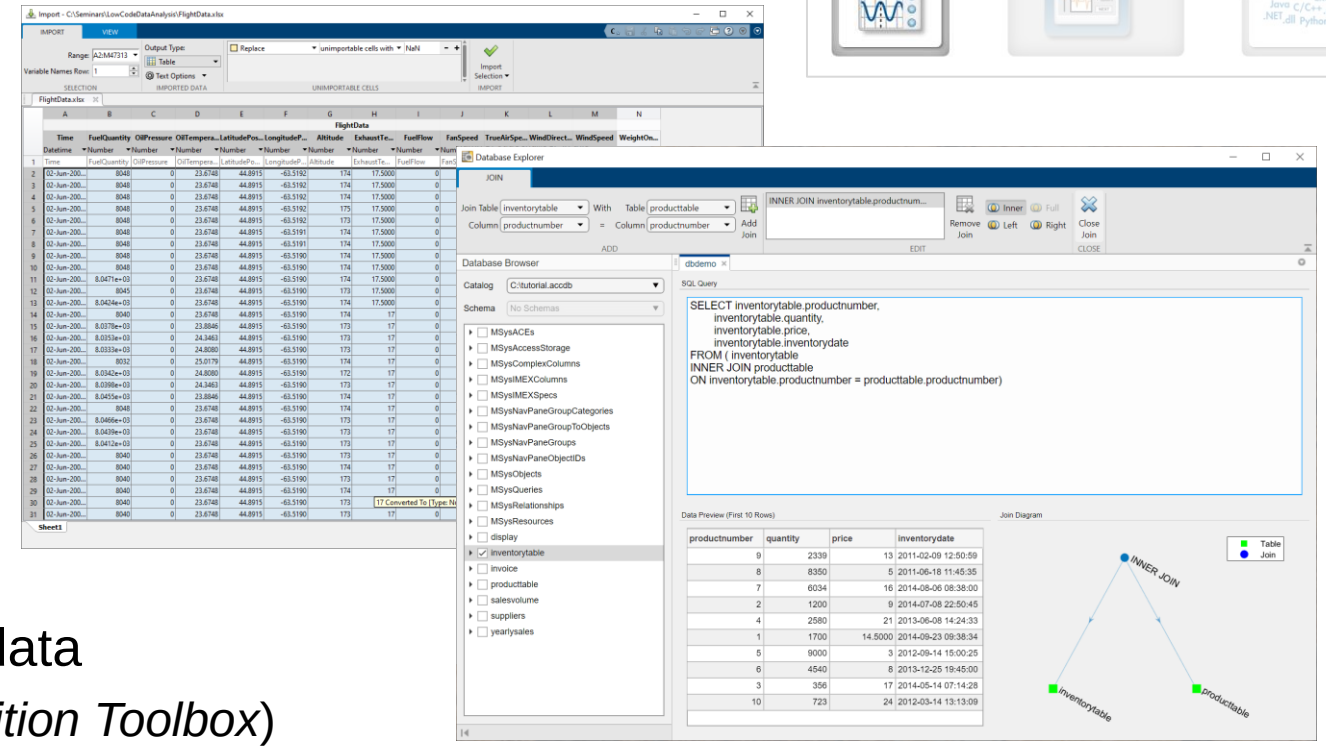
MATLAB simplifies the data analysis workflow with low code tools



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

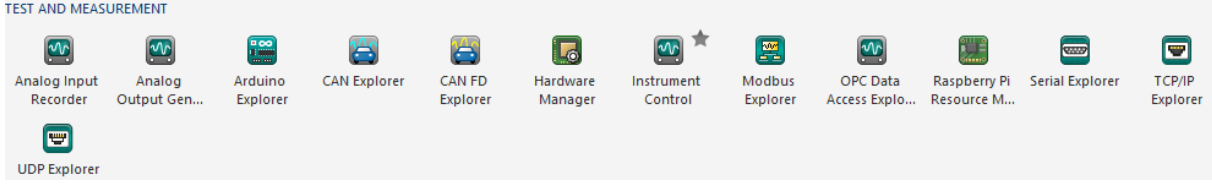


- Import Tool and Import Live Task
  - Text, CSV, and Excel files

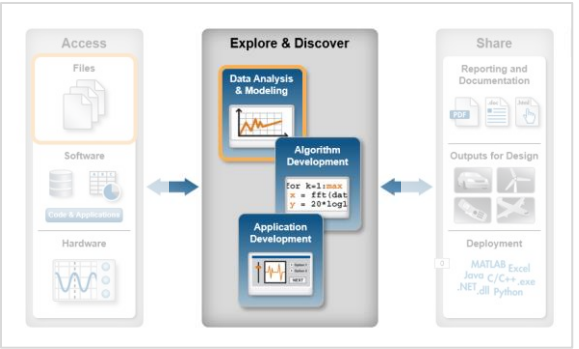


- Database Explorer (*Database Toolbox*)
  - ODBC & JDBC SQL Databases

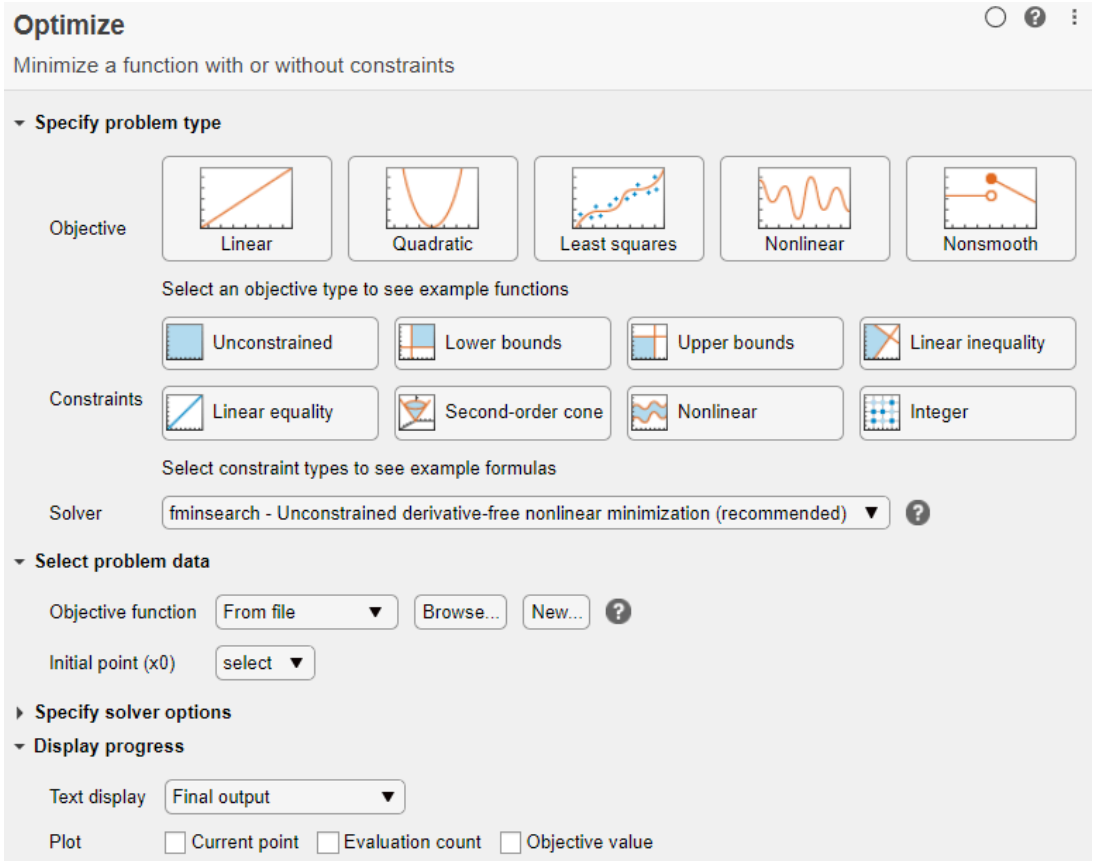
- Measurement hardware and industrial data
  - Data acquisition hardware (*Data Acquisition Toolbox*)
  - Stand-alone instruments and hardware (*Instrument Control Toolbox*)
  - OPC UA and Aveva PI Server, Modbus devices (*Industrial Communication Toolbox*)
  - CAN, J1939, and XCP (*Vehicle Network Toolbox*)



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

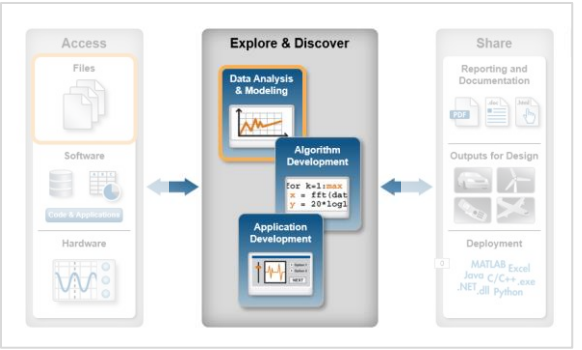


- Data Analysis
  - Visualize, manipulate, and preprocess
  - Math, statistics, and optimization



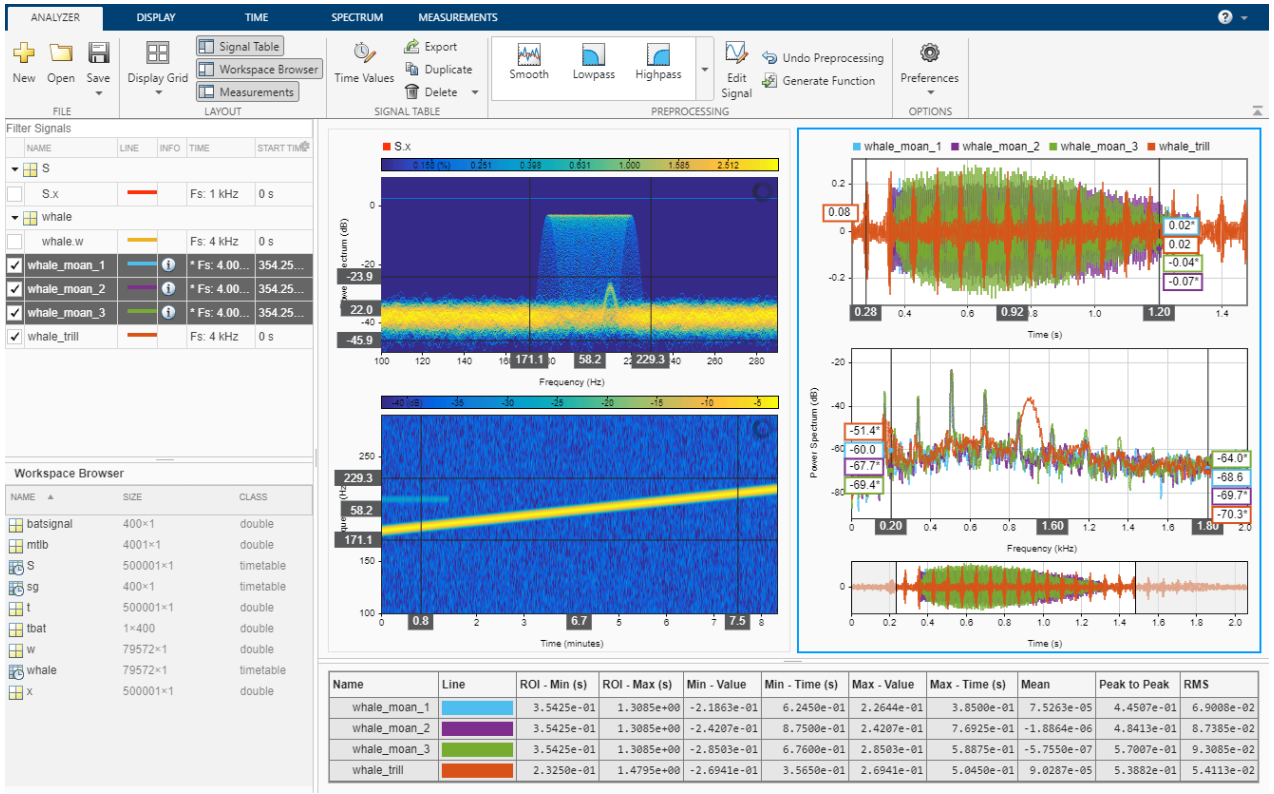
Optimize Live Task (Optimization Toolbox)

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



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

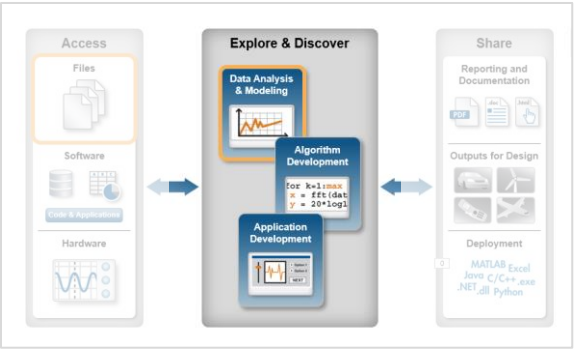
- Engineering
  - Control system design and analysis
  - Signal processing and communications
  - Image processing and computer vision



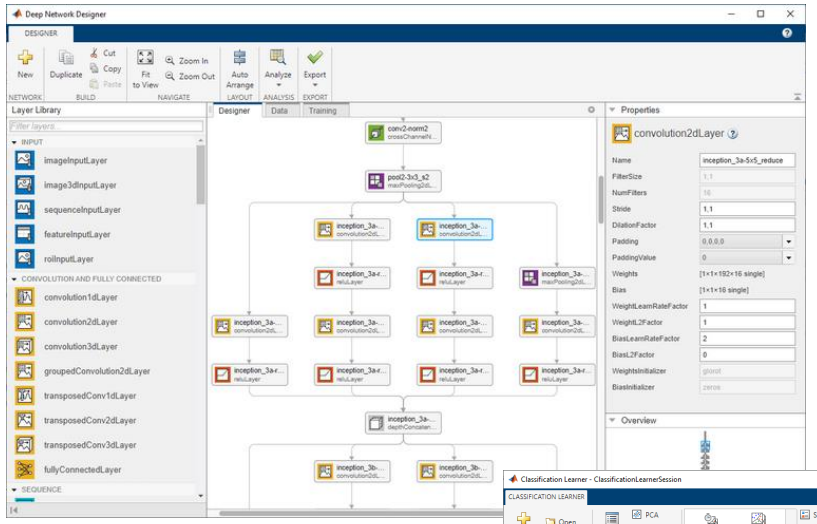
Name	Line	ROI - Min (s)	ROI - Max (s)	Min - Value	Min - Time (s)	Max - Value	Max - Time (s)	Mean	Peak to Peak	RMS
whale_moan_1		3.5425e-01	1.3085e+00	-2.1863e-01	6.2450e-01	2.2644e-01	3.8500e-01	7.5263e-05	4.4507e-01	6.9008e-02
whale_moan_2		3.5425e-01	1.3085e+00	-2.4207e-01	8.7500e-01	2.4207e-01	7.6925e-01	-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

Signal Analyzer (Signal Processing Toolbox)

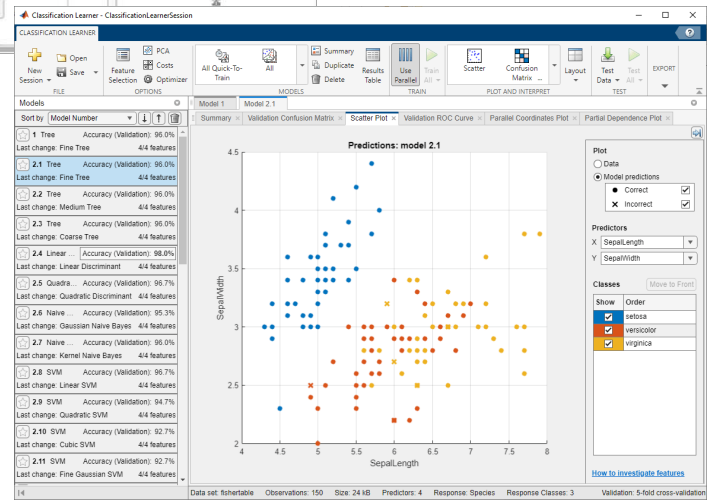
Over 100 low code tools for data analysis, engineering, and AI



- 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

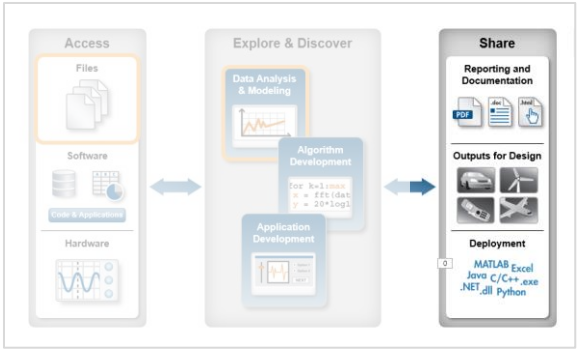


Deep Network Designer
(Deep Learning Toolbox)

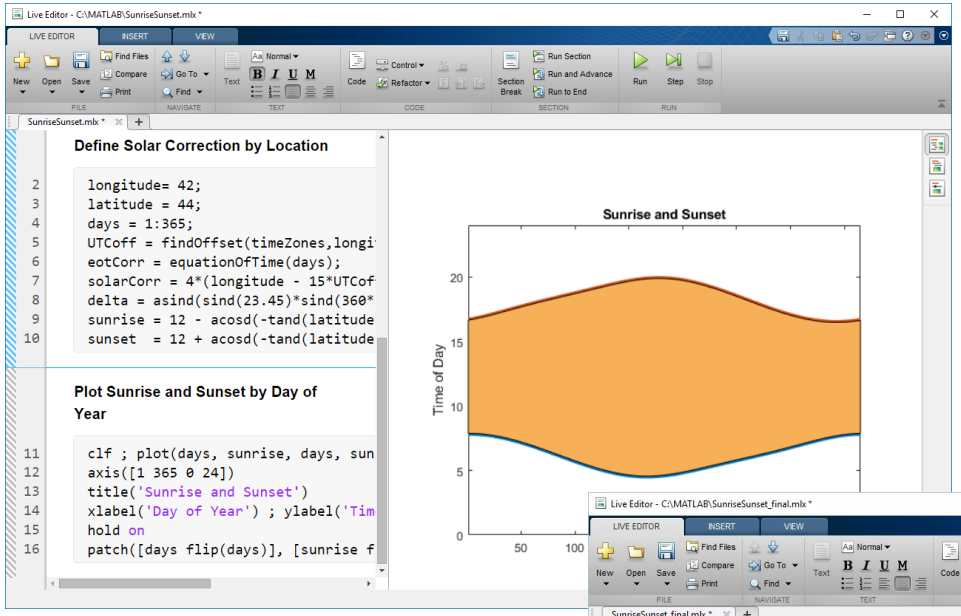


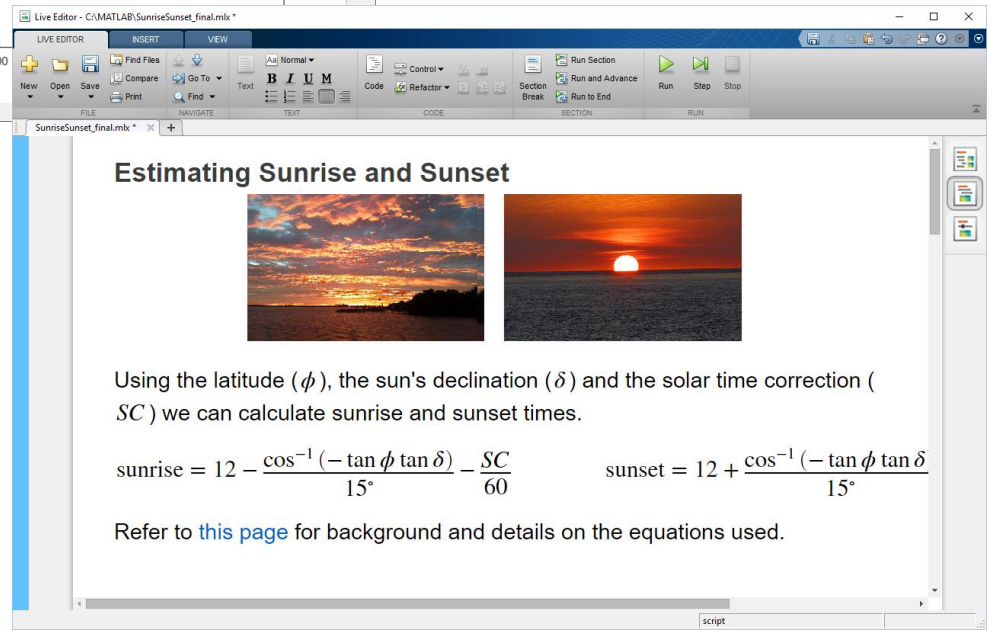
Classification Learner
(Statistics and Machine Learning Toolbox)

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

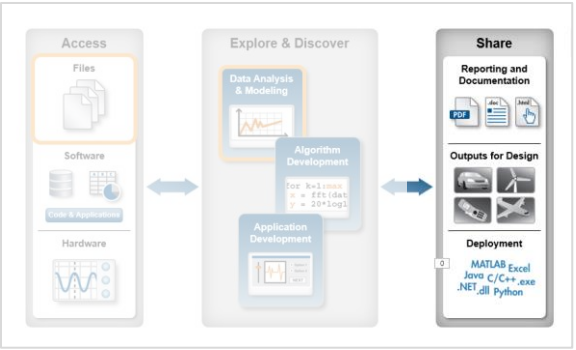


- Divide code into sections
- Embed outputs next to the code
- Add rich text formatting, equations, images, and hyperlinks
- Save directly to PDF, HTML, Word, and LaTeX

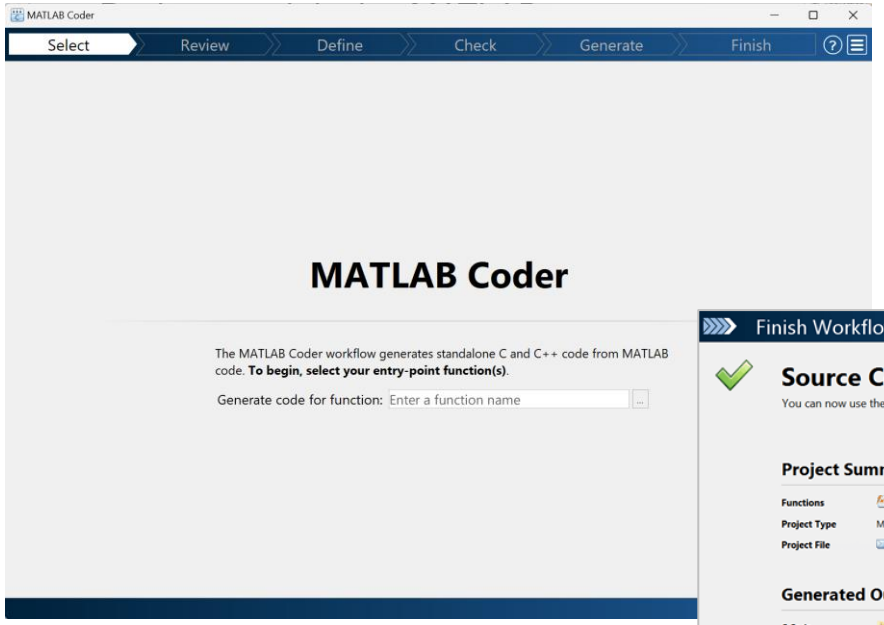


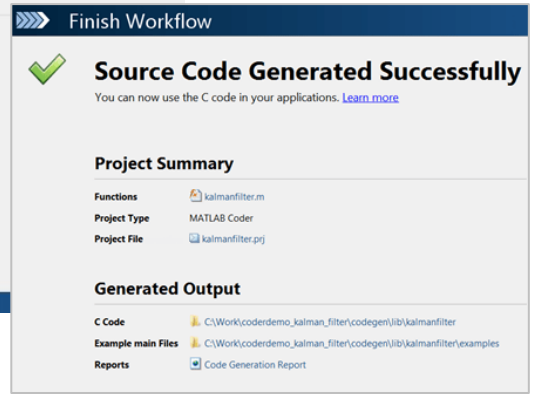


Deploy and integrate MATLAB code

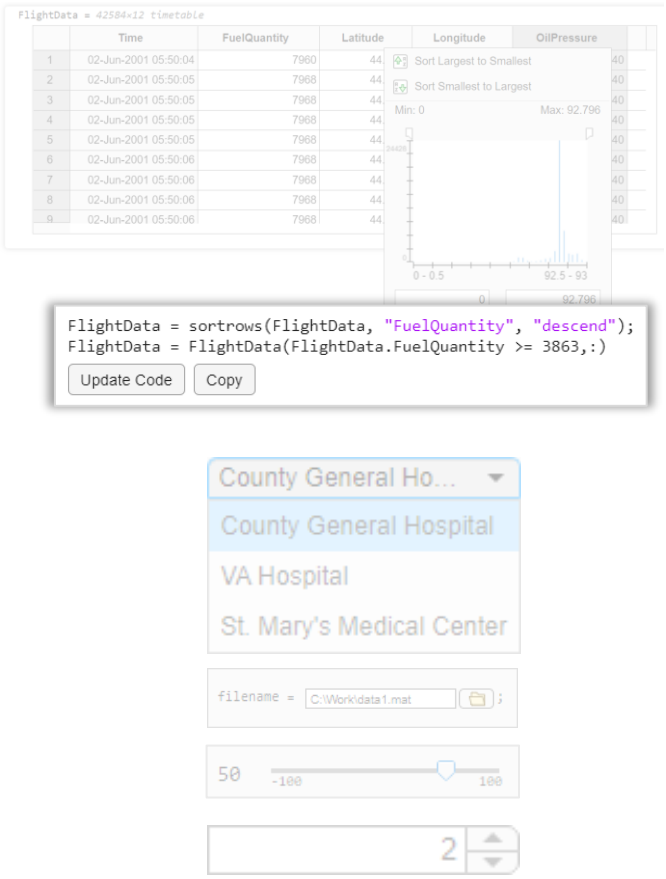


- Package and deploy MATLAB programs
- Generate code (C, Mex, GPU, HDL)

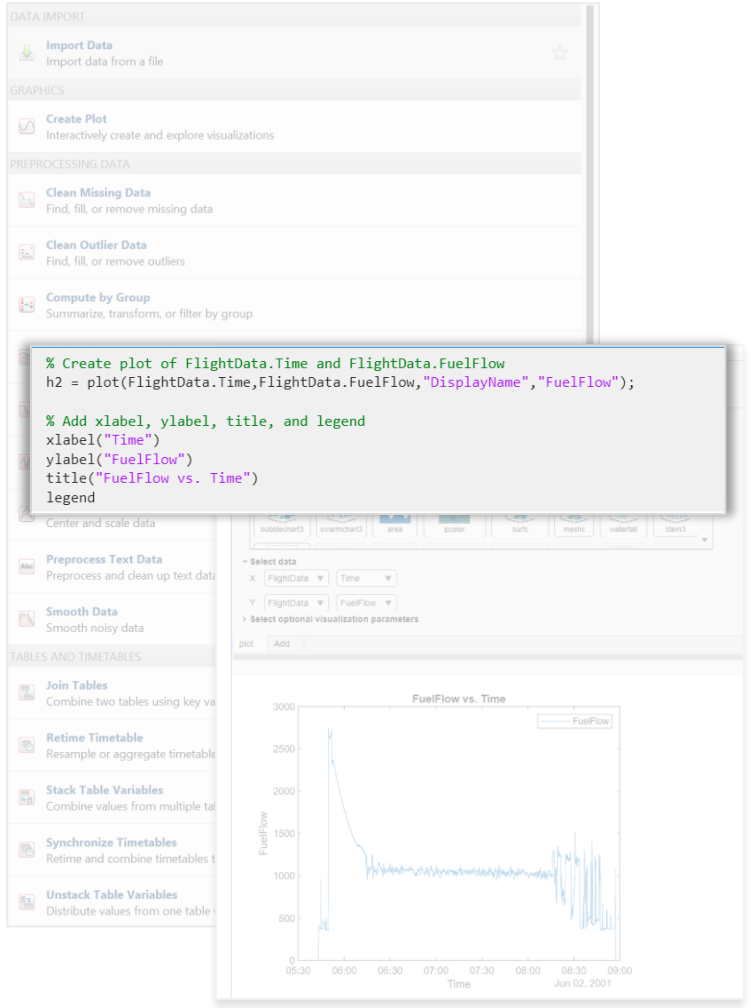




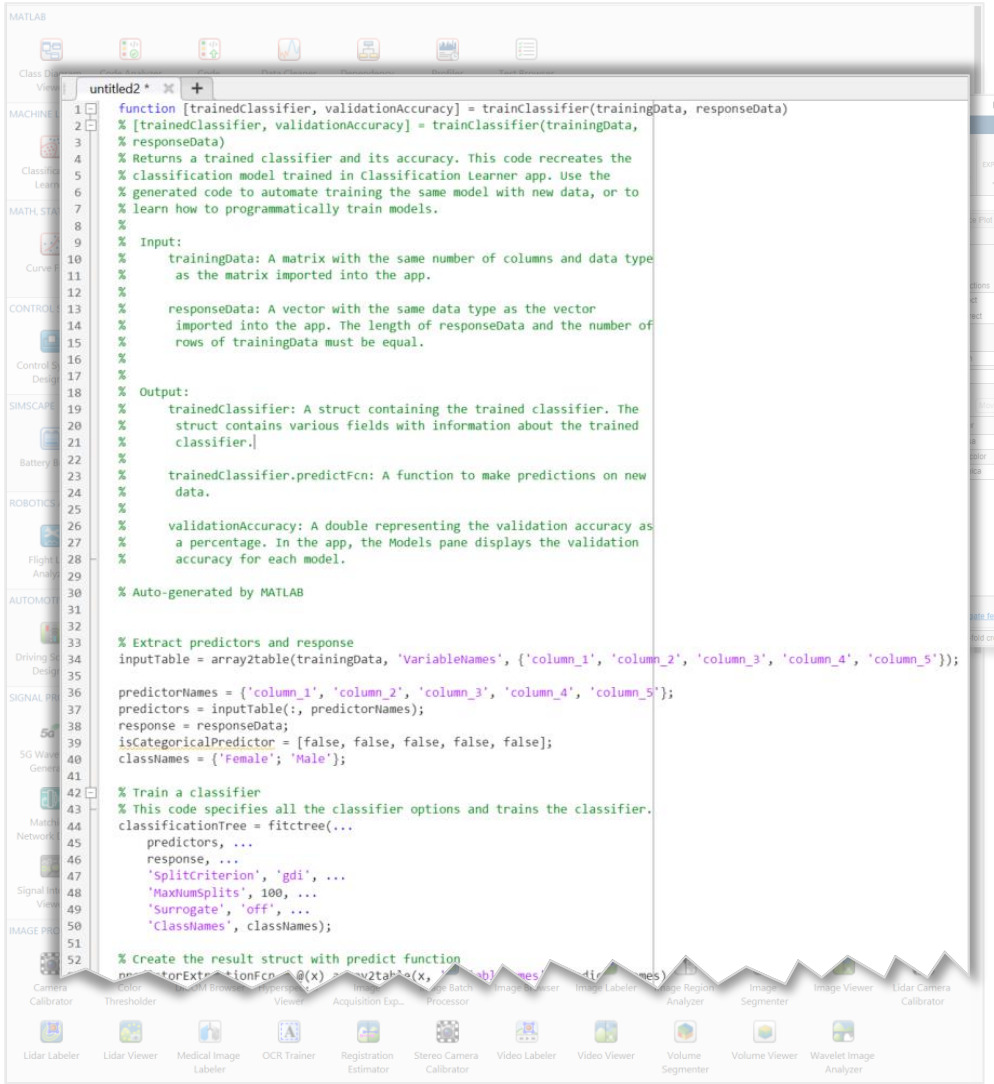
Start with low code … and switch to code easily when needed



Interactive Controls



Live Tasks



Apps

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Thank you

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Share the EXPO experience
#MATLABEXPO

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