

# 21+ MATLAB Features You Need Now!

This is a quick summary of the features covered in the talk *21 MATLAB Features You Need Now*.

## Table of Contents

Live Editor.....	1
Formatted text, images, and equations.....	1
Output on right or inline.....	2
Interactive outputs.....	4
Function hints.....	5
Interactive controls.....	5
Live Editor Tasks.....	6
Refactoring.....	6
Local functions in scripts.....	6
Document export.....	7
Graphics.....	7
Default plot interactivity.....	7
Geographic plots.....	7
tiledlayout.....	8
Plots tab.....	8
Building and Sharing Apps.....	9
App Designer.....	9
Web Apps.....	10
Data Preprocessing.....	11
table and timetable.....	11
stackedplot.....	11
Missing data functions.....	12
Preprocessing Live Editor Tasks.....	13
Apps.....	13
Hardware support.....	14
Add-On Explorer.....	15
Programming.....	16
Code Compatibility Report.....	16
File Comparison Tool.....	17
Code Analyzer.....	18
Projects.....	18
Multi-release Release Notes.....	19

## Live Editor

You can create scripts that combine code, output, and formatted text with the [Live Editor](#). In fact, this document was created with the Live Editor. Some of our favorite features of the Live Editor are:

### Formatted text, images, and equations

You can use formatted text and insert images and equations. There's a really nice equation editor, or you can use LaTeX if you prefer:

Live Editor - /Users/mhirsch/OneDrive - MathWorks/mfiles/Demos/21 Features You Need Now/21-matlab-features-you-need-now/Scripts/Earthquakes\_Final.mlx

LIVE EDITOR    INSERT    EQUATION    VIEW

α λ π σ Δ Λ ∞ ∇ · … ∙ ∴ ∵ ≠ ≤ ≥ ≈ ∈ β γ δ  
 ε ε ζ η θ ϑ ι κ μ ν ξ ο π ρ ϱ ς τ υ φ ψ  
 χ ψ ω Α Β Γ Ε Ζ Η Θ Ι Κ Μ Ν Ξ Ο Π Ρ Σ Τ

Power    Fraction    Sqrt    Index    Subsup...    Def Sum    Def Int    MATRICES

FORMAT    SYMBOLS    STRUCTURES

TwentyOneFeaturesSummary.mlx    EnergyUsageAnalysis\_Final.mlx    Earthquakes\_Final.mlx

## Where are the earthquakes?

There were a lot of earthquakes in February 2018. Where were they, and how strong were they?

These earthquakes are rated using the [Richter magnitude scale](#) which is determined from the logarithm of the amplitude of waves recorded by seismographs.

### Earthquake Magnitude Scale

The formula is:  $M_L = \log_{10}A - \log_{10}A_0(\delta) = \log_{10}[A/A_0(\delta)]$

```

1 load EarthquakesFebruary2018 quakes
2 plotquakes(quakes);

```

UTF-8    script

## Output on right or inline

Output appears immediately adjacent to your code, either below or side-by-side:

Live Editor - /Users/mhirsch/OneDrive - MathWorks/mfiles/Demos/21 Features You Need Now/21-matlab-features-you-ne...

LIVE EDITOR    INSERT    FIGURE    VIEW   

TwentyOneFeaturesSummary.mlx    Earthquakes.mlx \*    +

## Earthquake Magnitude Scale

1: Micro (1000/yr) → 2: Minor (> 10/yr) → 3: Minor (> 100/yr) → 4: Light (100 to 1000/yr) → 5: Moderate (10 to 100/yr) → 6: Strong (100 to 1000/yr) → 7: Major (10 to 20/yr) → 8: Great (1/yr) → 9: Great (1 per 10 to 50 yrs)

The formula is:  $M_L = \log_{10} A - \log_{10} A_0(\delta) = \log_{10}[A/A_0(\delta)]$ . [Earthquake Data Credit](#): U.S. Geological Survey; Department of the Interior/USGS

```

1  load EarthquakesFebruary2018 quakes
2  plotquakes(quakes);

```

**Earthquake Locations**

### Earthquakes around the world

Let's take a look at where earthquakes occur and how strong they are. Filter out the smallest earthquakes.

```

3  minmagnitude = 5;
4  theseQuakes = quakes(quakes.Magnitude > minmagnitude,:);
5  scatter(theseQuakes, "Latitude" "Longitude" "Size/Variable" "Magnitude"

```

UTF-8    script    Ln 6    Col 31

Live Editor - /Users/mhirsch/OneDrive - MathWorks/mfiles/Demos/21 Features You Need Now/21-matlab-features-you-need-now/Earthquakes.mlx

LIVE EDITOR    INSERT    FIGURE    VIEW    C 2


TwentyOneFeaturesSummary.mlx    Earthquakes.mlx    +

### Where are the earthquakes?

There were a lot of earthquakes in February 2018. Where were they, and how strong were they?

These earthquakes are rated using the [Richter magnitude scale](#) which is determined from the logarithm of the amplitude of waves recorded by seismographs.

### Earthquake Magnitude Scale



The formula is:  $M_L = \log_{10} A - \log_{10} A_0(\delta) = \log_{10}[A/A_0(\delta)]$ . [Earthquake Data Credit: U.S. Geological Survey; Department of the Interior/USGS](#)

```

1 load EarthquakesFebruary2018 quakes
2 plotquakes(quakes);

```

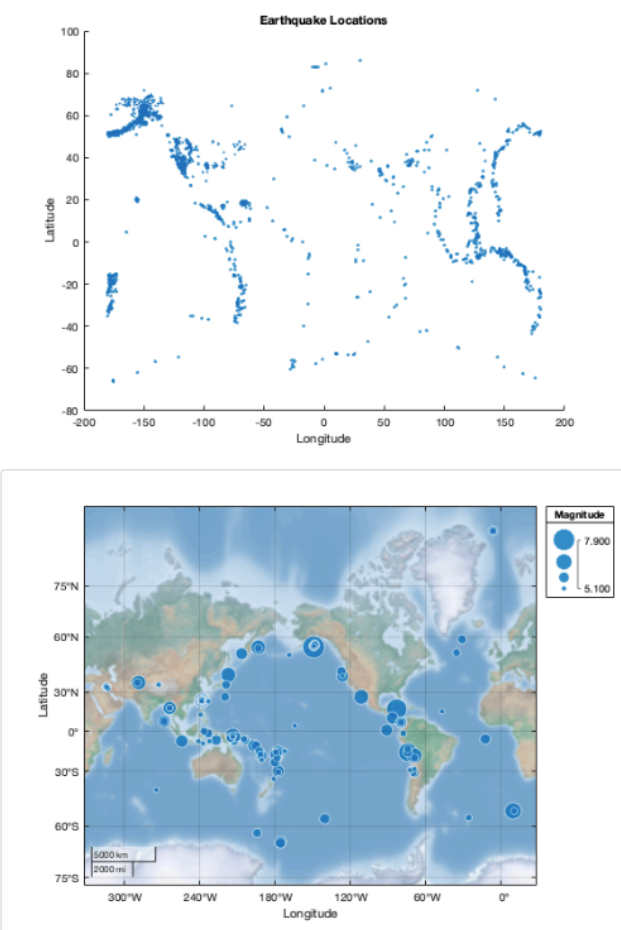
### Earthquakes around the world

Let's take a look at where earthquakes occur and how strong they are. Filter out the smallest earthquakes.

```

3 minmagnitude = 5;
4 theseQuakes = quakes(quakes.Magnitude > minmagnitude,:);
5 geobubble(theseQuakes,"Latitude","Longitude","SizeVariable","Magnitude"
6           "Basemap","colorterrain");

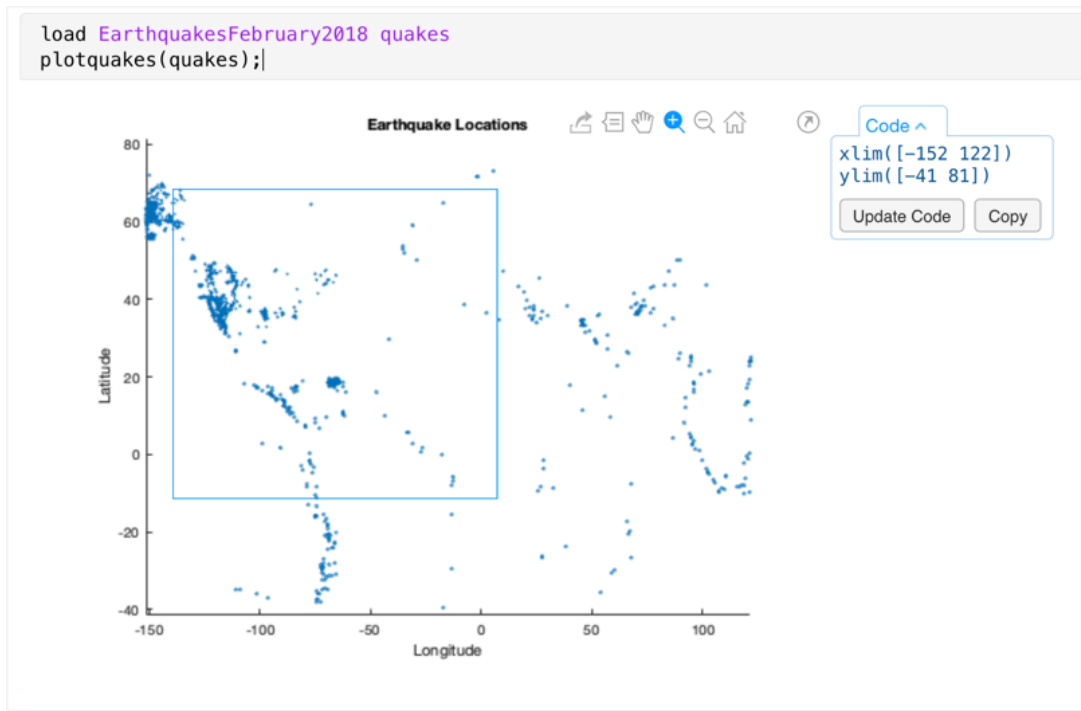
```



UTF-8    script    Ln 6    Col 31

## Interactive outputs

You can interact with outputs and generate MATLAB code for your interactions. For instance, you can zoom into a plot and then automatically update your program to set the new axis limits.



## Function hints

Function hints make it easy to call functions without having to look at the documentation, and even to navigate to select files to import:

**Load energy data**

```
energyLoad = readtimetable("Data/NYEnergyData.xlsx")
```

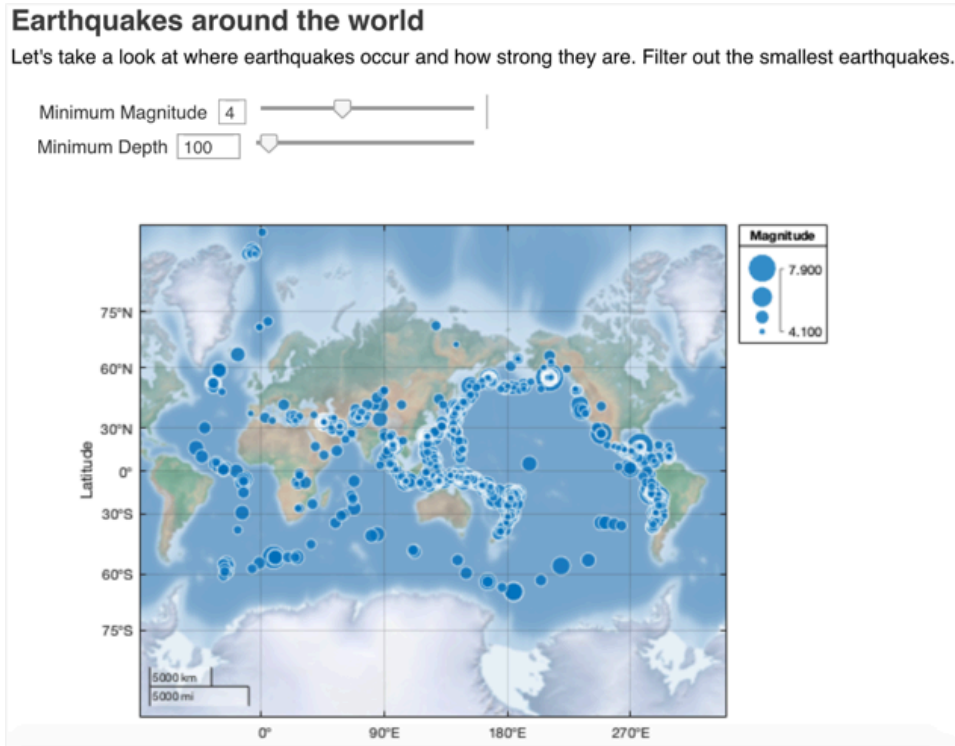
readtimetable(filename, options) 1 of 2

Name of file to read

- Not Using/
- NYEnergyData.xlsx

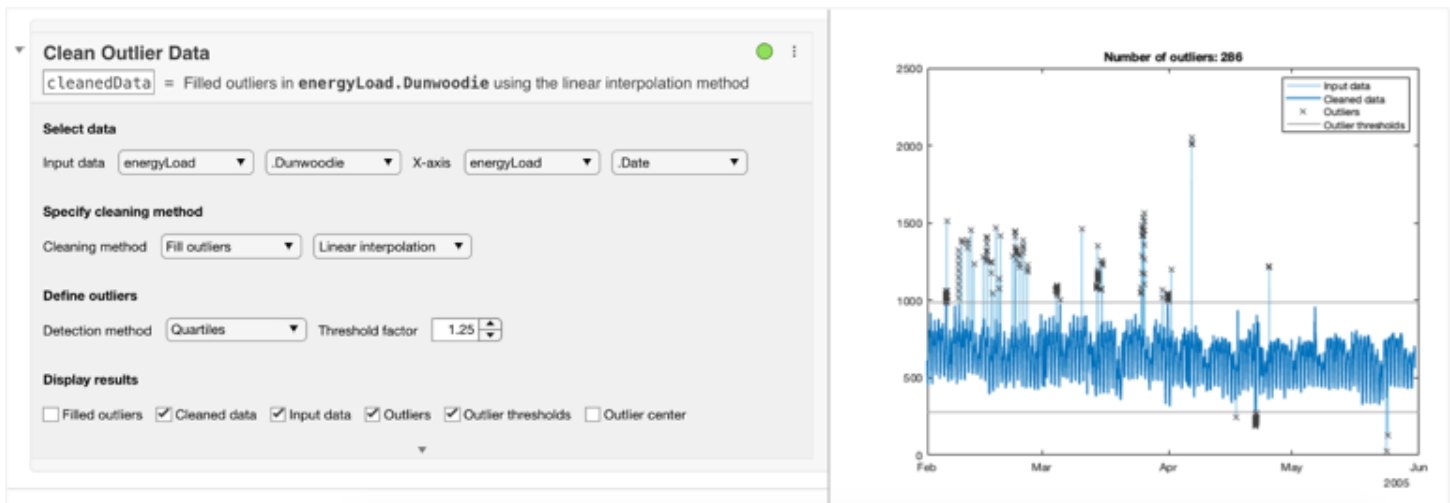
## Interactive controls

You can replace the value of variables with interactive controls to make it easy to interact with your program, and even hide the code altogether:



## Live Editor Tasks

You can use Live Editor tasks to preprocess data interactively and the MATLAB code is automatically written for you. There are also Live Editor tasks for working with symbolic expressions, designing control systems, and more.



## Refactoring

You can [refactor](#) a selected area of code into a separate function, with the inputs and outputs of the new function automatically defined.

## Local functions in scripts

You can include [local functions in MATLAB scripts](#) in the Live Editor or traditional editor.

## Document export

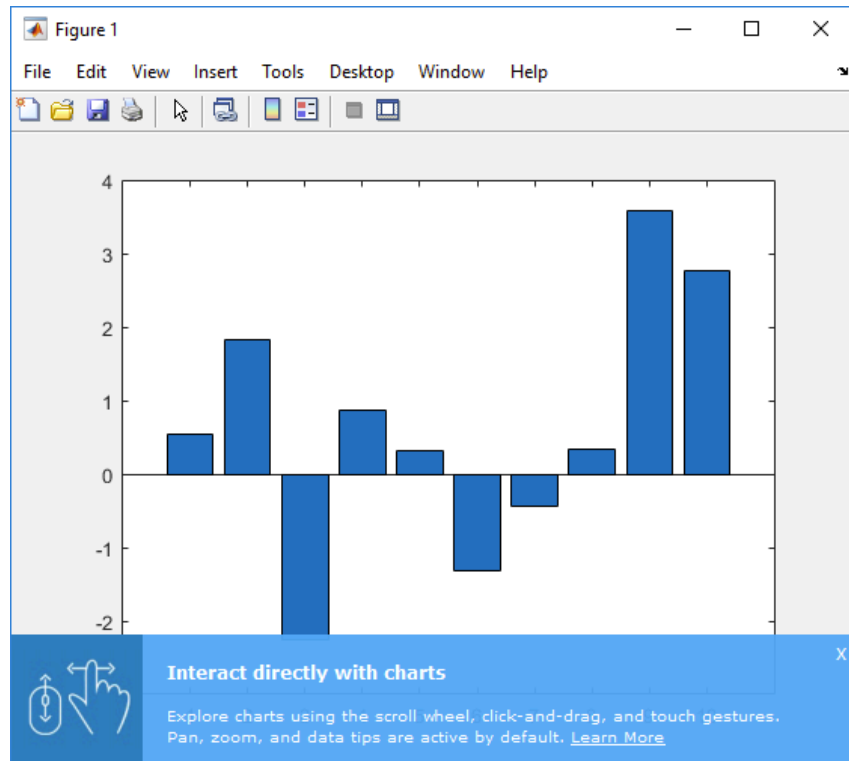
You can export your Live Scripts to PDF, Word, HTML, or LaTeX documents. Using the Save menu, you can export one script at a time or all scripts in the current folder.

## Graphics

There are a lot of new and some undiscovered graphics features. Here are just a few of our favorites:

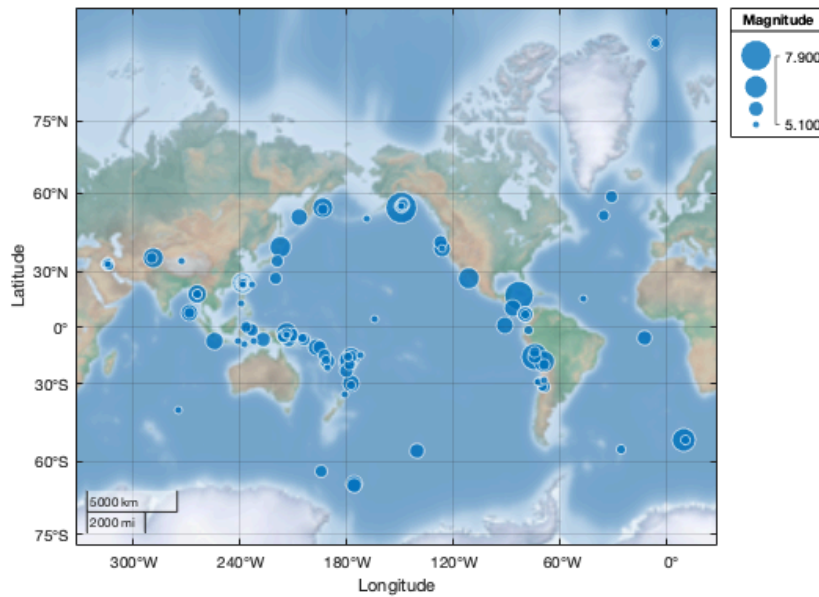
### Default plot interactivity

You can use your mouse or trackpad to zoom, pan, rotate, and add datatips without having to click separate toolbar buttons first:



## Geographic plots

You can now create [geographic plots](#) in MATLAB, such as this geographic bubble chart showing the location and magnitude of earthquakes around the world:



## tiledlayout

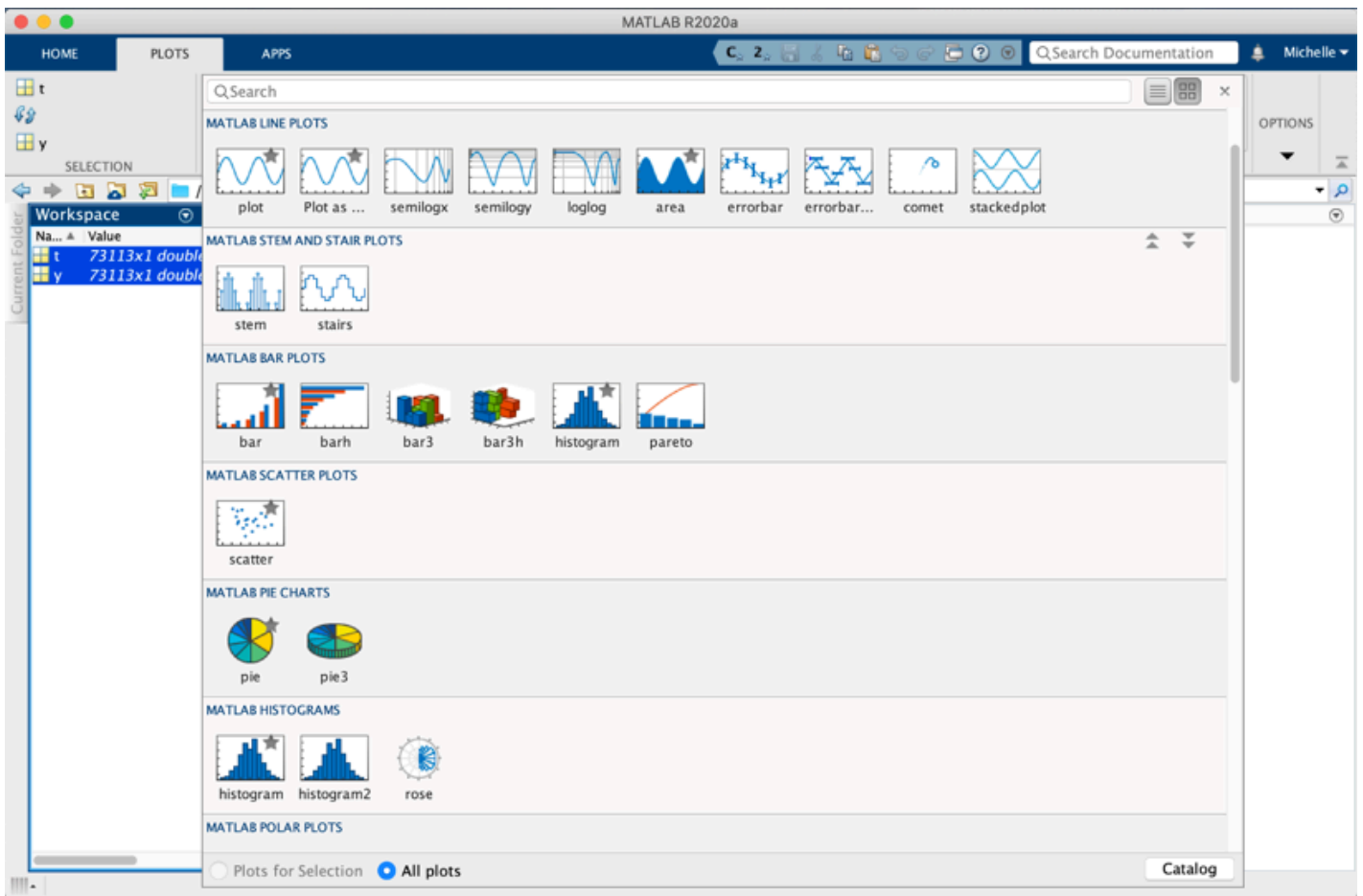
You can much more easily control the layout of figures with multiple plots using `tiledlayout` instead of `subplot`.



## Plots tab

You can easily plot your data with the Plots tab of the MATLAB Toolstrip. Just select your data in the Workspace browser or Variable Editor and you'll get a list of plots that work with your specific data. The equivalent MATLAB code is automatically entered in the command window for you to access later.



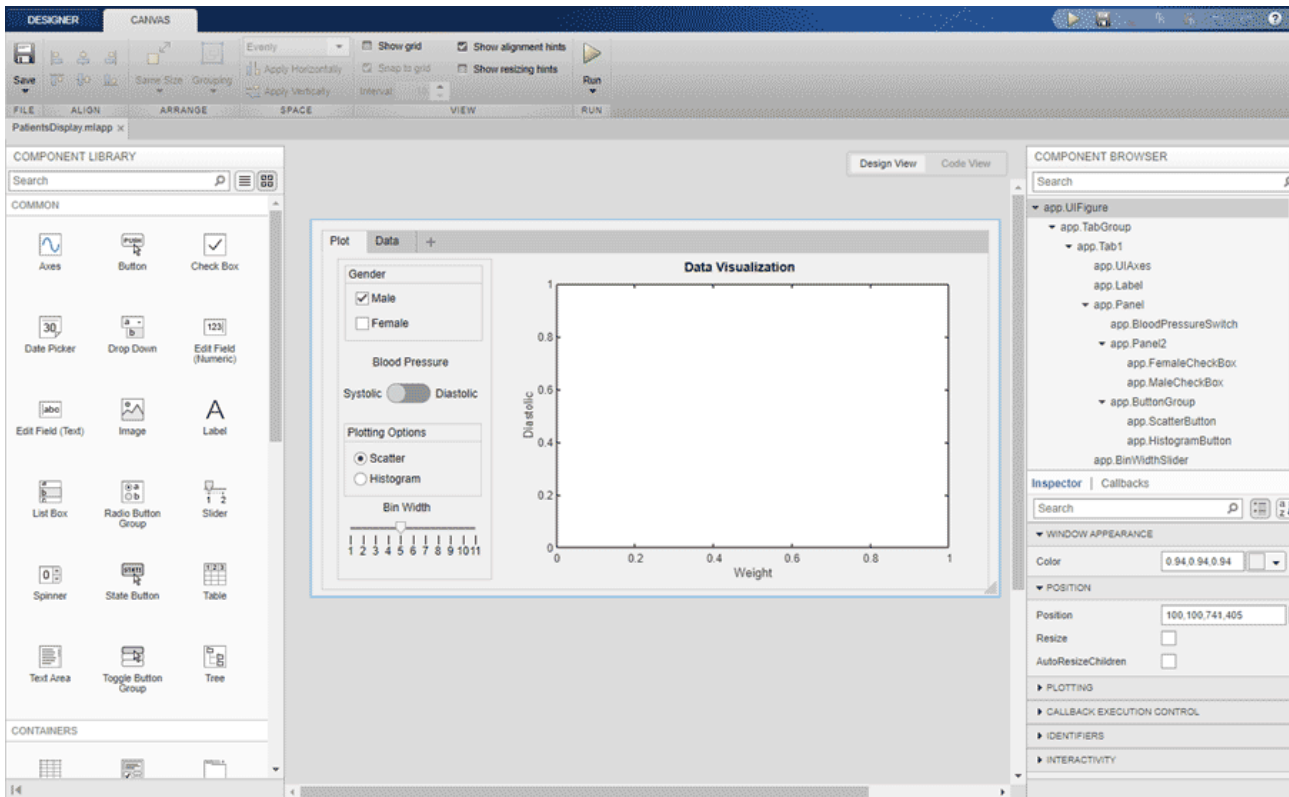


## Building and Sharing Apps

You can build and share custom apps with MATLAB.

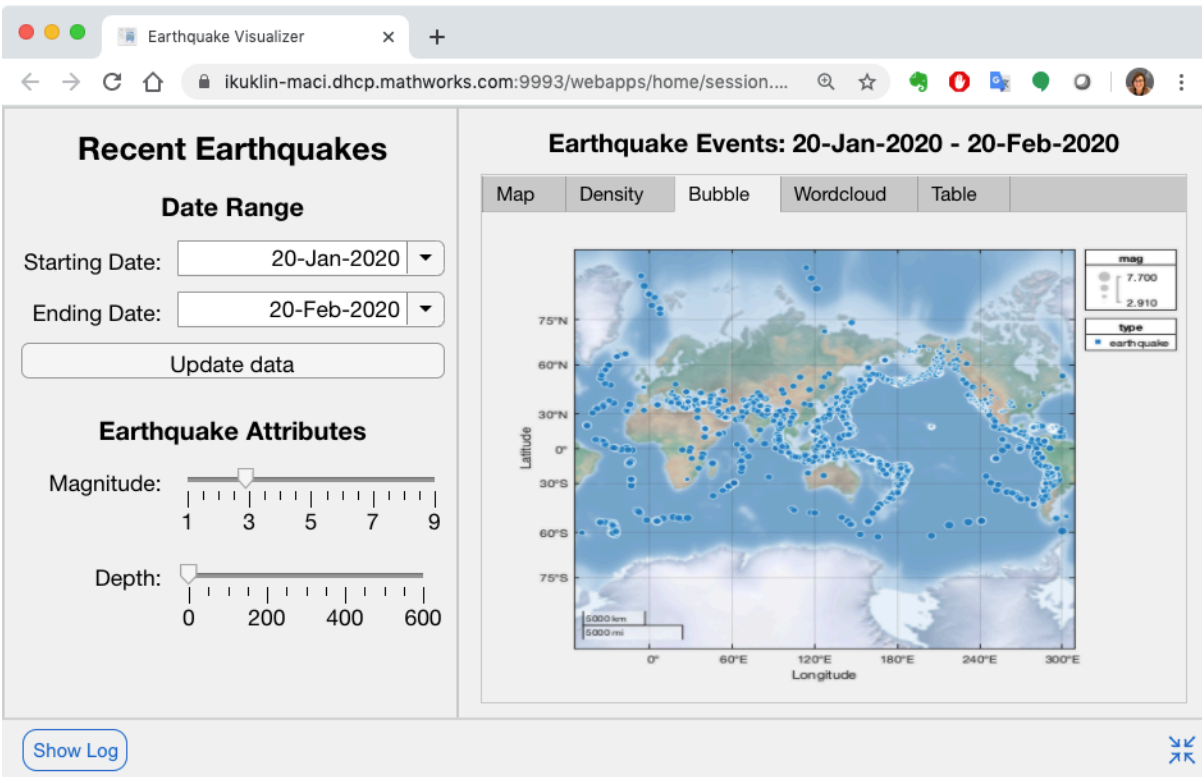
### App Designer

[App Designer](#) lets you create professional apps without having to be a professional software developer. Drag and drop visual components to lay out the design of your graphical user interface (GUI) and use the integrated editor to quickly program its behavior.



## Web Apps

Using the MATLAB Compiler and the [MATLAB Web App Server](#), you can share your apps as web apps that anybody in your organization can access from their web browser.

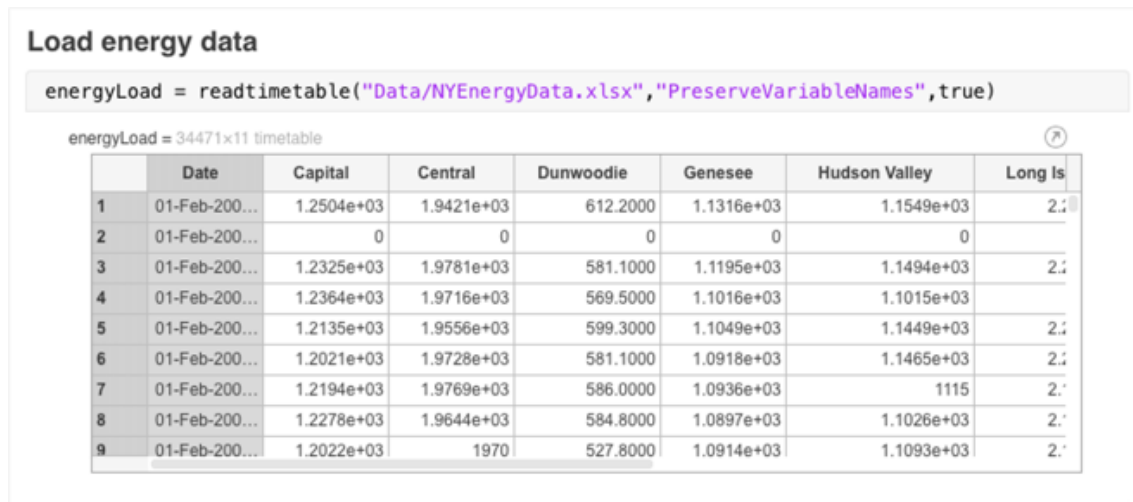


## Data Preprocessing

MATLAB [takes the pain out of preprocessing](#) your data to get it ready for analysis.

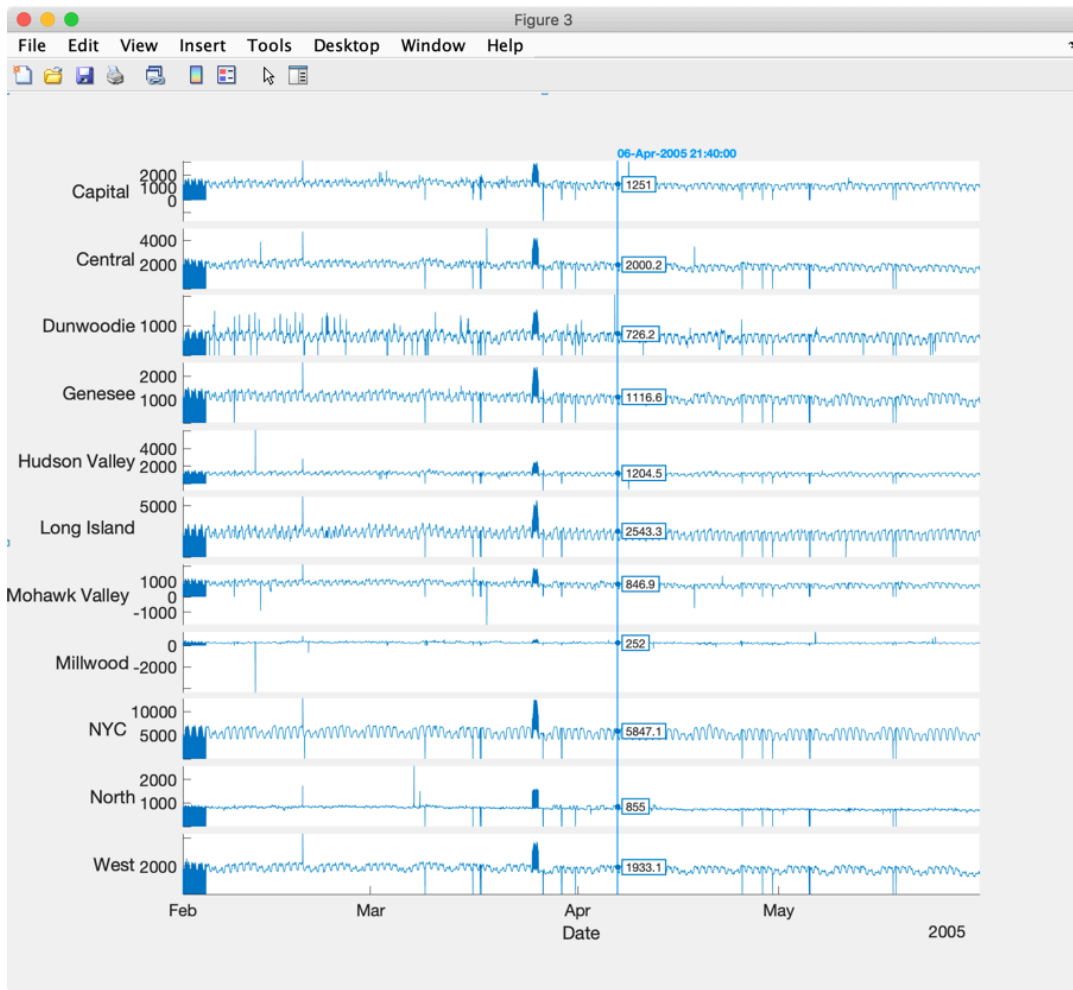
### table and timetable

You can organize tabular data, such as you might store in spreadsheets, using the [table](#) and [timetable](#) data types. Timetables provide additional capabilities for managing data that varies vs. time, such as synchronizing and resampling.



### stackedplot

Visualize every variable in your table or timetable with a [stackedplot](#):



## Missing data functions

Use a straightforward collection of functions for cleaning up missing data and outliers:

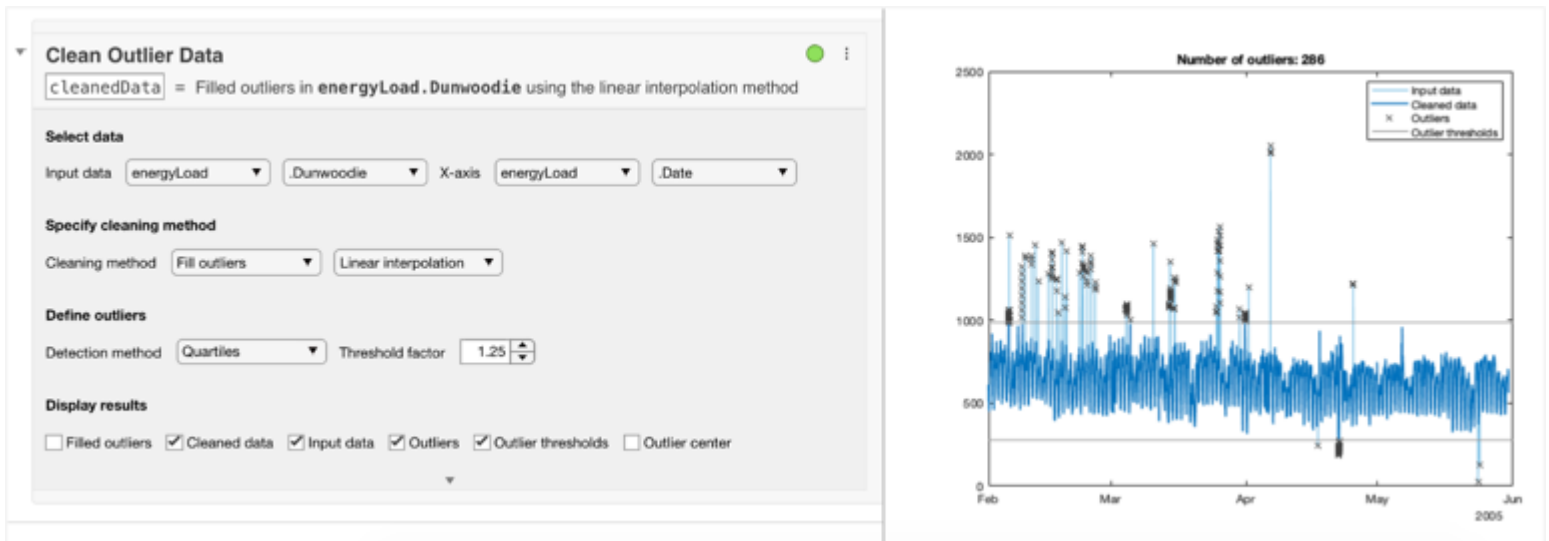
**Functions** expand all

▼ **Missing Data and Outliers**

<code>ismissing</code>	Find missing values
<code>rmmissing</code>	Remove missing entries
<code>fillmissing</code>	Fill missing values
<code>missing</code>	Create missing values
<code>standardizeMissing</code>	Insert standard missing values
<code>isoutlier</code>	Find outliers in data
<code>filloutliers</code>	Detect and replace outliers in data
<code>rmoutliers</code>	Detect and remove outliers in data
<code>movmad</code>	Moving median absolute deviation

## Preprocessing Live Editor Tasks

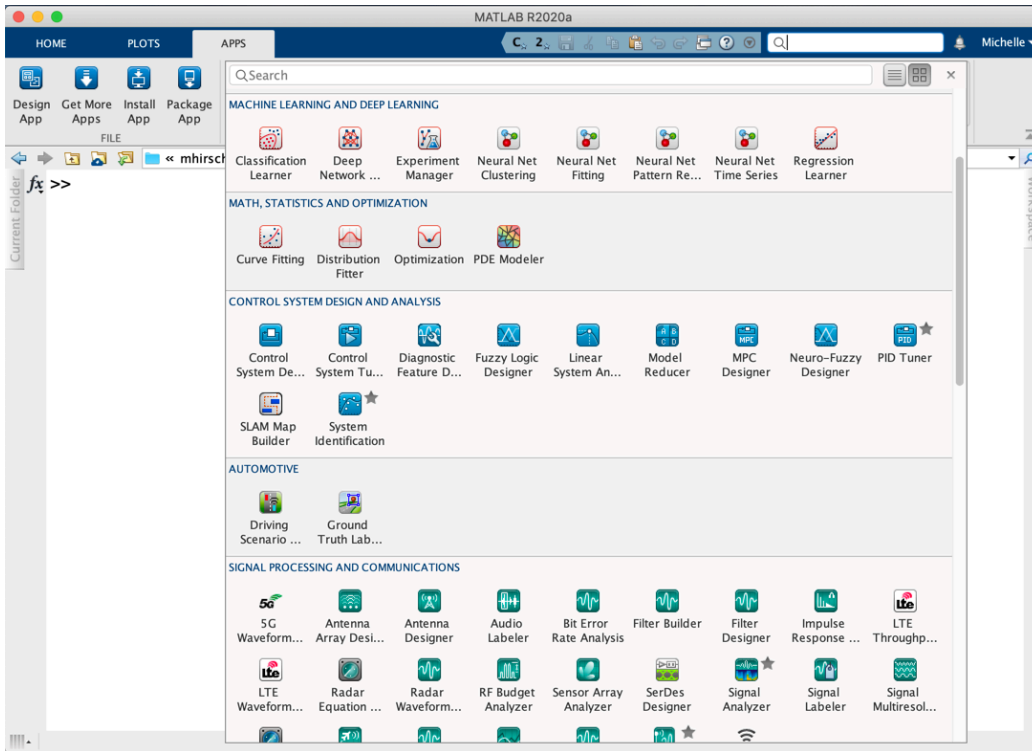
As mentioned above, you can use Live Editor tasks to preprocess data interactively and the MATLAB code is automatically written for you.



## Apps

Even though a programming language is the heart of MATLAB, you don't have to write code to complete common tasks in MATLAB. You can design control systems or deep neural networks, analyze signals or radar waveforms, process images and videos, and so much more, without writing a single line of code. Even better - they write the code for you, so you don't have to choose between the ease and speed of using an app and

the automation and flexibility of writing a program. Here are some of the almost 100 different [MATLAB Apps](#) available on the Apps tab of the MATLAB Toolstrip:



## Hardware support

[MATLAB and Simulink connect](#) to the hardware you use, whether you want to capture images from a webcam or a high-end IP camera, automatically generate real-time C code for rapid prototyping or deploying on an embedded processor, or give students hands-on experiences for project-based learning. Find and install hardware support directly within MATLAB:

**Add-On Explorer** | [Contribute](#) | [Manage Add-Ons](#)

Clear Filters x Search for add-ons

**Filter by Source**

- MathWorks 185
- Community 123

**Filter by Category**

**Using MATLAB**

- Data Import and Analysis 6
- Graphics 1
- External Language Interfaces 1

**Applications**

- Science and Industry 12
- Image Processing and Computer Vision 26
- Signal Processing 30
- Wireless Communications 7
- Control Systems 1
- Autonomous Systems 16
- Hardware, IoT, and Test & Measurement 192

**Using Simulink**

- Simulink 32
- Real-Time Simulation and Testing 1
- Physical and Event-Based Modeling 5
- Code Generation 47
- Verification, Validation, and Test 4

**Filter by Type**

- Toolboxes and Products 21
- Apps 3
- Simulink Models 44
- Hardware Support Packages 308**
- Optional Features 3
- Functions 71

**Filter by Hardware Type**

- Audio 10
- CAN Devices 4
- Data Acquisition Devices 6
- FPGA 7
- GPU 3

**308 RESULTS**

### Hardware Support Packages (308)

**MATLAB Support Package for Arduino Hardware**

Acquire inputs and send outputs on Arduino boards

1740 Downloads ★★★★★

**Legacy MATLAB and Simulink Support for Arduino**

MATLAB class and Simulink blocks for communicating with an Arduino microcontroller board

1132 Downloads ★★★★★

**Simulink Support Package for Arduino Hardware**

Run models on Arduino boards.

1025 Downloads ★★★★★

**MATLAB Support Package for USB Webcams**

Acquire images and video from UVC compliant webcams.

460 Downloads ★★★★★

**Communications Toolbox Support Package for RTL-SDR Radio**

Acquire RF data using RTL-SDR.

444 Downloads ★★★★★

**Image Acquisition Toolbox Support Package for OS Generic Video Interface**

Acquire video and images from generic video capture devices.

423 Downloads ★★★★★

## Add-On Explorer

Download, install, and use add-ons without leaving the MATLAB environment, using the [Add-On Explorer](#). Whether you need additional toolboxes, apps, hardware support packages, or community submissions, you can easily browse and find what you're looking for.

The screenshot displays the MATLAB Add-On Explorer window. On the left, there are filters for 'Filter by Source' (Community: 37,835) and 'Filter by Category'. The categories include 'Using MATLAB' (e.g., Get Started with MATLAB: 27, Language Fundamentals: 923) and 'Applications' (e.g., Science and Industry: 3,531). The main area is divided into three sections: 'Community Toolboxes', 'Community Apps', and 'Community Simulink Models'. Each section shows a grid of toolboxes/apps with their respective icons, titles, descriptions, download counts, and star ratings. For example, 'Simulink Onramp' has 1809 downloads and a 5-star rating. 'GUI Layout Toolbox' is marked as 'Installed' and has 1158 downloads. 'Numerical Computing with MATLAB' has 830 downloads. In the 'Community Apps' section, 'PID Controller Simulator' has 716 downloads, 'Transfer Learning' has 410, and 'Aircraft Intuitive Design (AID)' has 383. The 'Community Simulink Models' section shows a grid of model thumbnails.

## Programming

We barely scratched the surface on programming, but touched on a few of our favorite tools that make programming easier:

### Code Compatibility Report

You can run the [Code Compatibility Report](#) to analyze compatibility of your code. This report helps you identify and address any potential compatibility issues, and estimate the effort required (if any) to upgrade to a newer MATLAB release.



Web Browser - (4 Removals) Code Compatibility Report

(4 Removals) Code Compatibility Report

**Code Compatibility Report** Refresh

[Overview](#)
[2 Syntax](#)
[4 Removals](#)
[0 Behavior](#)
[0 Upcoming Removals](#)

[0 Upcoming Behavior](#)
[3 Not Recommended](#)
[492 Checks](#)
[5 Files](#)

► **Overview**

► **(2) Syntax Errors**

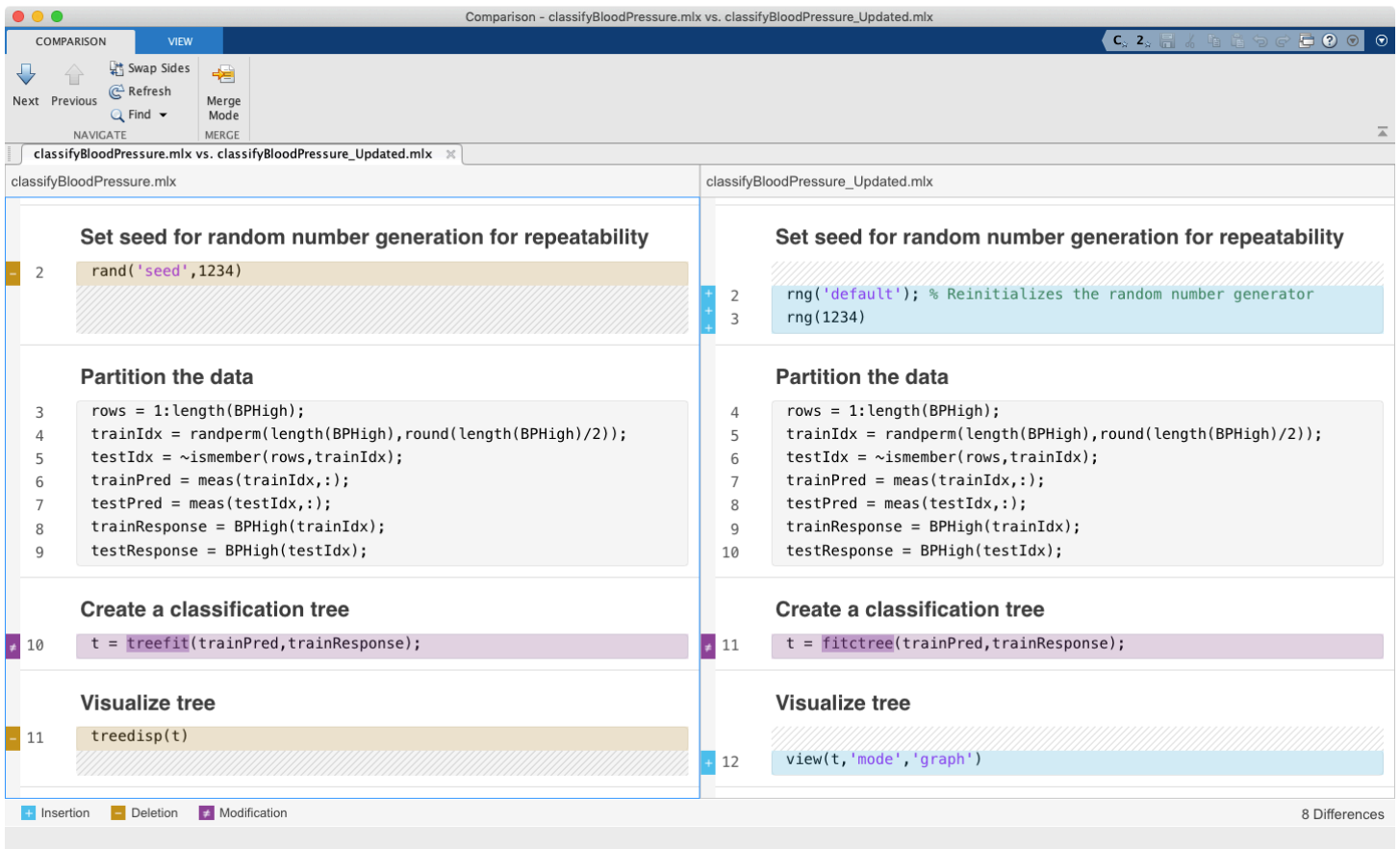
▼ **(4) Functionality that has been removed**

Update your code to avoid compatibility errors. The files listed here use functionality that has been removed and will result in an error when you run your code.

Description	Documentation	Removed In	Filename	Line
TREEDISP has been removed. Use ClassificationTree or RegressionTree VIEW methods instead. <b>Action: Fix</b>	<a href="#">Documentation</a>	R2016a	classifyBloodPres:	<a href="#">11</a>
TREEDISP has been removed. Use ClassificationTree or RegressionTree VIEW methods instead. <b>Action: Fix</b>	<a href="#">Documentation</a>	R2016a	classifyBloodPres:	<a href="#">13</a>
TREEFIT has been removed. Use fitctree or fitrtree instead. <b>Action: Fix</b>	<a href="#">Documentation</a>	R2016a	classifyBloodPres:	<a href="#">10</a>
TREEVAL has been removed. Use ClassificationTree or RegressionTree PREDICT methods instead. <b>Action: Fix</b>	<a href="#">Documentation</a>	R2016a	classifyBloodPres:	<a href="#">12</a>

## File Comparison Tool

Compare two versions of a program and merge changes using the [File Comparison Tool](#).



## Code Analyzer

Did you ever wonder what those orange and red squiggles in your code meant? These are the [Code Analyzer](#) at work, telling you about code that will definitely error when you try to run it (red), or that could potentially be improved (orange).

```

% Find input indices that are not line objects
nothandle = ~ishandle(hline);
for nh = 1:prod(size(hline))
    notline(nh) = ~ishandle(hline(nh)) || ~strcmp('line',lower(get(hline(nh),'type')));
end
% Use STRCMP(str1,str2) instead of using UPPER/LOWER in a call to STRCMP. (Fix)

len = zeros(size(hline));
for nl = 1:prod(size(hline))
    % If it's a line, get the data and compute the length
    if ~notline(nl)
        flds = get(hline(nl));
        fdata = {'XData','YData','ZData'};
        for nd = 1:length(fdata)
            data{nd} = getfield(flds,fdata{nd});
        end
        % If there's no 3rd dimension, or all the data in one dimension is
        % unique, then consider it to be a 2D line.
        if isempty(data{3}) || ...

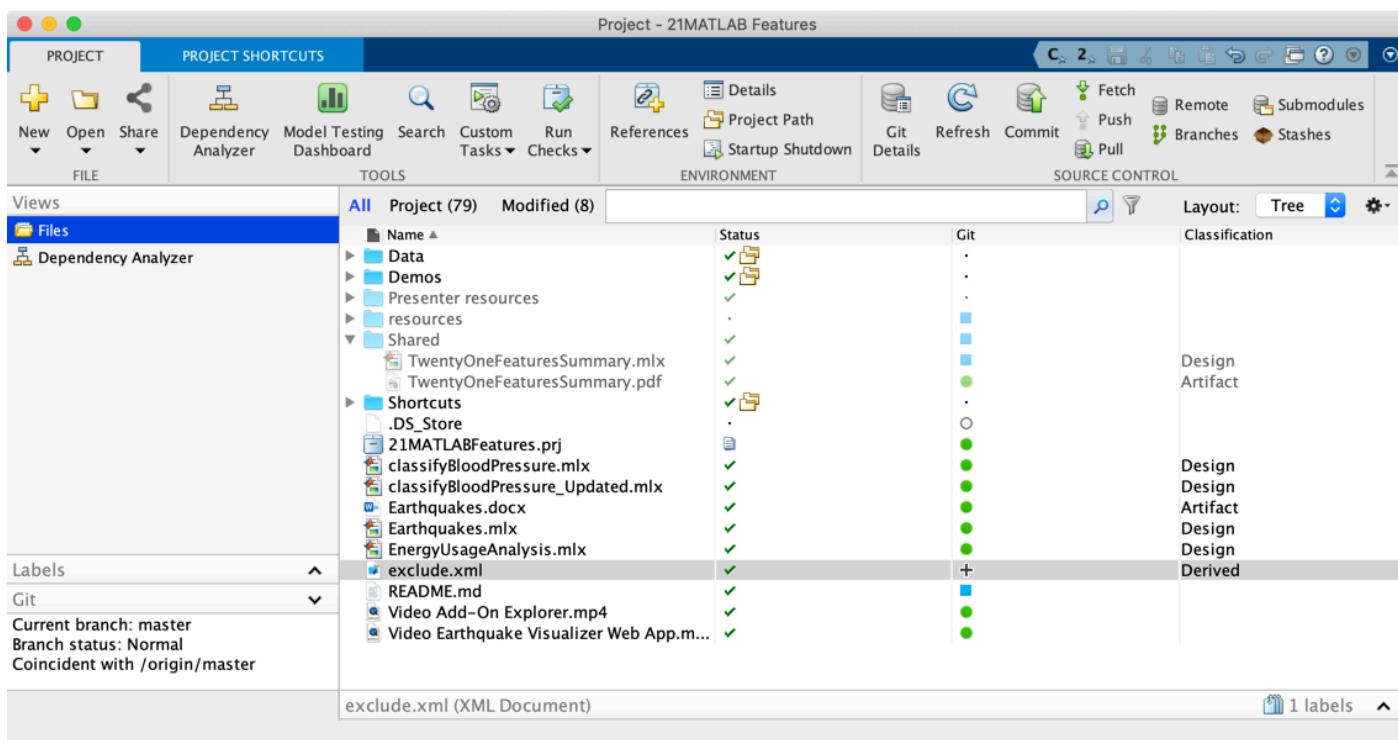
```

## Projects

A [project](#) is a scalable environment where you can manage MATLAB files, data files, requirements, reports, spreadsheets, tests, and generated files together in one place.

Projects can help you organize your work and collaborate. Projects promote productivity and teamwork by helping you with common tasks:

- Find all the files that belong with your project.
- Create standard ways to set up and shut down the MATLAB environment across a team.
- Create, store, and easily access common operations.
- View and label modified files for peer review workflows.
- Share projects using built-in integration with Git™, Subversion® (SVN), or using external source control tools.



## Multi-release Release Notes

We know it's hard to keep up with so many great new capabilities released twice a year, every year. That's why we've given you more control over the [release notes](#), so you can view all of the changes for a given section of MATLAB or add-on product across a range of releases.

Help

MATLAB Release Notes

Documentation

CONTENTS

Category

- Mathematics
- Graphics
- App Building
- Performance
- Software Development Tools
- External Language Interfaces
- Hardware Support

Simulink

5G Toolbox

Aerospace Blockset

Aerospace Toolbox

Antenna Toolbox

Audio Toolbox

Automated Driving Toolbox

AUTOSAR Blockset

Text Filter

Release Range:

R2018b to R2020a

All Examples Functions

## MATLAB Release Notes

[Bug Reports](#) | [Bug Fixes](#) [expand all in page](#)

YOUR SELECTIONS **Graphics** x

Found 53 notes | **Sort by:** Release: Latest to Earliest

Release Range: R2018b to R2020a

- > **R2020a**  
New Features, Bug Fixes, Compatibility Considerations
- > **R2019b**  
New Features, Bug Fixes, Compatibility Considerations
- > **R2019a**  
New Features, Bug Fixes, Compatibility Considerations
- > **R2018b**  
New Features, Bug Fixes, Compatibility Considerations

How useful was this information?

☆☆☆☆