Welcome to the

11th Annual

Teaching Computation with MATLAB

Educator Workshop

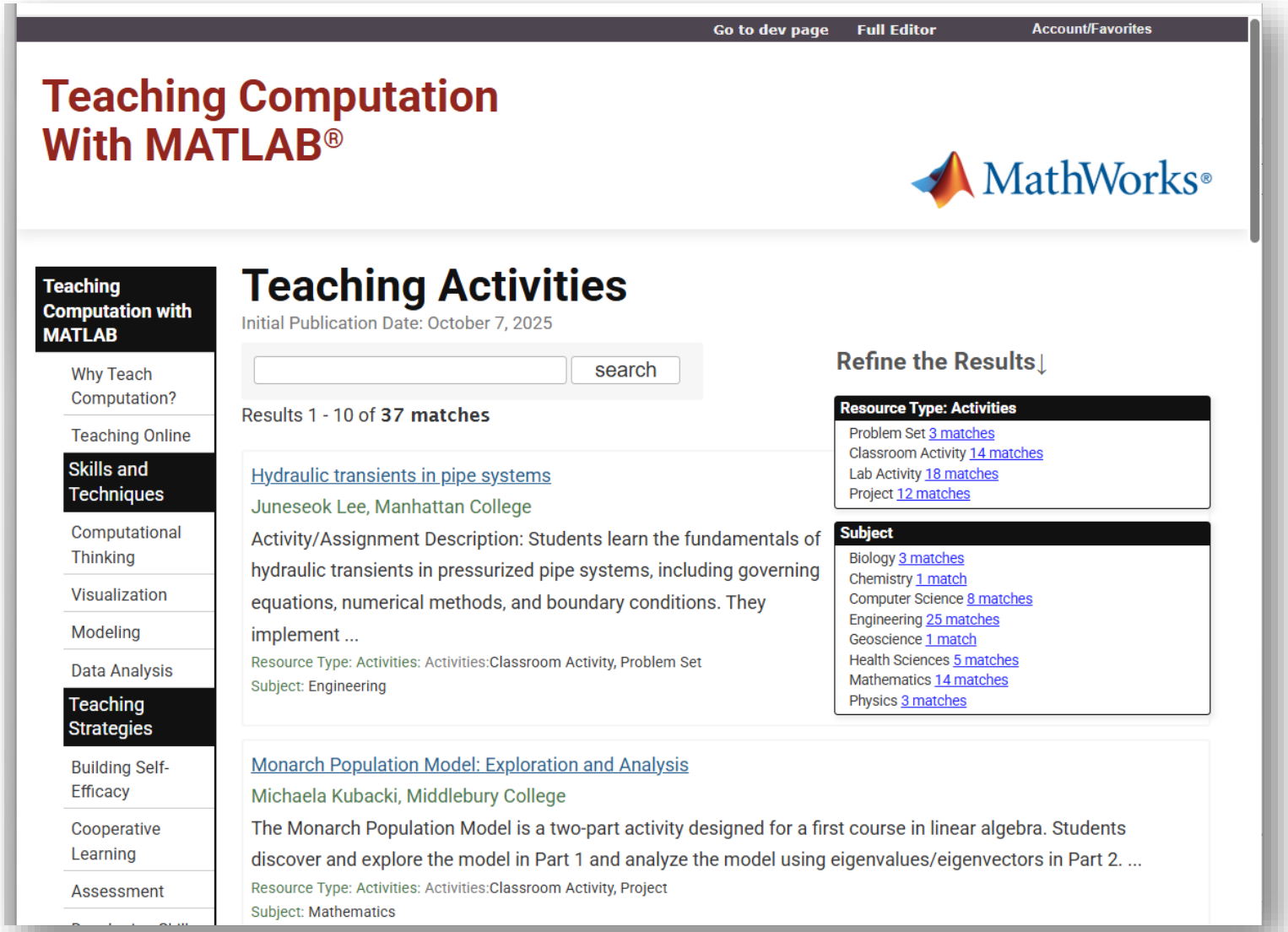
School Affiliations of 50+ 2025 Workshop Participants

(some with multiples, >20 returning participants)

- Bradley University
- California State University-Fullerton
- Elon University
- Emory University
- Florida Agricultural and Mechanical University
- Florida Gulf Coast University
- Florida Polytechnic University
- Instituto Tecnologico de Costa Rica
- Marshall University
- McGill University
- Merrimack College
- Middlebury College
- Minnesota State University-Mankato
- North Carolina A & T State University
- Ohio Northern University
- Polytechnic University of Puerto Rico (3?)
- Prairie View A & M University
- Purdue University-Main Campus (2)
- Sienna College
- Sonoma State University
- St. Olaf College
- Texas A & M University (2?)
- The University Of Trinidad and Tobago
- University of Alaska Anchorage
- University of Arizona
- University of Bridgeport
- University of Colorado at Boulder (3)
- University of Ferrara
- University of Florida (2?)
- University of North Carolina at Chapel Hill
- University of Oklahoma Norman Campus
- University of Southern Mississippi
- University of Technology, Jamaica
- University of Tennessee, The
- University of Texas at Dallas (2)
- University of the Incarnate Word
- University of Wyoming
- Vanderbilt University
- Virginia Military Institute
- Washington University in St. Louis
- Western Connecticut State University
- White Station High School

Your 2025 Teaching Activity Submissions – 37!

Review editors have reviewed and shared feedback on ~2/3 of the reviews



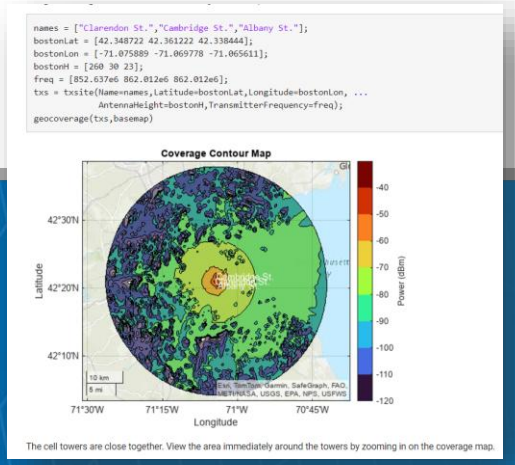
Teaching and Learning –

What's Important to Know?

Lisa Kempler, Lead Convener, MathWorks

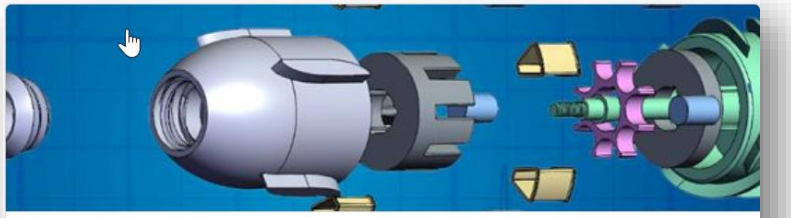
2025 MATLAB Educator Workshop

Keynote



Do you need an aspirational story to motivate students?

Making it real inspires . . . .



ENGINEERED SYSTEMS / MEDICAL DEVICES

Students Design a Low-Cost, Lifesaving Heart Pump

AI, Model-Based Design, and Code Generation Optimize Biomedical Device Development

Medical Devices

Toyota Builds Virtual Proving Ground for ADAS

Creating Digital Assets for Realistic Virtual Testing

Automotive

Fighting Crop Diseases with AI and Internet of Things

IoT Sensors Help Boost Maize Production in Africa

Agriculture

AI / INTERNET OF THINGS

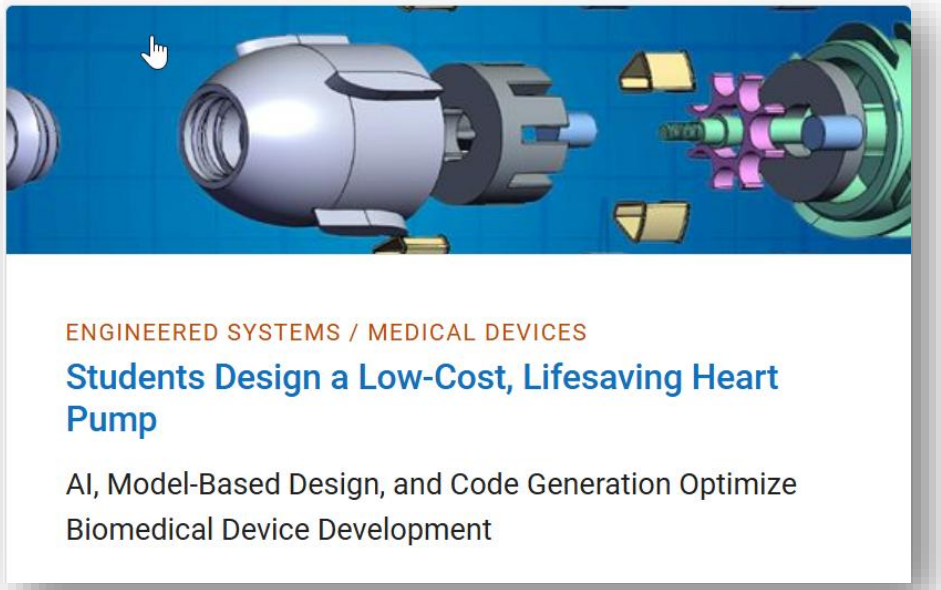
Stopping Cyberattacks with AI

Math Plus Machine Learning Quickly Identifies and Deflects Malicious Traffic

Cybersecurity

Story: Students Cut Design Time, Build a Cheaper Heart Pump

Technologies: AI, Controls, Image Processing, GPUs, and Code Generation



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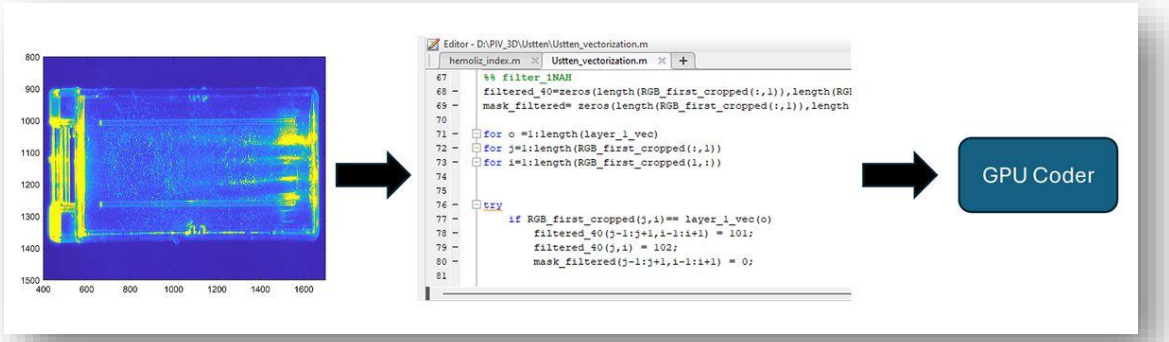


Medical Devices

Tools used

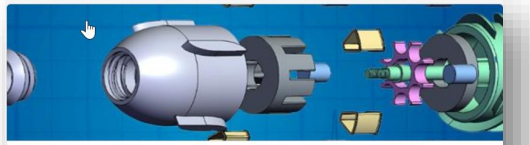
- Algorithms
  - MATLAB
  - AI/RL, Image Processing
- Digital Twin (“mock circuit” of heart)
  - Simulink, Simscape
  - Simulink RT, dSPACE
- Code Generation (motor)
  - MATLAB Coder
  - GPU Coder + Nvidia TX2

Outcomes

- Practical development
- Real-time speed adjustments
- 50% cost reduction (surgery+device)
  - More practical for Turkish patients
- Paper published
- Planned: Work with manufacturers

Students Design Heart Pump Using AI, PIV, and Code Generation - MATLAB & Simulink

Students LVAD Heart Pump Project: What They Built



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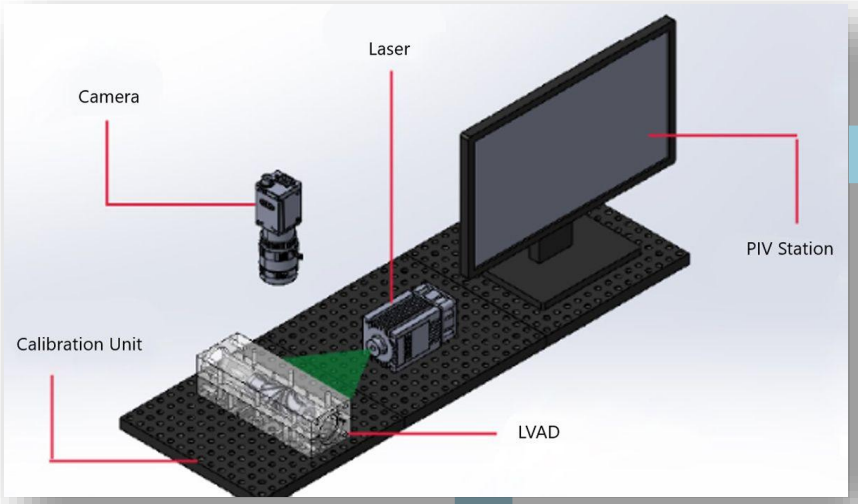
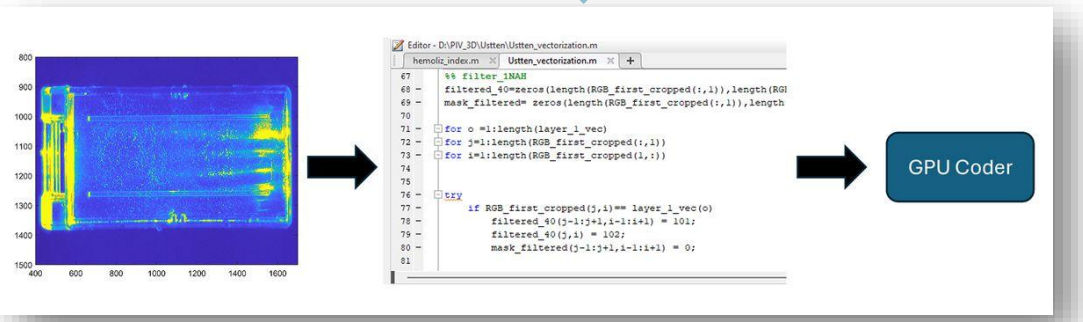
Cardiovascular Model Test Platform (with PIV)



1



2

Digital Twin model of 2-motor LVAD with auto-adjusted speed

+

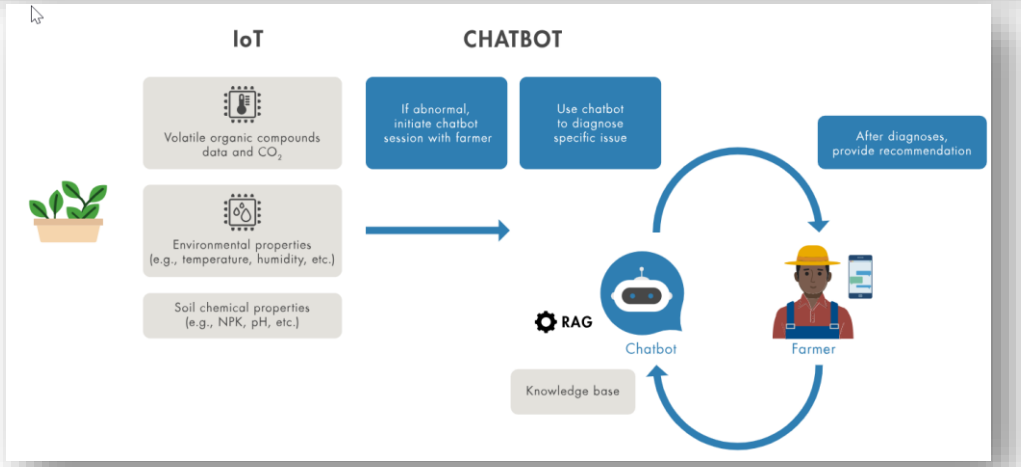
3

+

Wireless Patient Monitoring Device

Story: East African PhD Researcher Catches Maize Disease Early

Technologies: Sensors, ThingSpeak, MATLAB, Trained AIs and Chabots



Agriculture

Researchers used

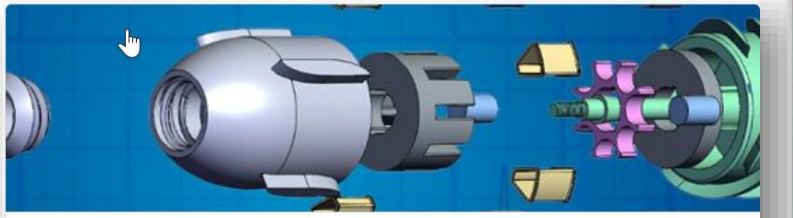
- Data collection about plants
  - Sensors: VOC air quality, movement
  - ThingSpeak
- Model training and development
  - MATLAB LSTMs + CNNs
- Plant health analysis process
  - MATLAB, GenAI

Outcomes ➔ Plant health monitoring process

- Trained, reusable ML models
- 1/3 time to detect disease (4 vs.14+ days)
- Higher crop yields
- New LLM ChatBot for farmers

Fighting Crop Diseases with AI, IoT, and Computer Vision - MATLAB & Simulink

Which cool classroom innovations should you invest in?



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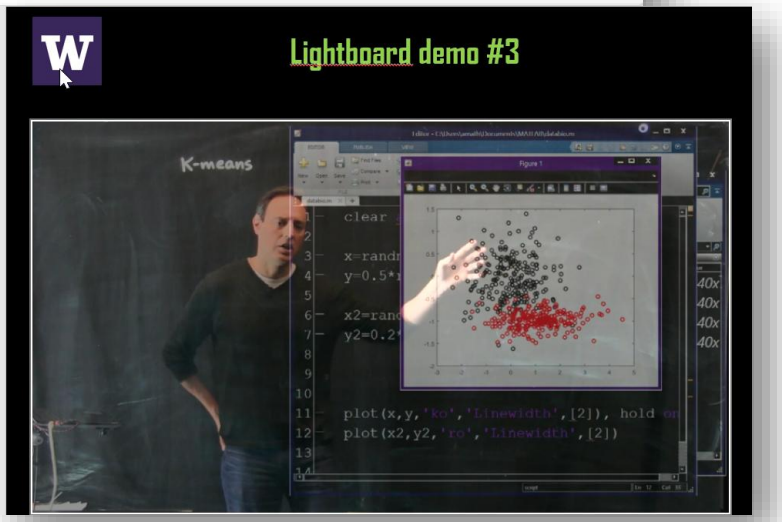
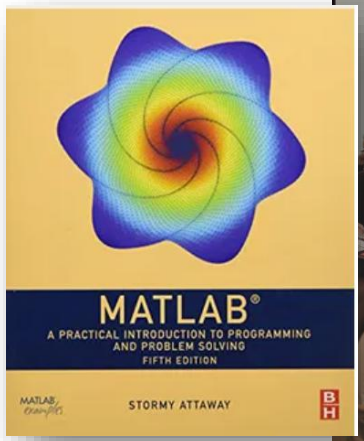




YouTube

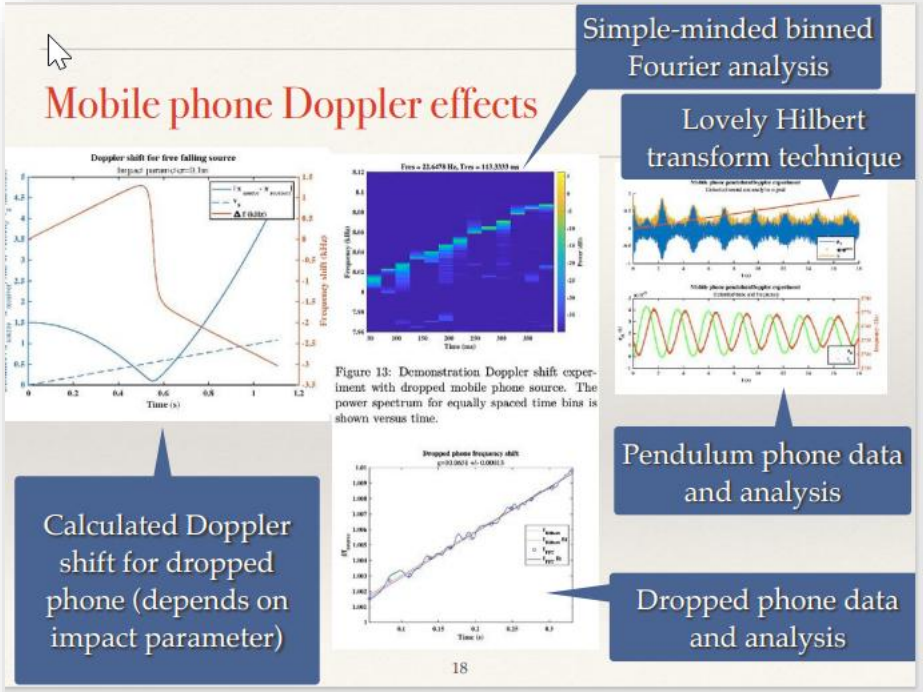
[Stormy Attaway, 2019 Workshop Keynote]

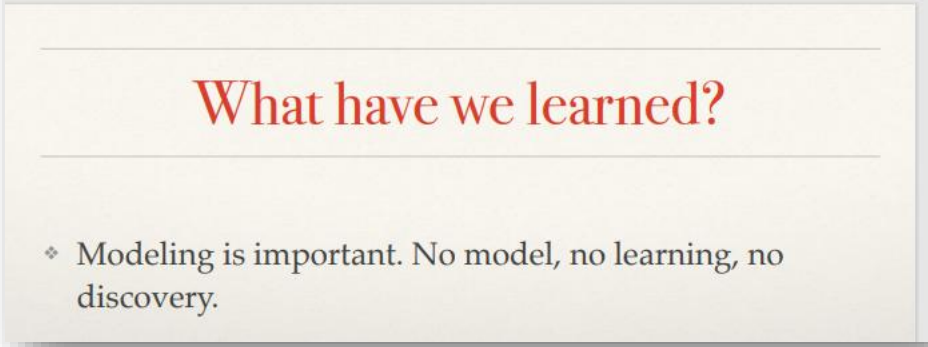
Example: Intro to Physics with **Simple Hardware**

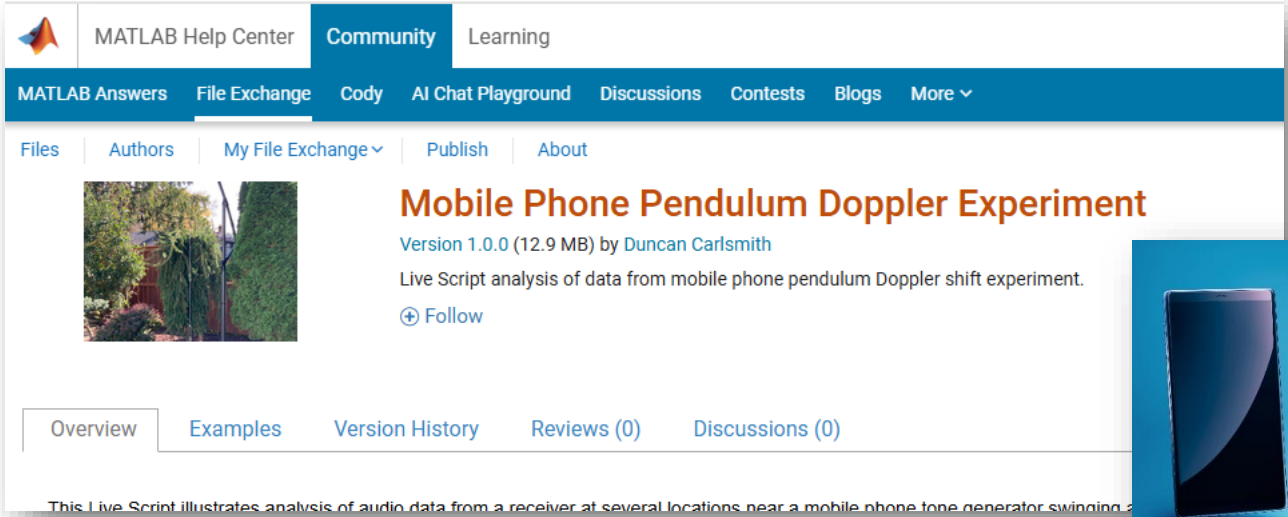
Record Doppler Effects with iPhone MATLAB Sensor Package

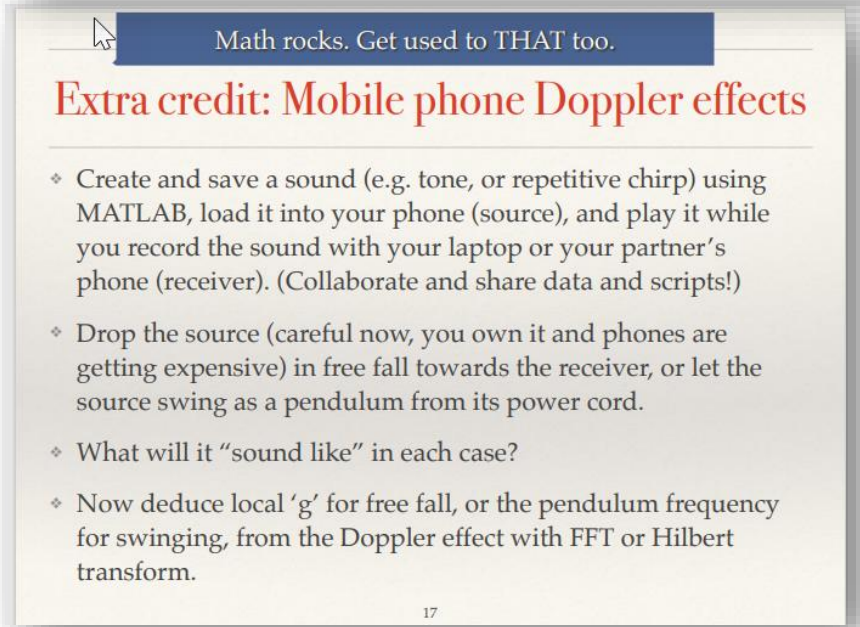
repo on File Exchange

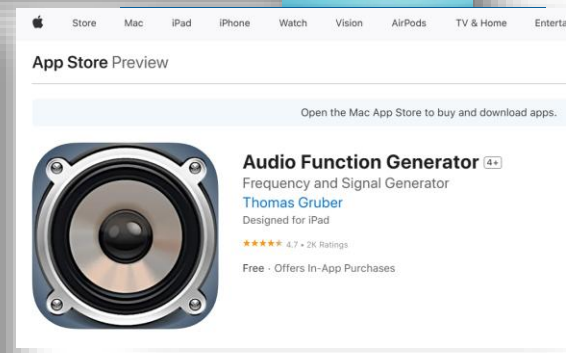
152 contributions!





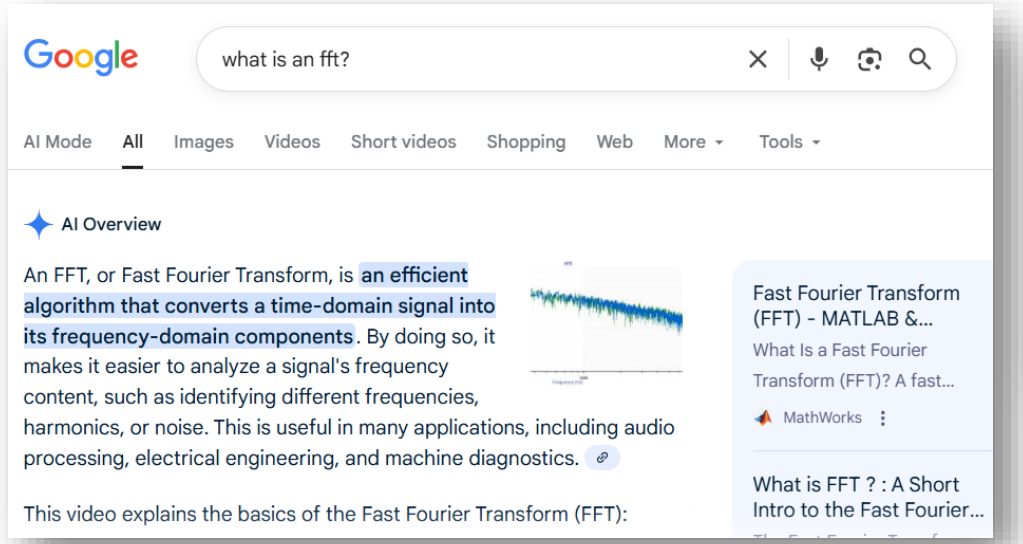


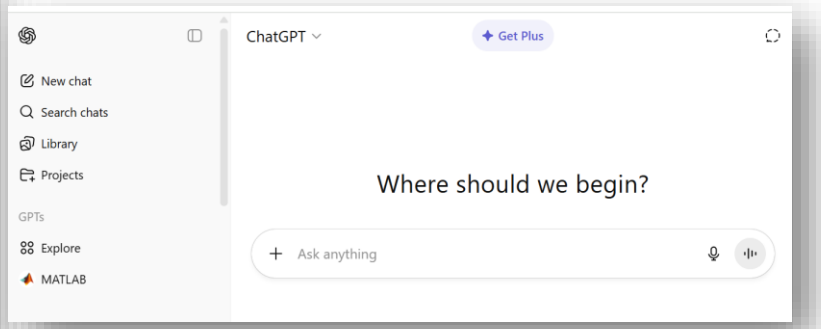


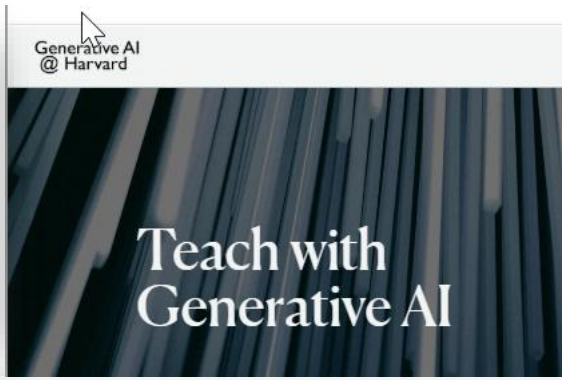


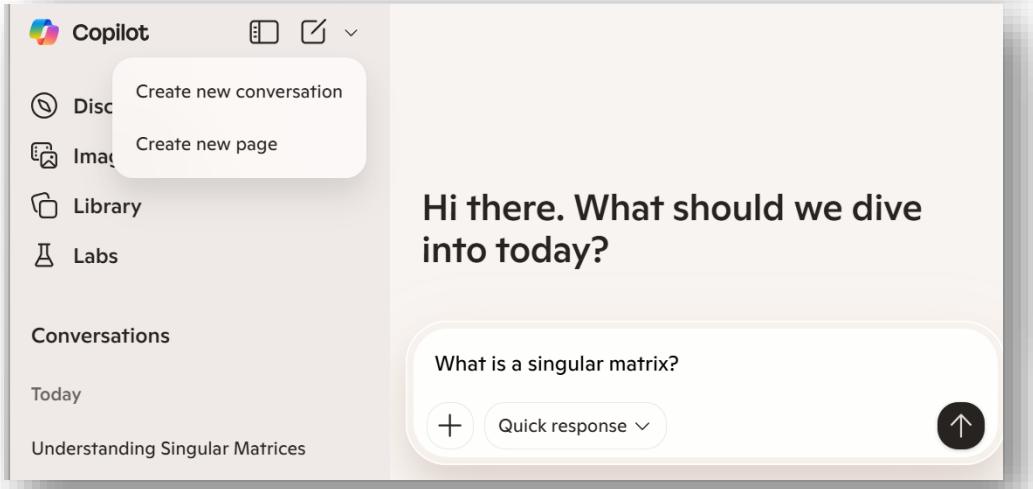
Duncan Carlsmith, UWisc-Madison workshop: 2019, '20, '22

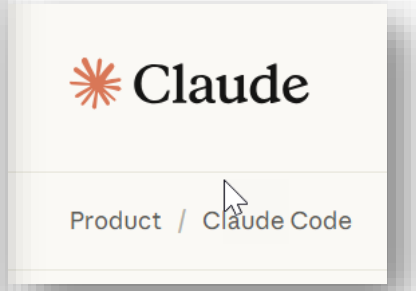
And Now GenAI: Forcing Curriculum Rethinking and Rework











Frequently asked questions

The following information offers advice for educators interested in using generative AI tools in their teaching and course preparation. As this technology is constantly evolving, this page will be updated frequently with new resources and advice.

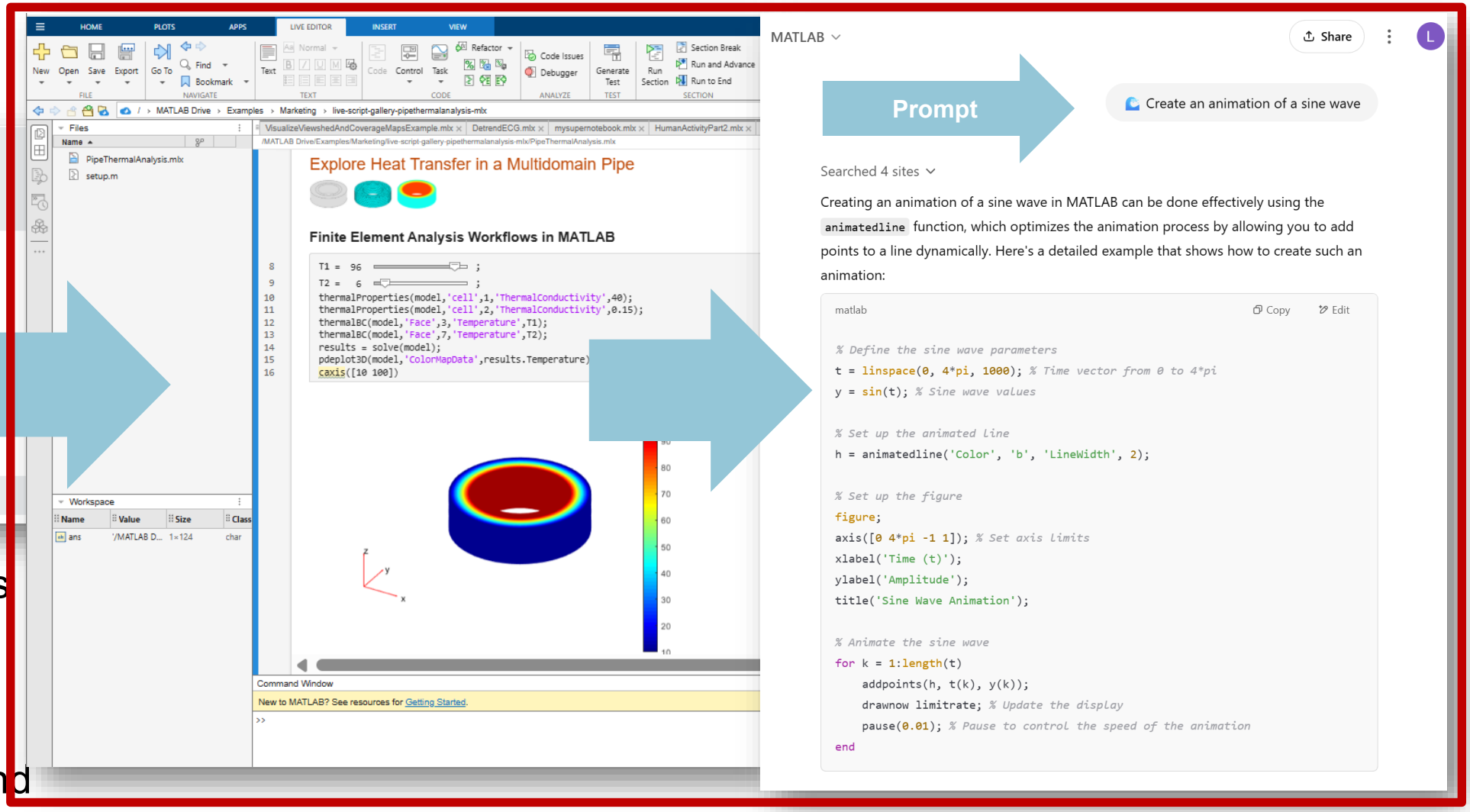
- How can I use generative AI to help prepare my curriculum?
- How can I use generative AI to help me teach in the classroom, day to day?
- How can I redesign assessments to reduce the misuse of generative AI?
- What are the most important risks of using GenAI tools in my classroom?
- How do I know whether GenAI is even effective for teaching?
- How can I become a GenAI whiz?
- What policies should I keep in mind when using LLMs in my classroom?

Programming Evolution: Blinking Cursor to Data-Driven Guided Coding

myfirstprogram.c

```c
#include <stdio.h>

int main() {
  printf("Hello World!");
  return 0;
}
```



Programming in the ’80s
(‘70s was assembly!)

Blank screen of death
Debug = “print” command

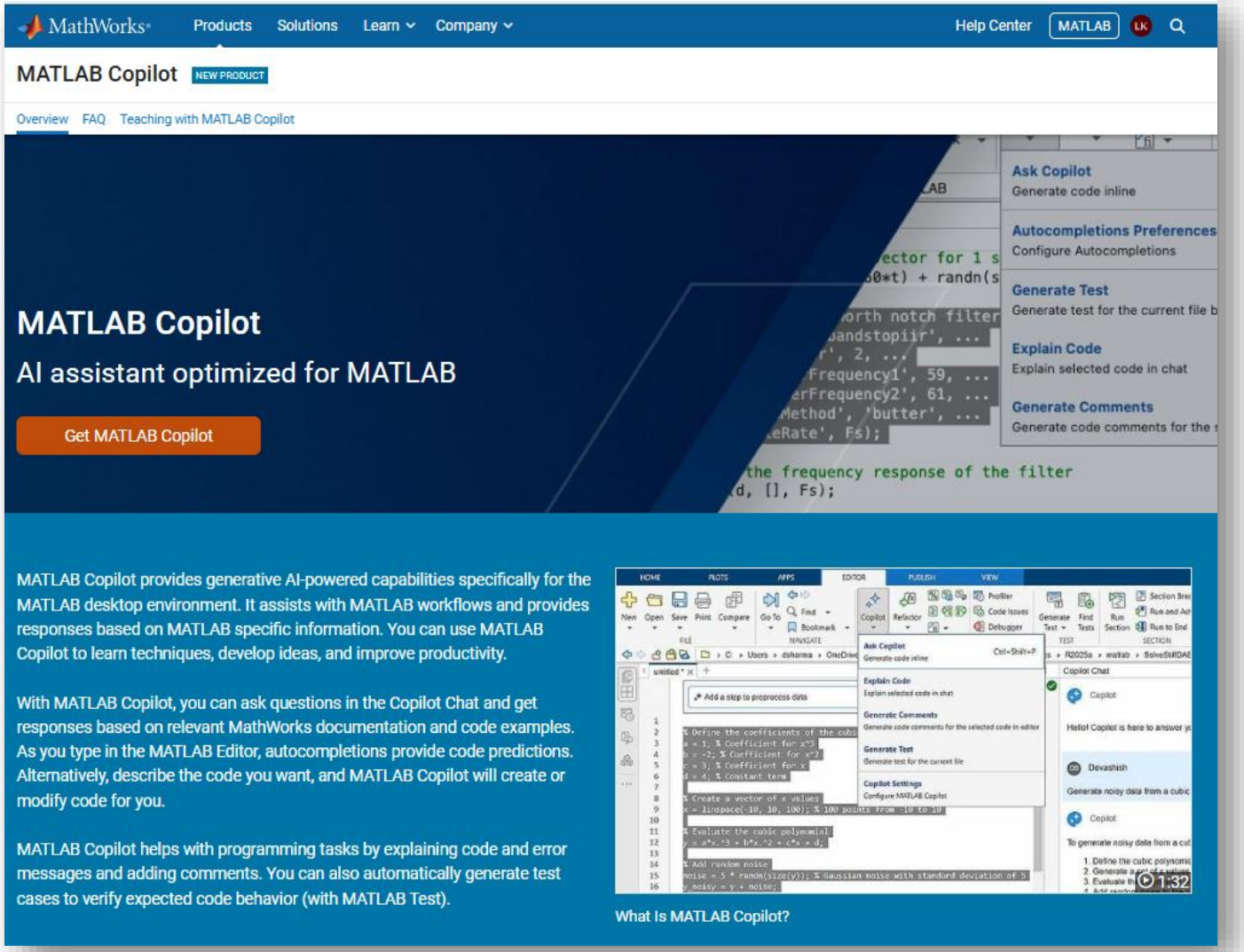
“IDEs” + 4GLs ➔ Executable Notebooks

Apps that know how to program

Who has used GenAI in your courses?

(hands up)

GenAI in MATLAB: MATLAB Copilot:



May 14th Release

DEMO

ChatGPT PROMPTS

create an errorbar plot that shows temperature differences in major cities

Modify to use different colors for the different city bars. make the positive and negative error different per city

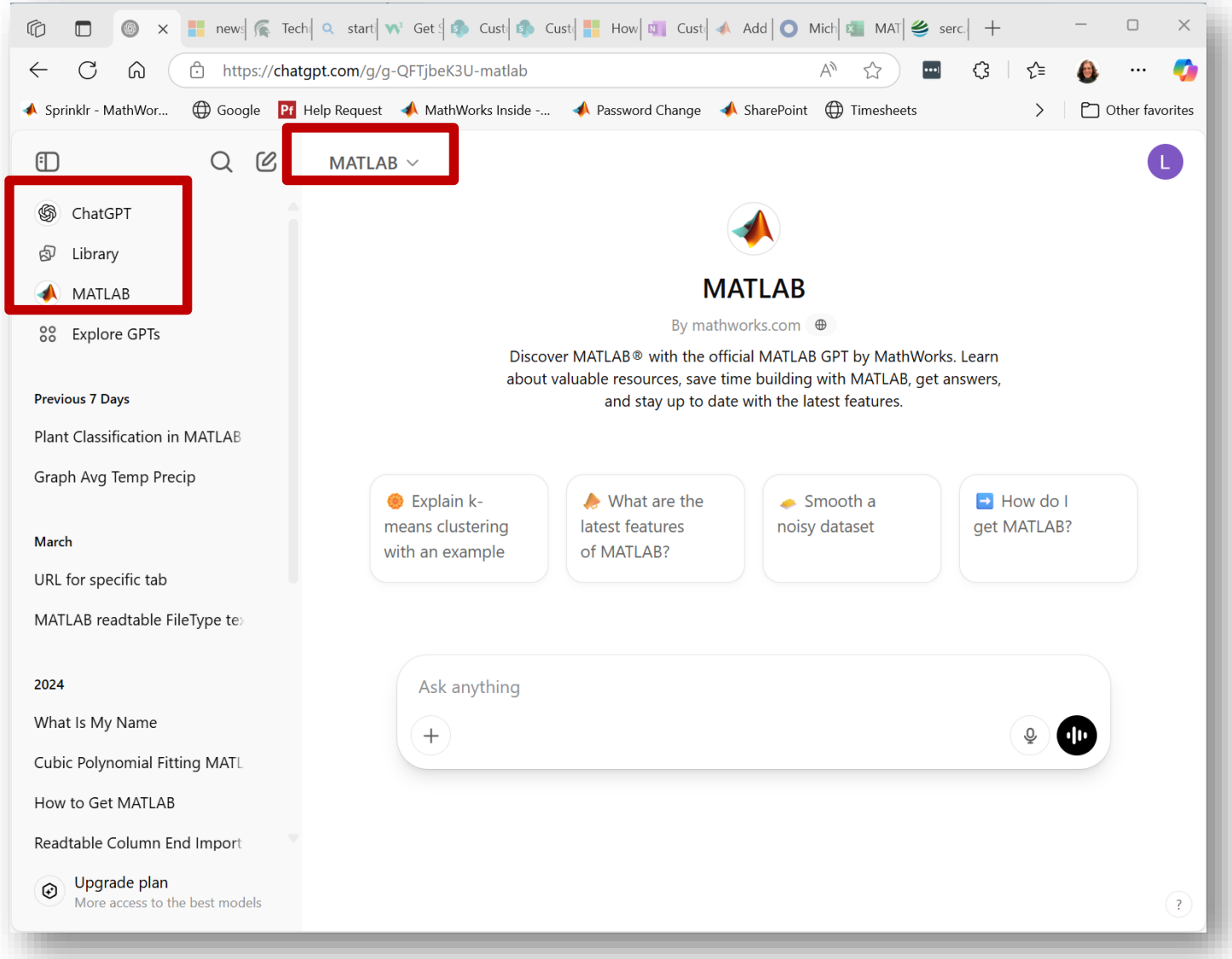
MATLAB GPT: A ChatGPT Variant

MATLAB GPT

OpenAI's ChatGPT
- LLM = GPT-5

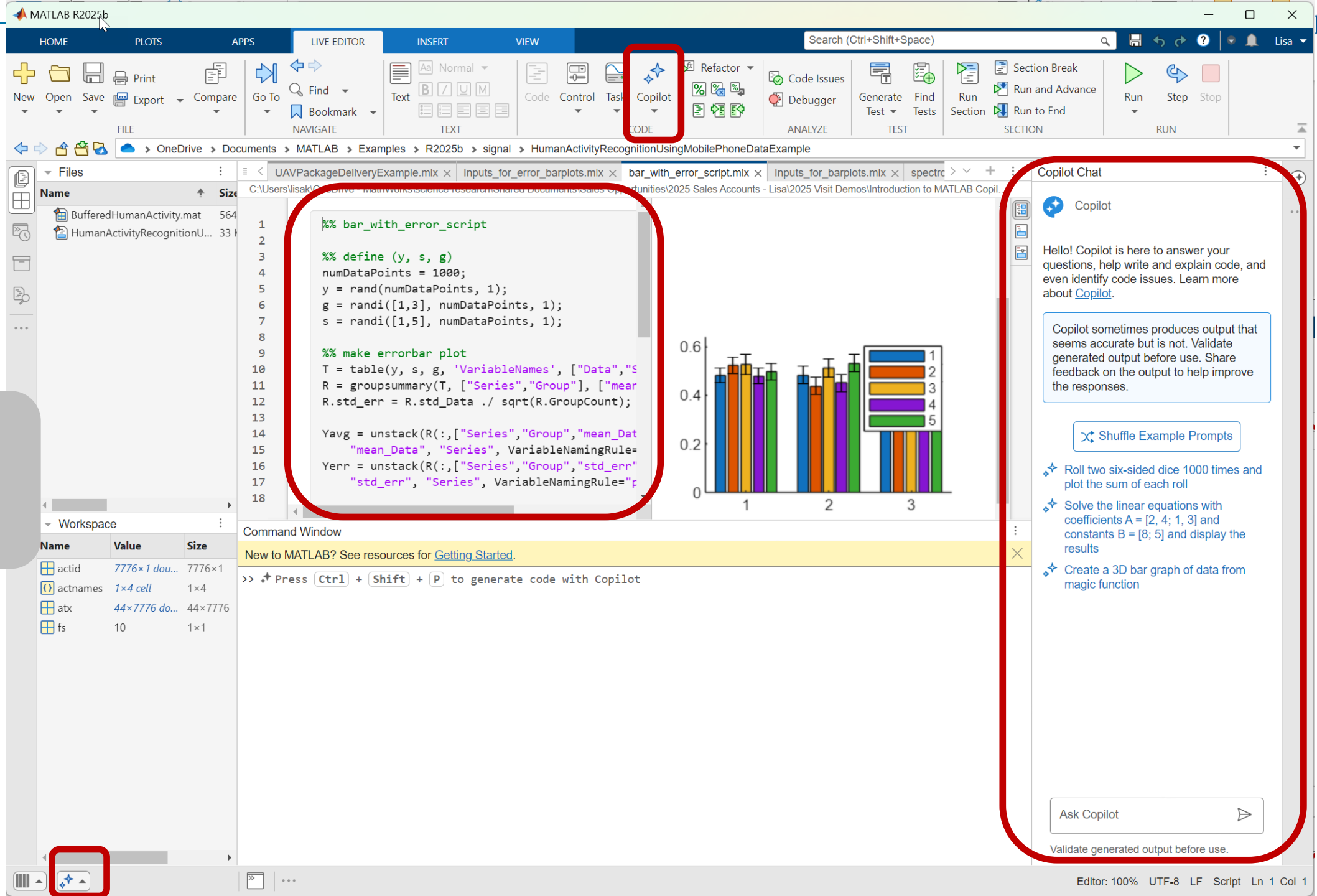
+

MATLAB plug-in with
- www.mathworks.com contents (documentation, examples, etc.)



Blog – 4 ways of using MATLAB with Large Language Models (LLMs) such as ChatGPT and Ollama

MATLAB Copilot



Recent University Trip: 2 Educators had a realization.

"*Teaching Computation: It's not just about working code anymore*"

Program Evaluation Rubrics **Name:**

Report: Culmination of Procrustes!

Attribute	Exceptional	Accomplished	Needs More Work	Not Acceptable	Score
Cover page (2 points – 2/0)	• Included			• Not included	/2

ProcWork m-file (5 points – 5/3/1/0)	• Works perfectly	• One minor mistake, ex,
		  • One wrong index.
		  • Procrustes not normalized.
		  • One piece of extra output on screen
			• Major mistakes, ex,
			  • Comparison based on 3 points instead of 18 points.
			  • Two or more minor mistakes.
			  • One or more (shifting, scaling, rotation) is wrong
				• No included, or
				• Not working
					/5

GetSkullPoints.m (5 points – 5/3/1/0)	• Works perfectly	• One minor mistakes, ex,
		  • Missing color input.
		  • One piece of extra output on screen
			• Major mistakes, ex,
			  •
				• No included, or
				• Not working
					/5

PlotSkullFunction.m (5 points – 5/3/1/0)	• Works perfectly	• One minor mistakes, ex,
		  • Missing color input.
		  • One wrong index.
		  • One piece of extra output on screen
			• Major mistakes, ex,
			  • Did not create four separate close polygons.
				• No included, or
				• Not working
					/5

Comments (12 points – 12/8/4/0)	• Headers included • Purpose • Variable explained • Detailed comments throughout.	• Missing one	• Missing two	• Missing three or four	/12

Efficiency (8 points – 8/5/3/0)	• Include clear, home
	• Compact code (loops and function used effectively).
		• One minor mistake, ex,
		  • Using for loop to get distance instead of as an array.
			• Major mistakes, ex,
			  • Compute distance for each pair (18 points) with 18 separate lines.
			  • Two or more minor mistakes.
				• Very inefficiency
				• No logical flow (counter intuitive)
					/8

Elegance (4 points – 4/2/0)	• Well named variables • Extra space for readability	• Missing one		• Missing both	/4

Figures (4 points – 4/3/1/0)	• Included both best fit and least fit skulls, and all information is present.	• One minor mistake, ex,
		  • Missing titles
		  • Wrong label axis
		  • Not identifying which pairs of skulls
			• Major mistakes, ex,
			  • 18 points on skull not in correct order.
			  • Two or more minor mistakes.
				• Not included	/4

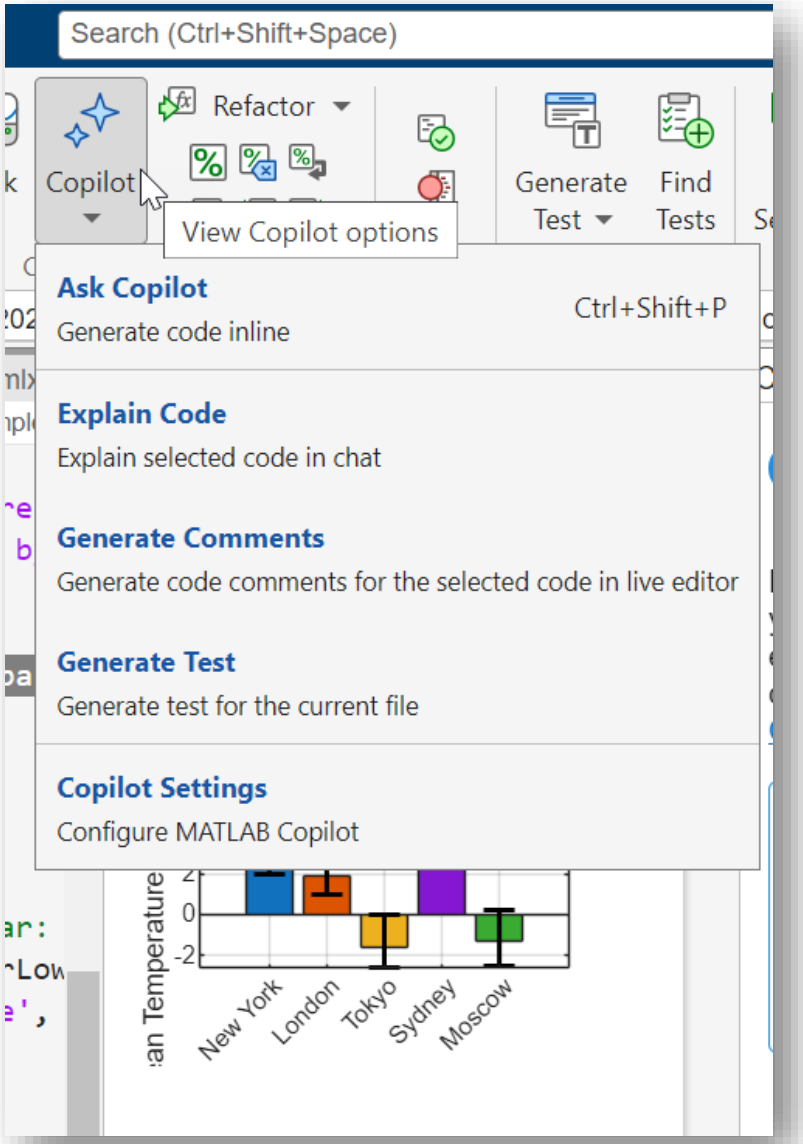
Discussion (5 points – 5/3/1/0)	• Give initial estimates. • Make sense. • Give procrustes values for all pairs.	• Missing one	• Missing two or more.	• Not included	/5
				Total (out of 50)	

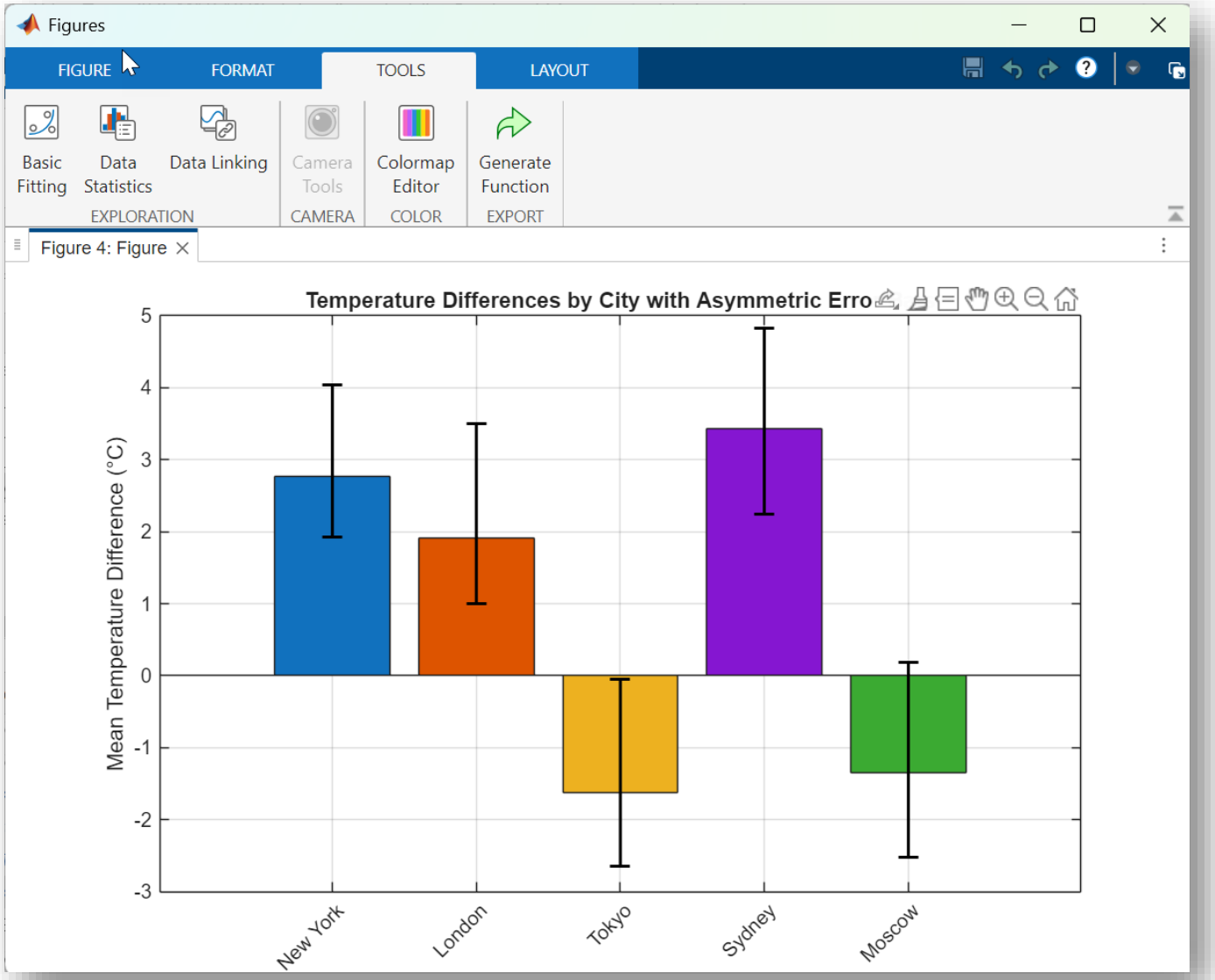
BE100 Program Evaluation Rubrics E. Dosmar Page 1 of 1

[Procrustes Shape Analysis Rubric --]

Emily Domar and Glen Livesay, Rose Hulman Institute

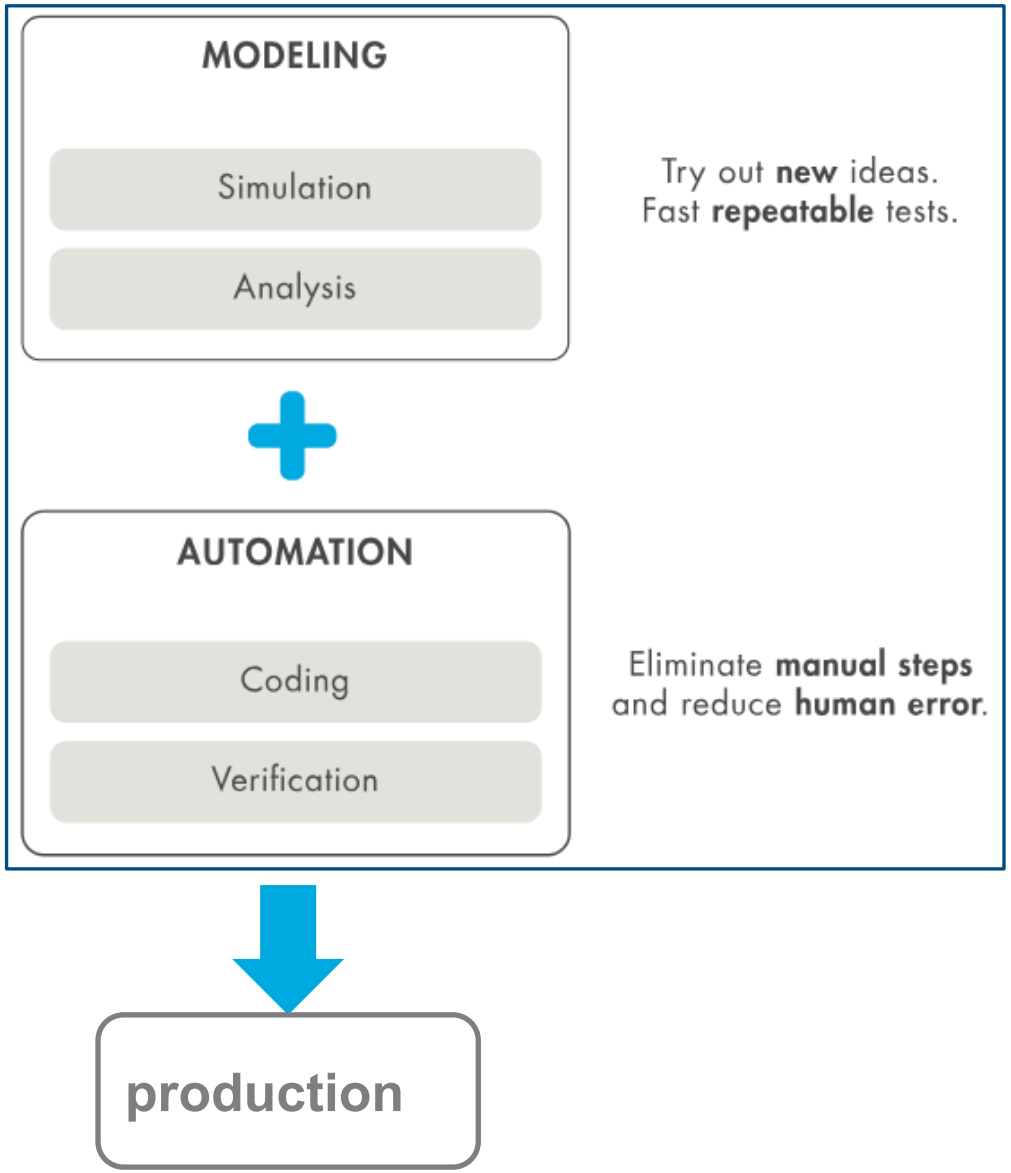
CoPilot Actions and `plot` Tools –Windows into Owning Your Code





More Beyond Code: What is Model-Based Design?

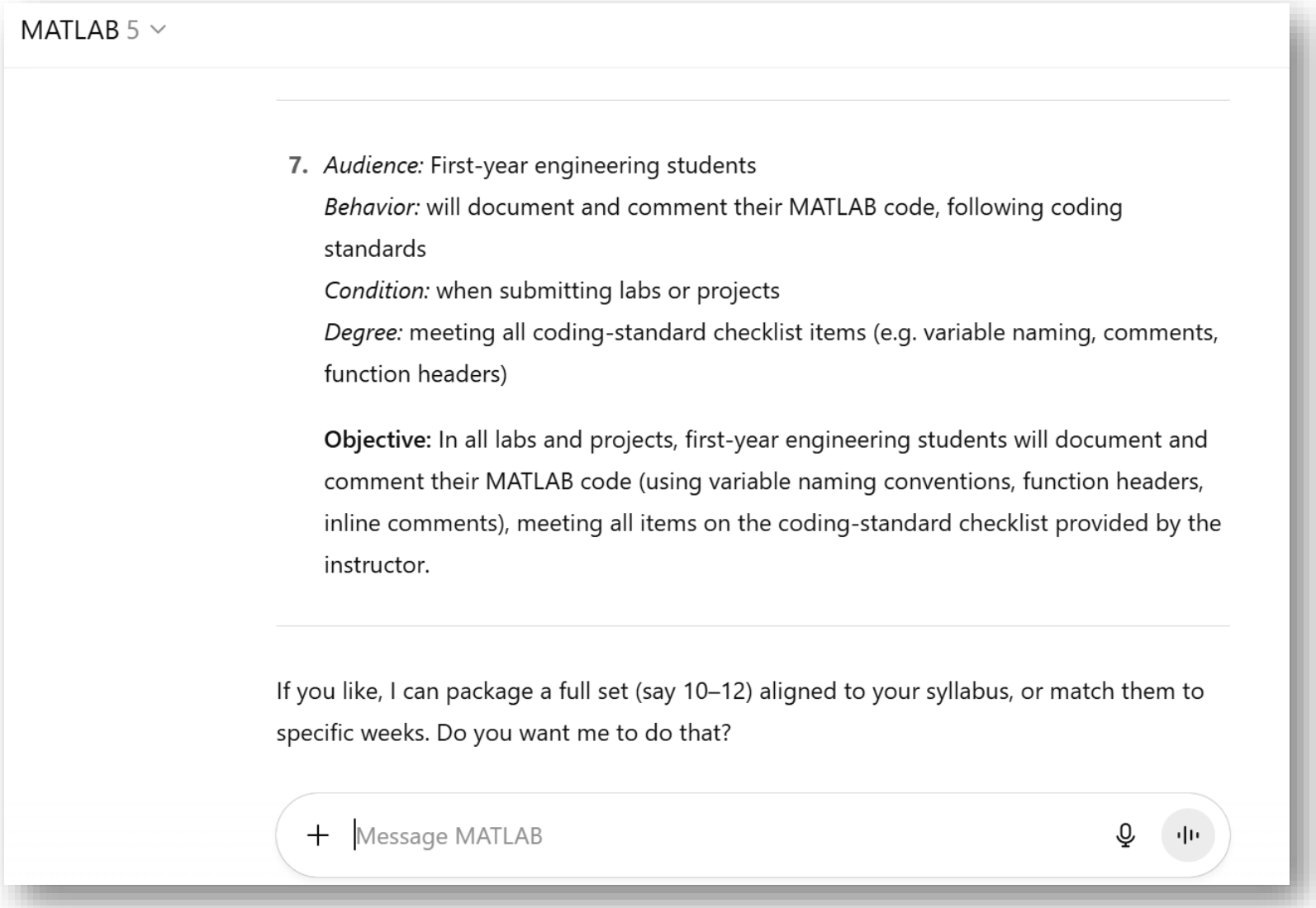
- Creating a virtual representation of a real-world system
  - **Model** new ideas and perform repeatable tests with **simulation**
  - Adjust **design** based on these simulations and **iterate**
  - **Digital twin =** Identical software model



MATLAB GPT to Write Assignments

(Output mapped well to Teaching Activity Structure – context, learning outcomes, assessment)

[ChatGPT Assignment Writing Prompts]



Complex GenAIs Tasks Require Thoughtful Design of Your Ask

Prompts

how do I create a model from data?

how do I fit a cubic

GenAI

Training (context)

Outputs

Data

What does Copilot/ChatGPT need to know about your data?

Can you use generated data?

← Input your data

Models

Do you want advice?

MATLAB GPT typically suggest approaches.

← Share an example result

New or Updated Documents

Tell GenAI structure, output you want

(Syllabus, paper, assignment)

← Share a current example

Code

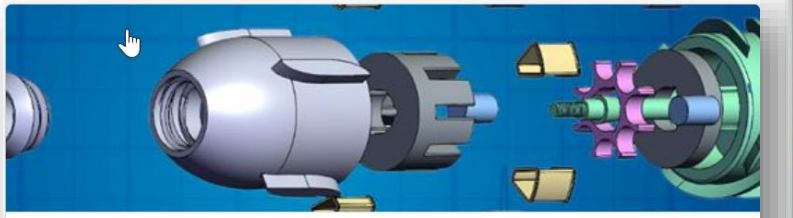
GenAIs can generate code. It may not run or be incomplete.

← Give it code to perform an action on

Tips

Shorter prompts are better.
Increase context over time.
Exploring is encouraged.

Which cool classroom innovations should you invest in?



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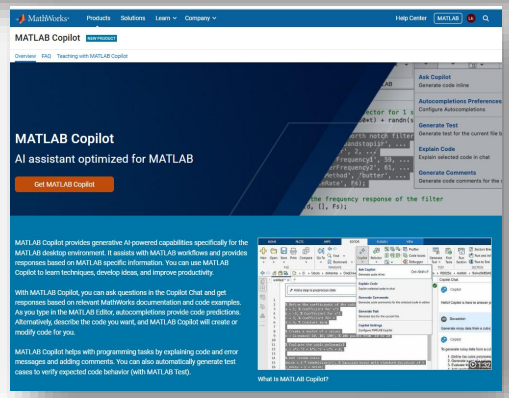
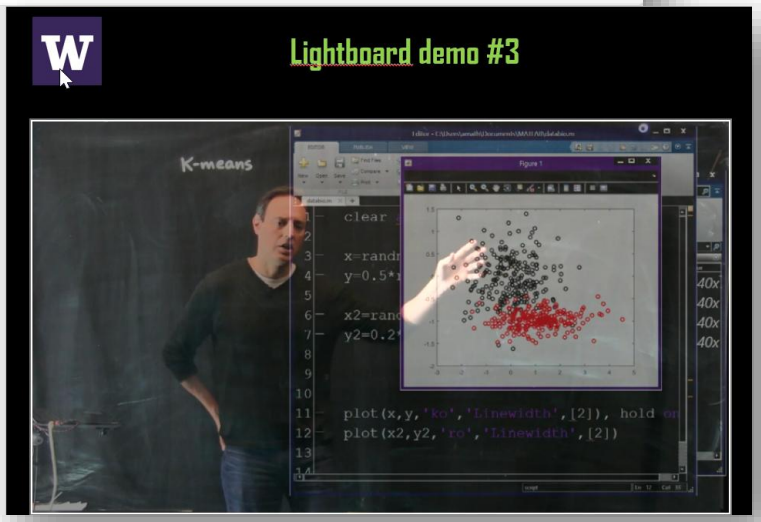
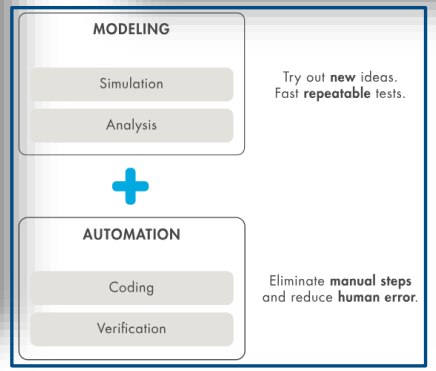
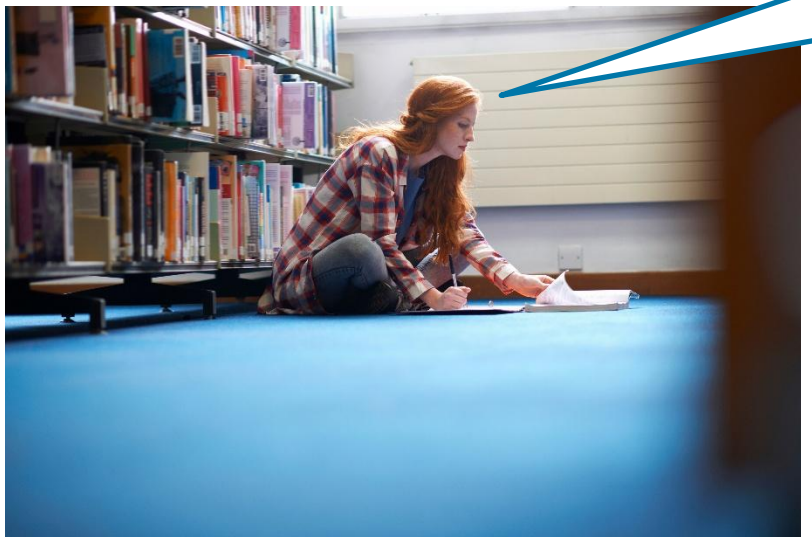






[Stormy Attaway, 2019 Workshop Keynote]



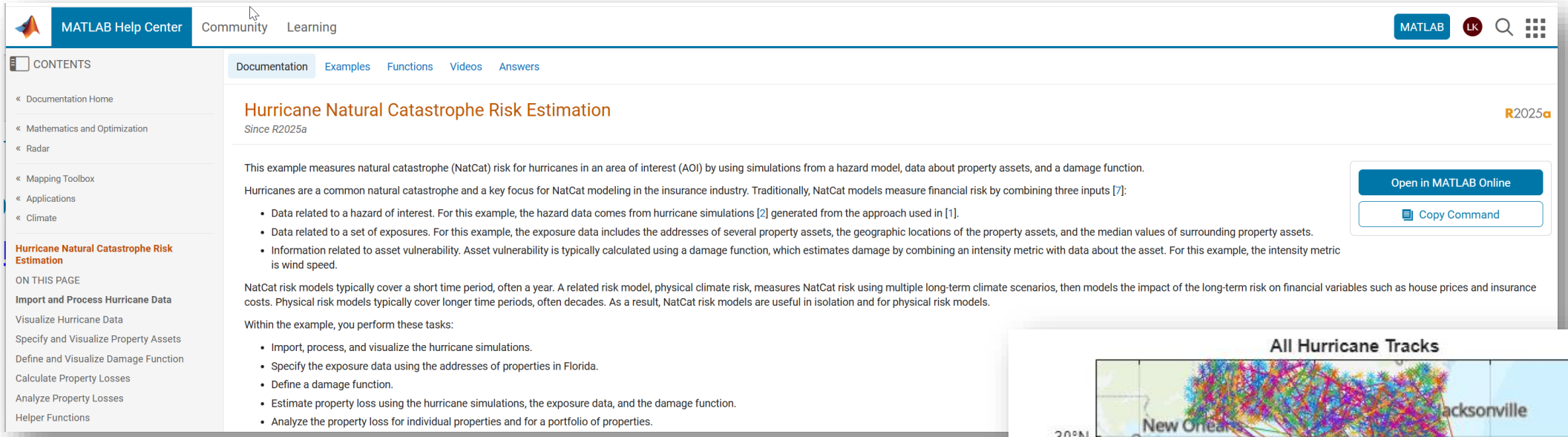
How can I (and students) learn to do all that?

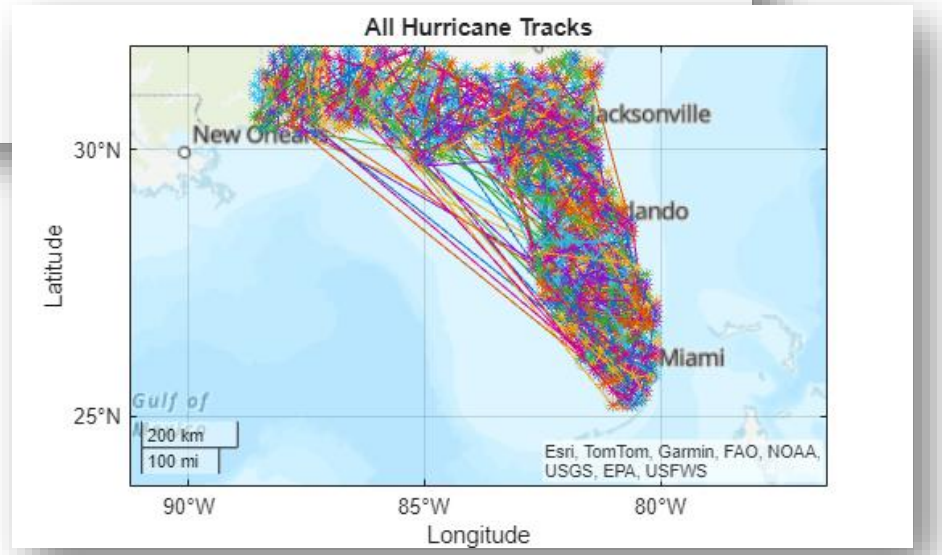
Expose students to *many* ways to learn

(and assign the exploration)

Documentation Code Examples:
Open in MATLAB ➔ Reuse for Projects
Hurricane Natural Catastrophe Risk Estimation

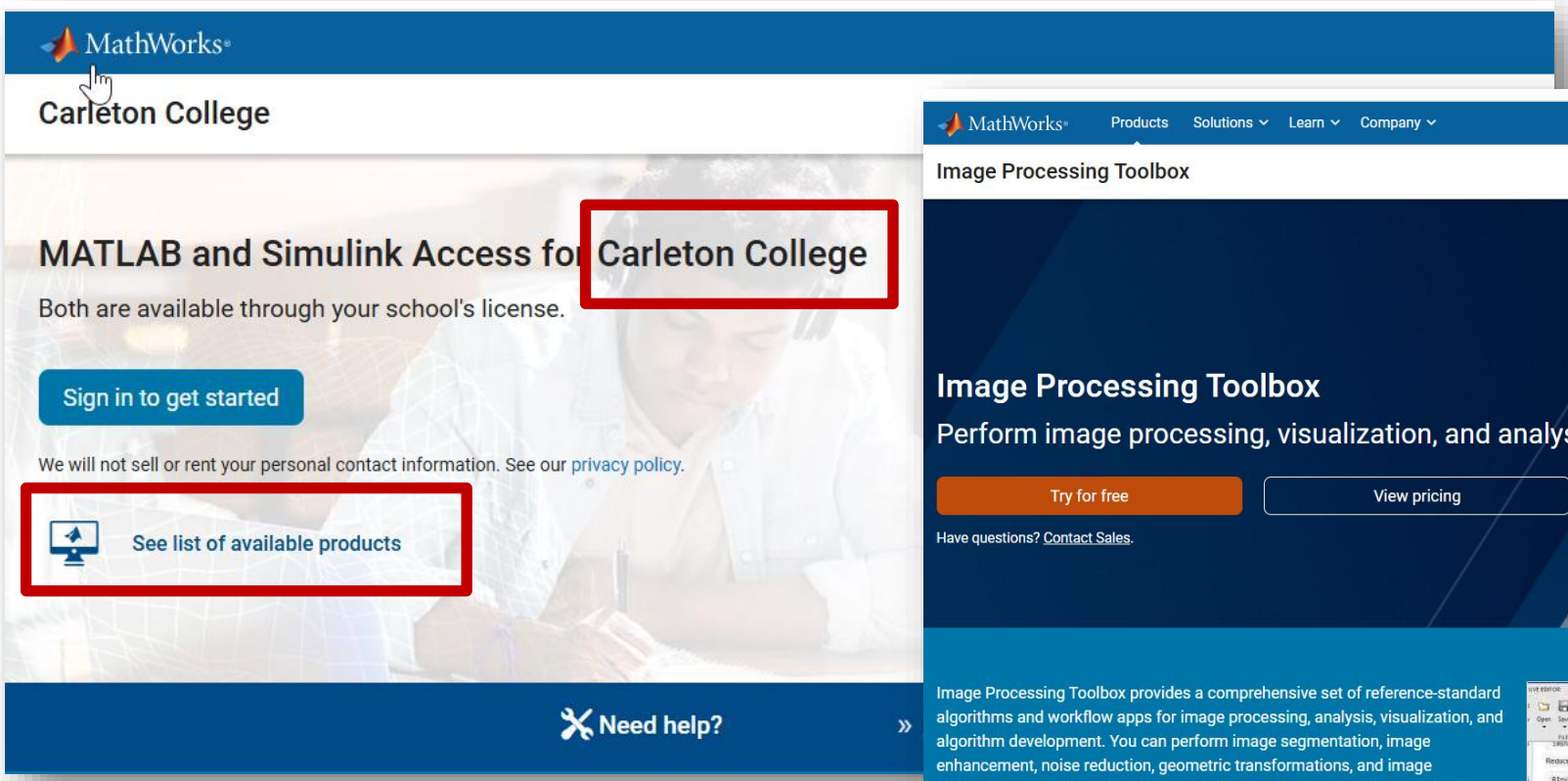
DEMO

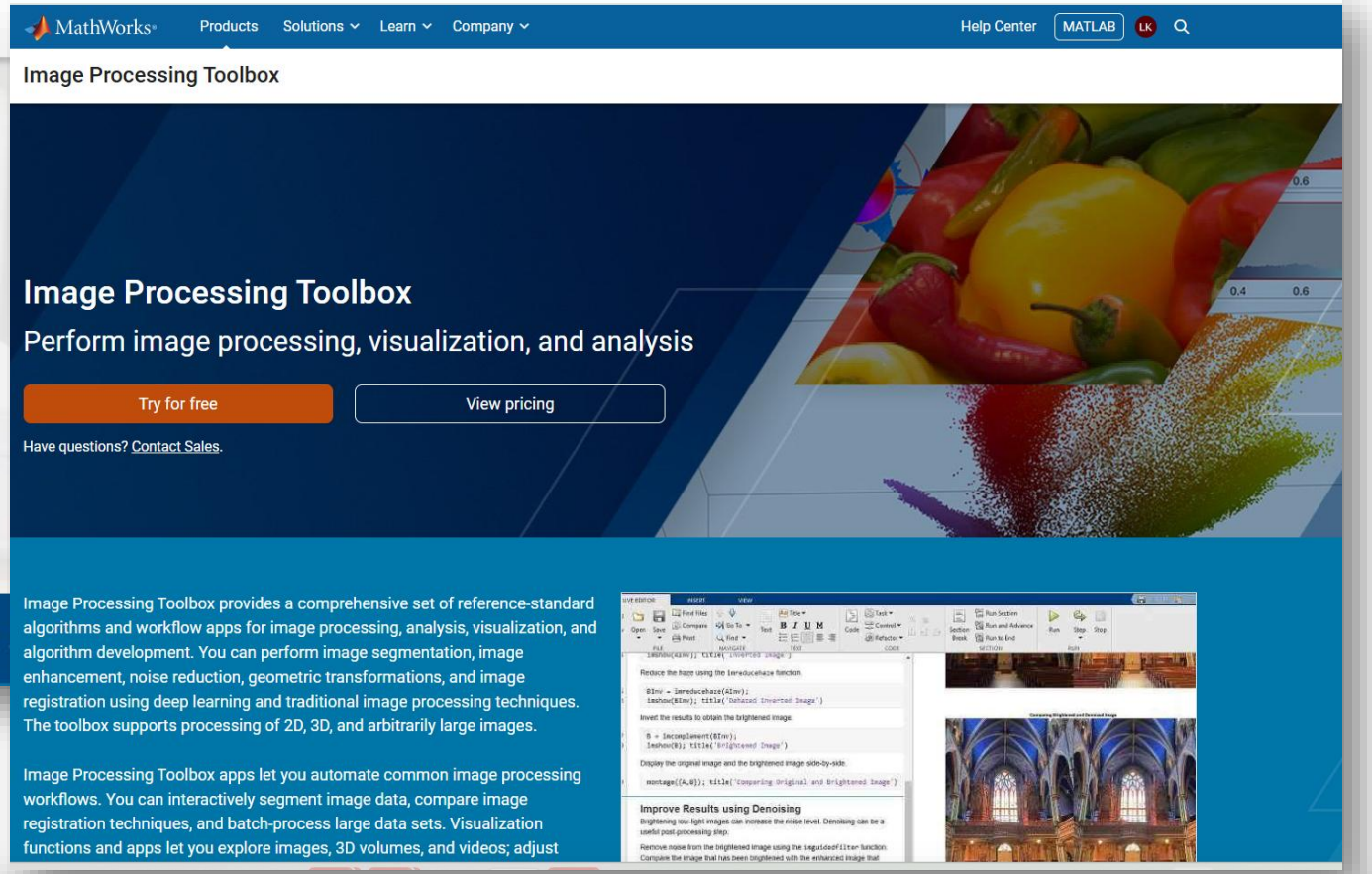




- View Notebook in doc
  - Open in MATLAB Online (or “Copy Command”)
  - Clear Output + Side Output
  - Run and Advance

Resources: University Portal Pages ➔ Individual Product Subsites

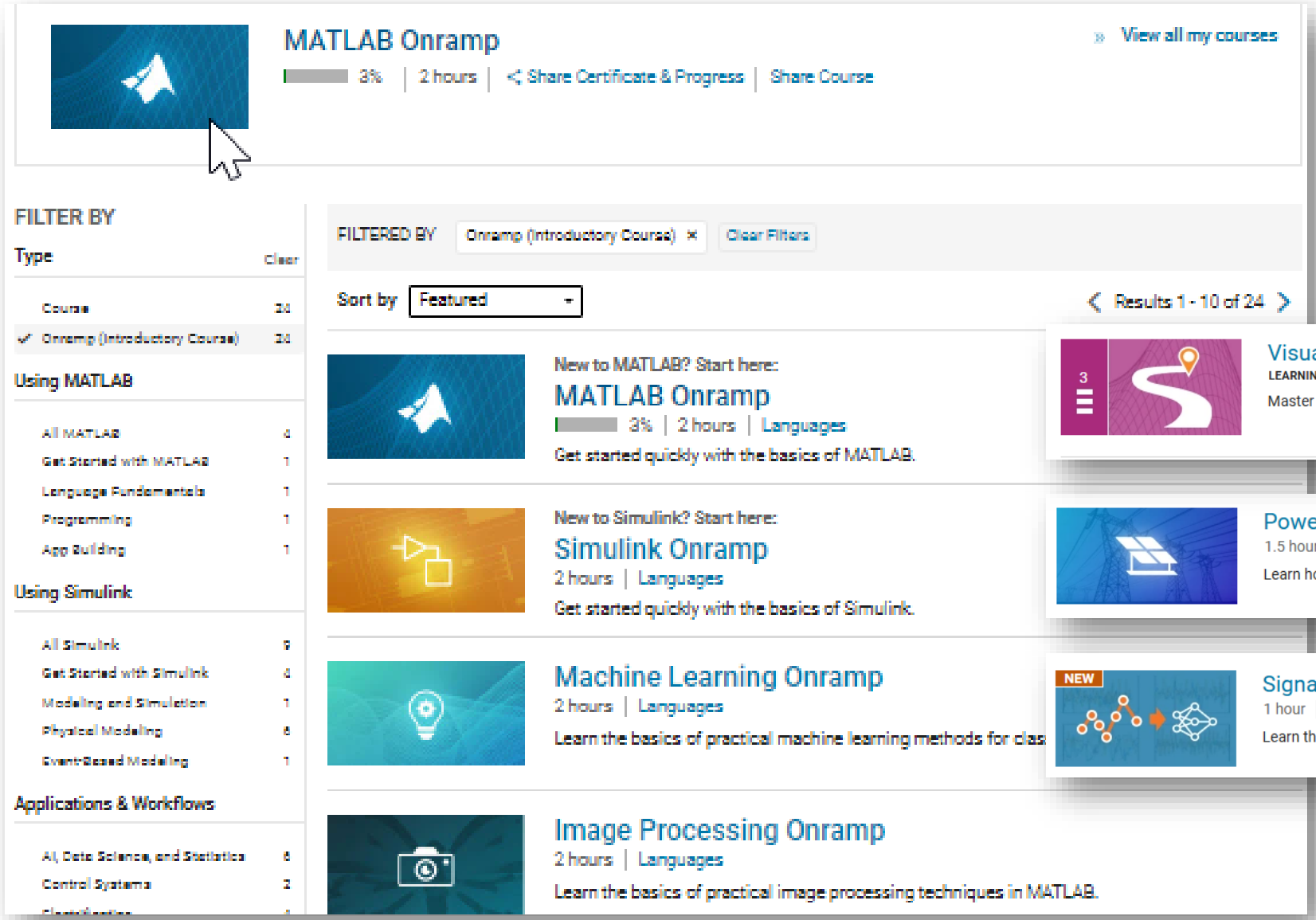




Product Resources: Documentation | Examples | Videos | Hardware support | Requirements | Release notes

rotate-rectangle-roi

MATLAB Onramps and Training: Learn MATLAB Capabilities (FREE)



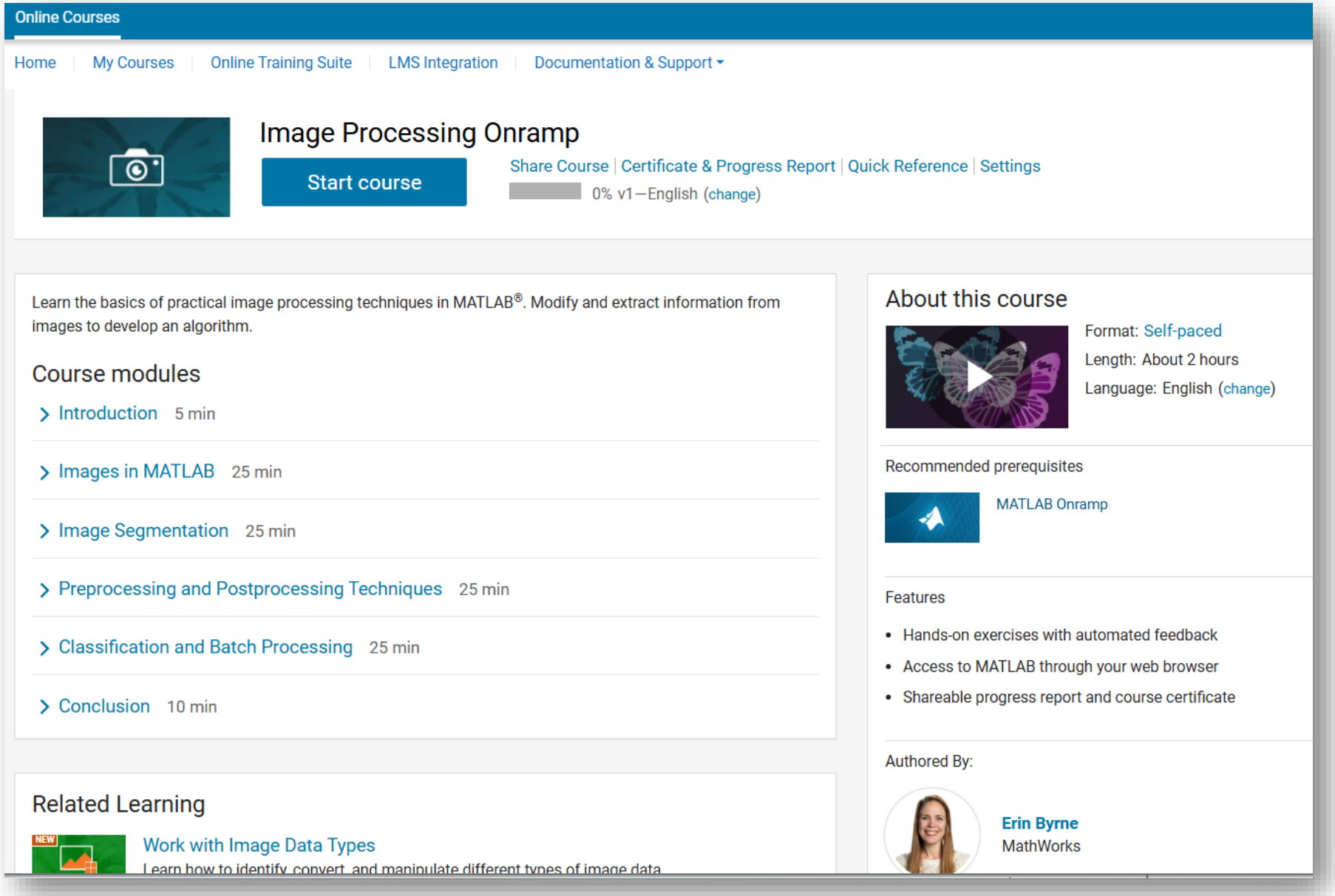
[90 Self-Paced Courses to Learn from]

Visualization in MATLAB
LEARNING PATH: 3 COURSES
Master creating and customizing 2D and 3D plots and gain fine control over your visualizations.

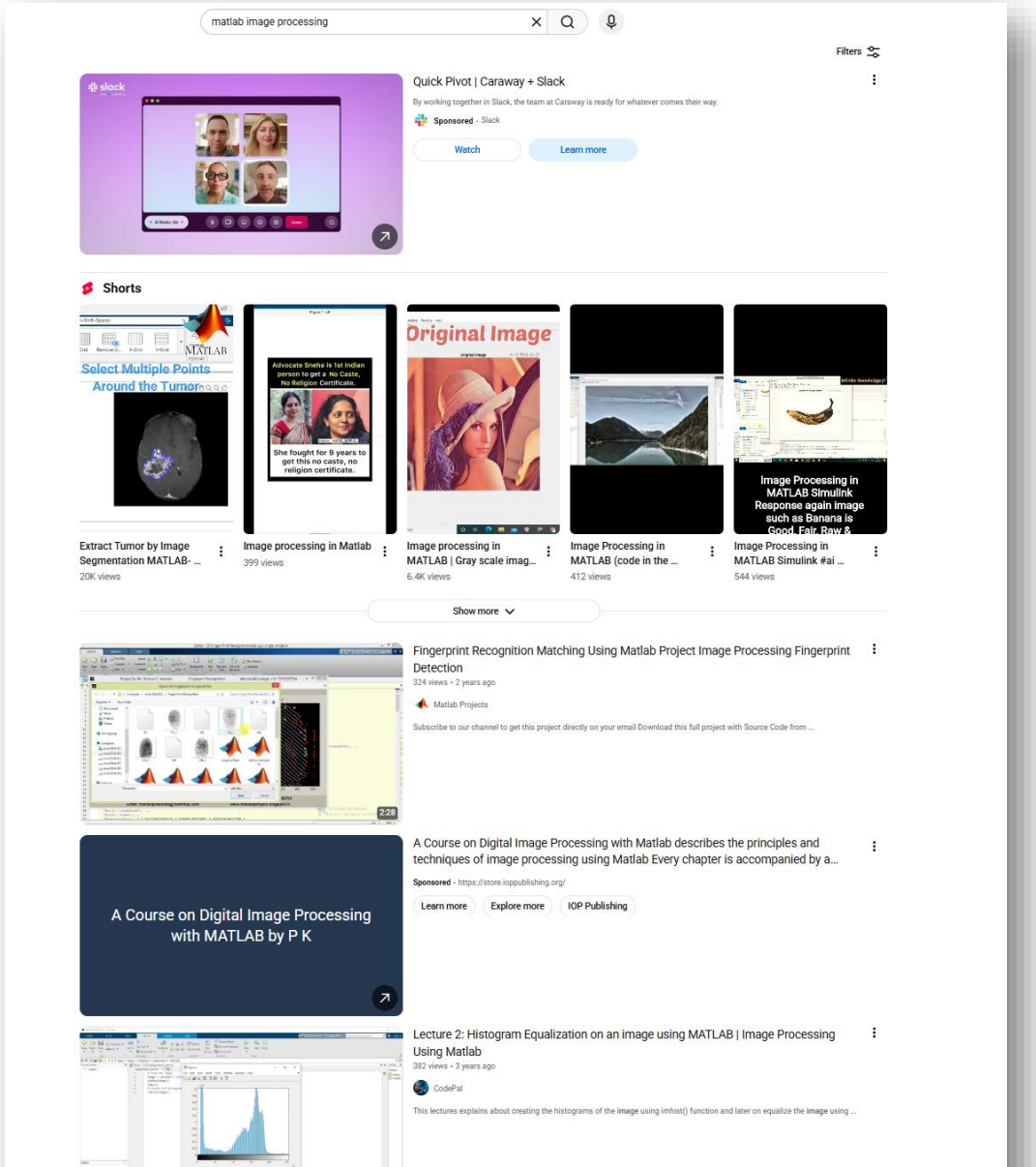
Power Systems Simulation Onramp
1.5 hours | Languages
Learn how to progressively build and validate power systems using Simscape Electrical.

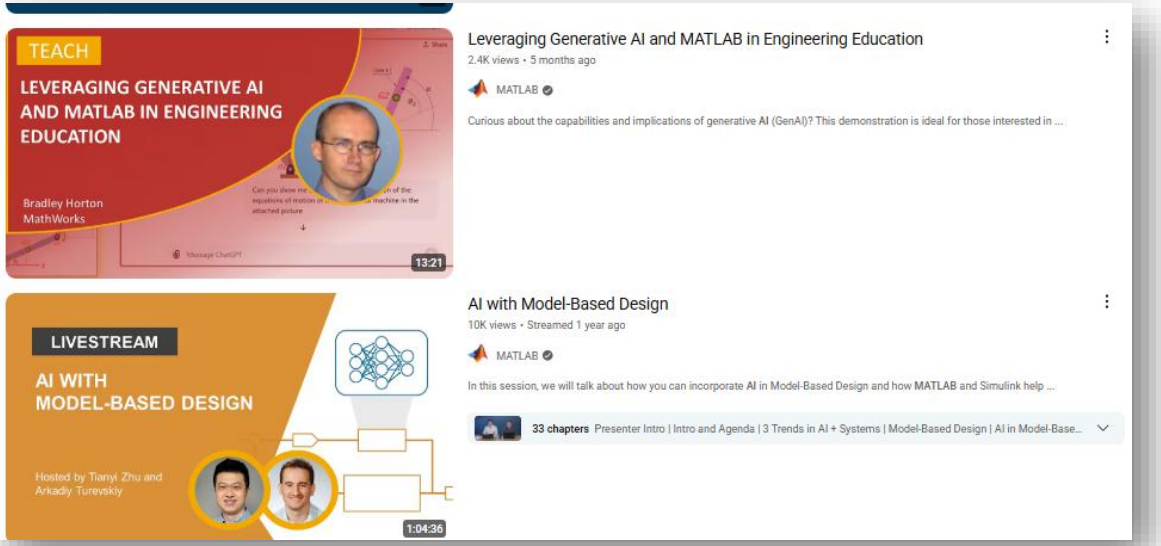
Signal Classification with Deep Learning
1 hour | Languages
Learn the workflow for classifying signals with deep networks.

Beyond MATLAB Onramp: Image Processing Onramp



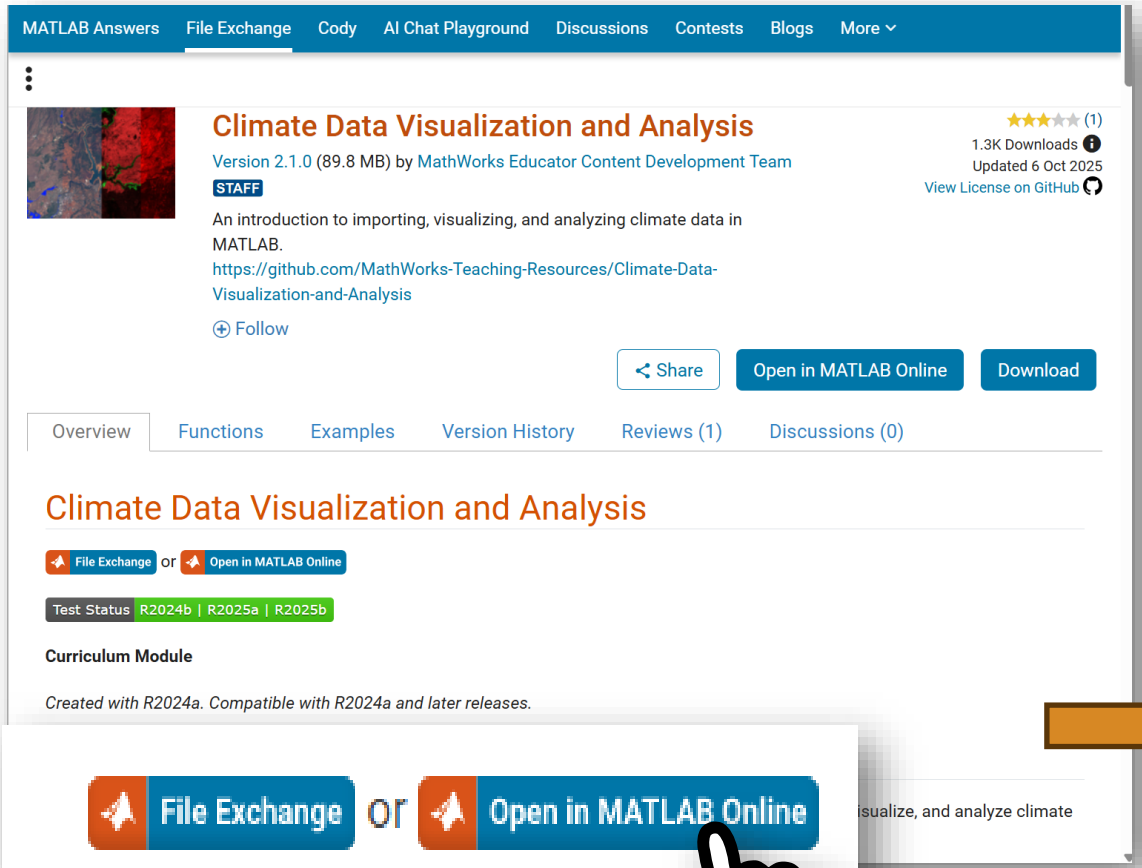
YouTube Select Some Videos for Students to Learn From

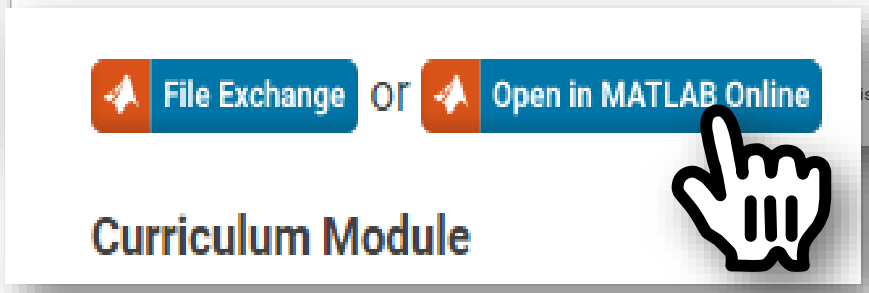




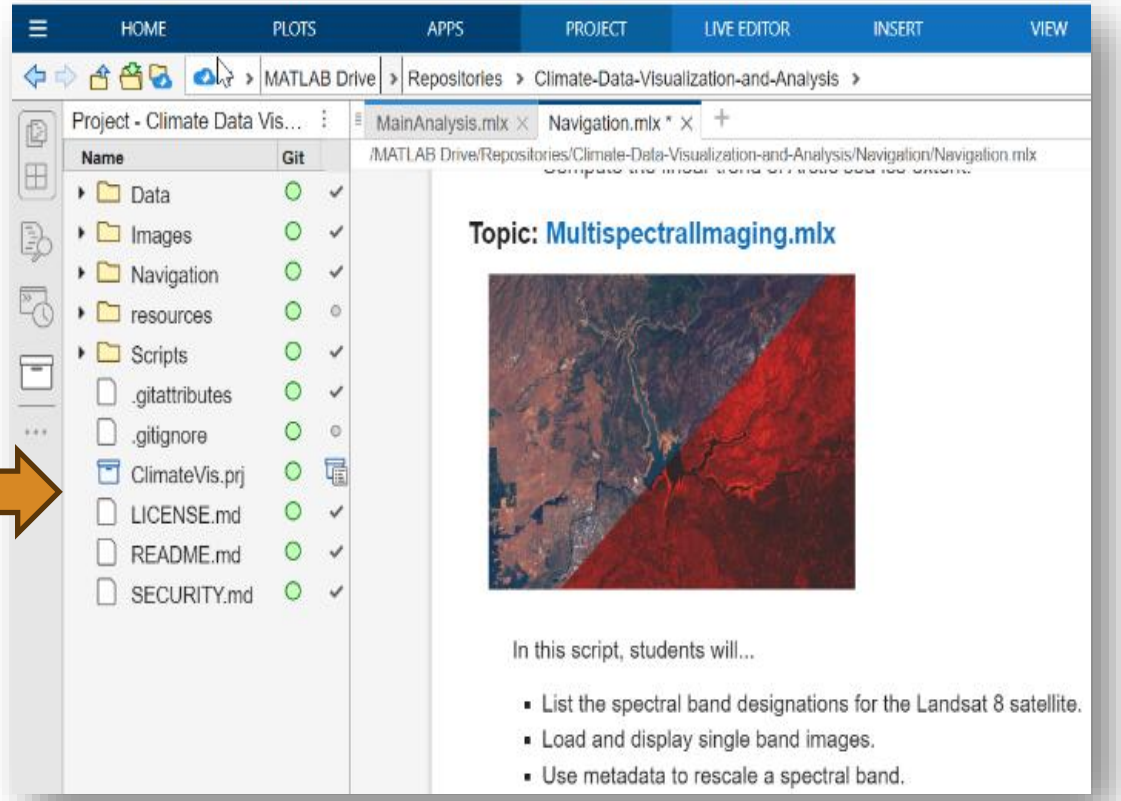
Free Curriculum on GitHub: Open directly in MATLAB Online

Add Open in MATLAB Online ***to your repos to open in MATLAB***





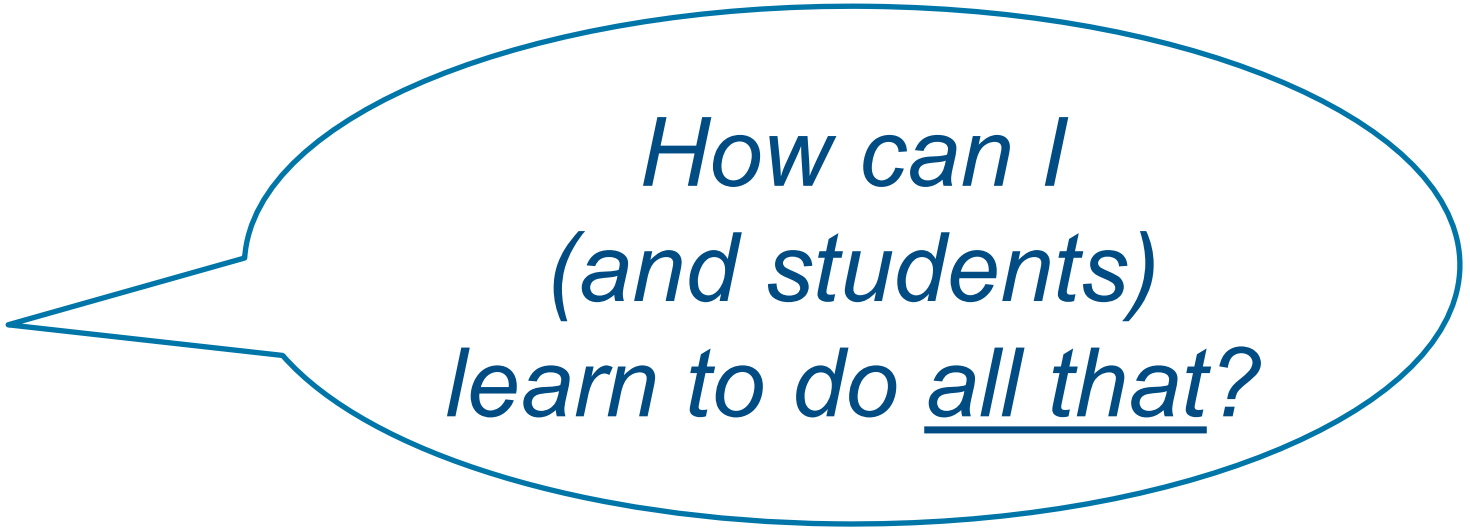
MATLAB Online



mathworks.com/matlabcentral/fileexchange/110125-climate-data-visualization-and-analysis

Summary: Learning Technologies and MATLAB Capabilities

- Documentation
- Code Examples
- Product Pages
- Onramps and training
- Curriculum
- Videos
- MATLAB GPT and MATLAB Copilot



And – Learn from each other.

Workshop Schedule

Sunday: Settling In and Zeroing in on What We Want to Accomplish

Teaching Activity Submission

Teaching Activity Peer Review

Prework

1-on-1 Mentoring Sessions

We Are Here

WORKSHOP BEGINS – Sunday 5-8 (CDT)

Intro and Ice Breakers

Talk: Teaching and Learning:
What's Important to Know?

Convener Panel

Networking

ACTION:
- Find the Program on the SERC site now.
- Spend a minute reviewing it.

Educator Talks + MATLAB Tools ➔ Curriculum Work

MONDAY

(Completed)
SUNDAY

Orientation and Networking

Practical Considerations for Teaching Computation

Invited Educator Talks (Kelly Roos)
Activity: Breakouts (best practices)

Learning Outcomes (Ben Bratton)
Activity: Breakouts (outcomes?)

MATLAB Teaching Tools Demo and Practice (Laura, Ram)

Invited Educator Talks (Michele McColgan)
Activity: Breakouts (assessing student learning)

Worktime: Upgrading Your Curriculum (Dan Burleson)
- Attributes of an exemplary teaching activity
- Affinity working group and feedback
- Individual work time: Teaching Activity/Module Development

Roadcheck (fill out survey)

Tuesday: Upgrade Courses ➔ Share Course Plan ➔ Feedback

Sunday
Orientation and Networking

. . . .

Monday
MATLAB Tools Deep Dive
+
Curriculum Development

TUESDAY

Intro

Upgrading Your Curriculum, Part 2 (Dan Burleson)
Activity: Individual Time + Groups

Teaching Activity Sharing and Feedback
Activity: Working group activity sharing and feedback

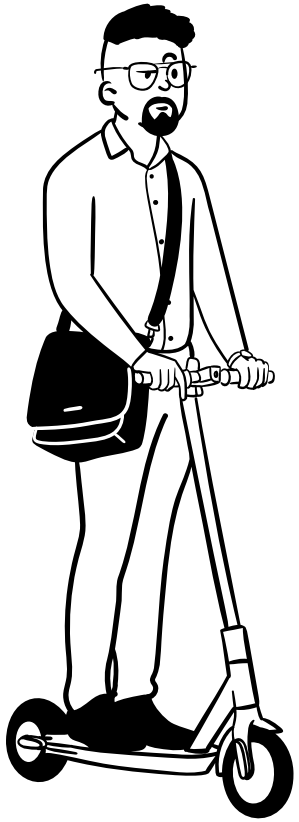
Workshop Synthesis and Next Steps

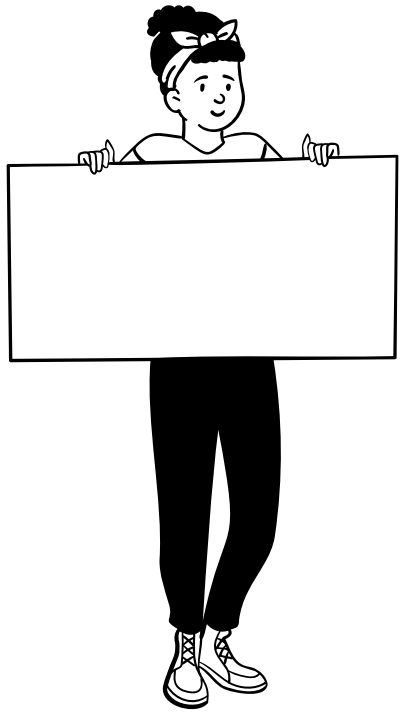
Workshop Evaluation (fill out survey)

Teaching Activity post-review updates

Dinner Time – Enjoy!

Convener Panel starts at 7:15





Convener Panel

Help yourself to dessert and coffee and get your questions ready . . . .