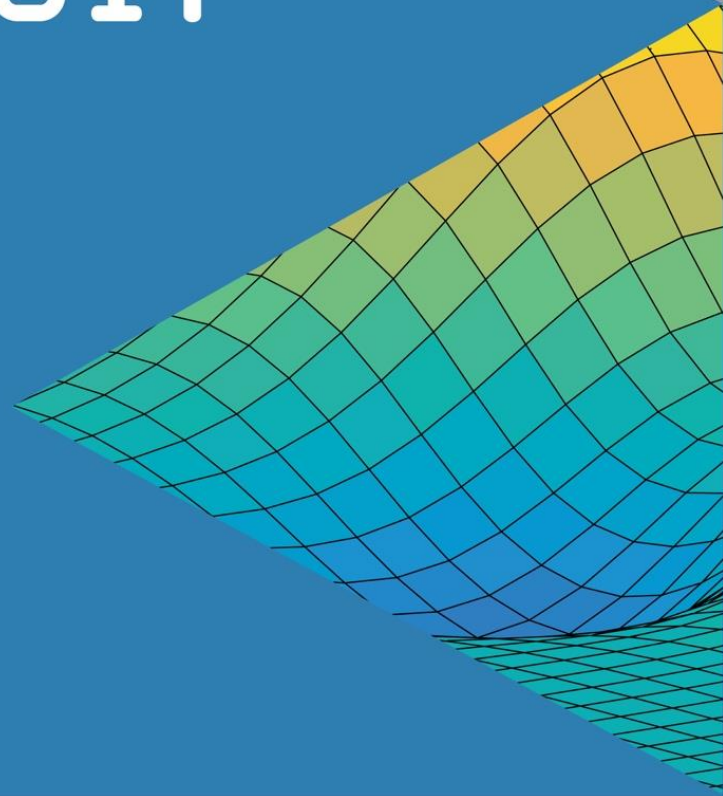


MATLAB EXPO 2017

Introduction to MATLAB

Lianne Crooks



Key Takeaways

- MATLAB can be used at all stages of your work.
- How to automate analysis.
 - Avoid repetition
 - Save time
- Many resources available to help you to learn basic and advanced MATLAB concepts.



MATLAB
The Language of Technical Computing

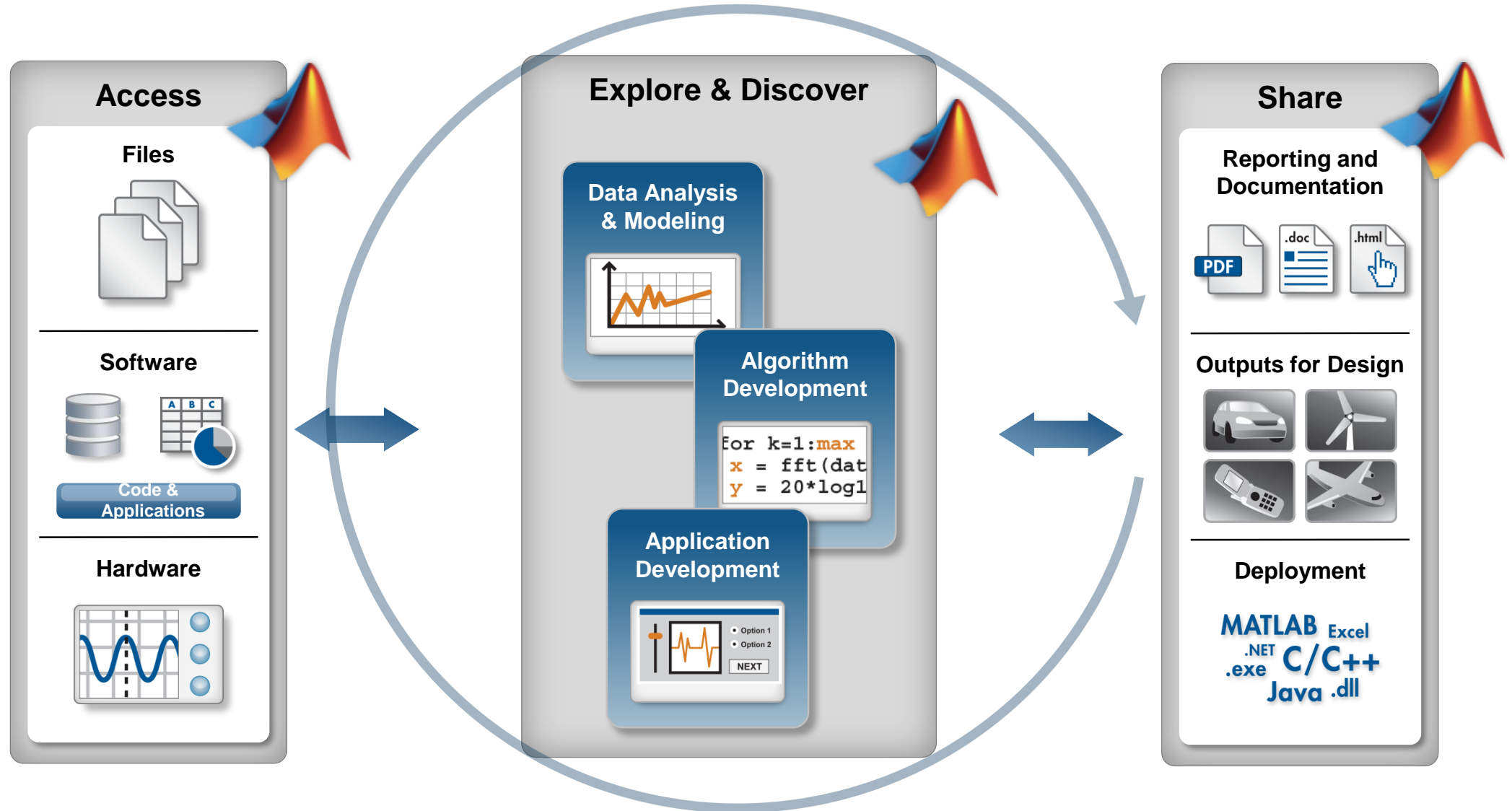
What is MATLAB?

- High-level computer language **designed to be used by scientists and engineers** within an easy-to-use interactive environment.
- **Extendable** using toolboxes that provide targeted functionality for specific types of analysis or area of expertise.
- Large range of use cases from simple, **quick analysis** to in-depth programmes for **production** deployment.

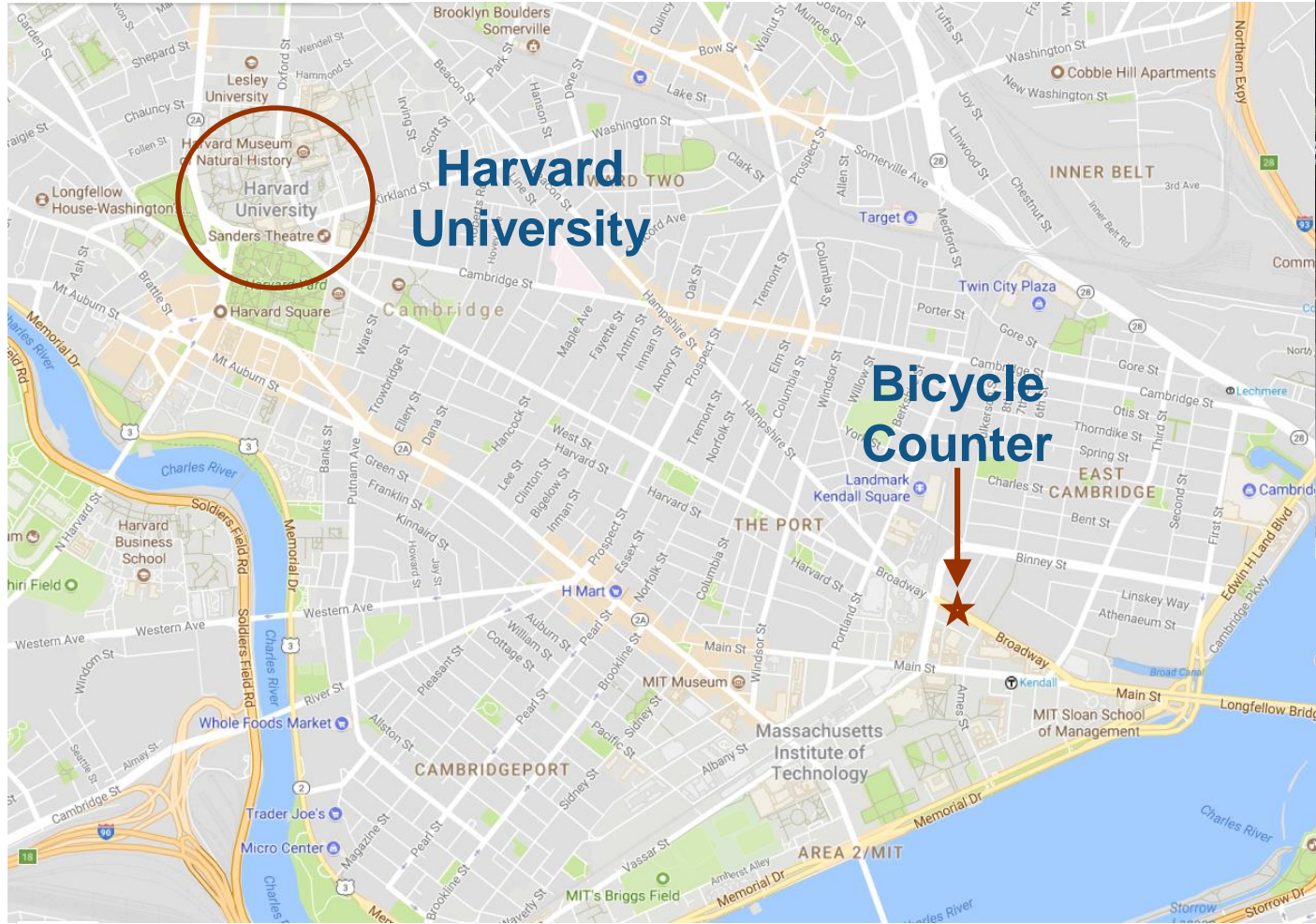


MATLAB
The Language of Technical Computing

Technical Computing Workflow

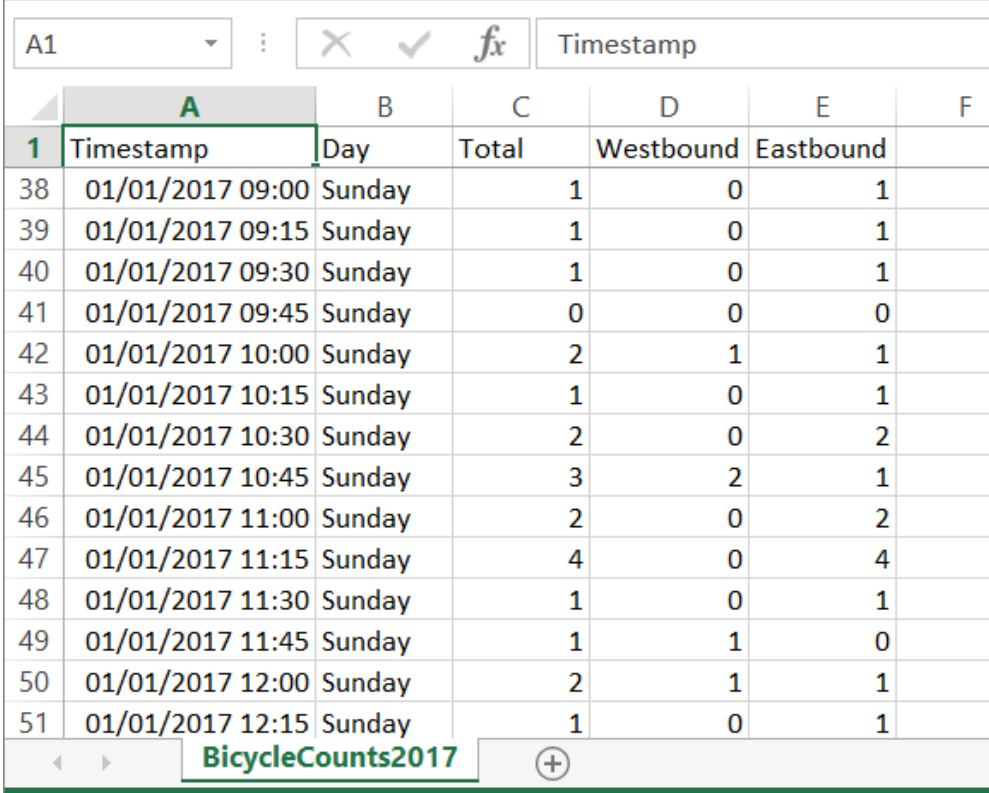


Example: Bicycle Traffic Analysis



Example: Bicycle Traffic Analysis

- Bicycle count for journeys toward Harvard (**Westbound**) and toward City Centre (**Eastbound**).
- Counts recorded every 15 minutes between 01/01/17 – /09/17.
- Data contains:
 - Timestamp
 - Day of the week
 - Total bicycle counts per 15 minutes
 - Counts separated by journey direction



	A	B	C	D	E	F
1	Timestamp	Day	Total	Westbound	Eastbound	
38	01/01/2017 09:00	Sunday	1	0	1	
39	01/01/2017 09:15	Sunday	1	0	1	
40	01/01/2017 09:30	Sunday	1	0	1	
41	01/01/2017 09:45	Sunday	0	0	0	
42	01/01/2017 10:00	Sunday	2	1	1	
43	01/01/2017 10:15	Sunday	1	0	1	
44	01/01/2017 10:30	Sunday	2	0	2	
45	01/01/2017 10:45	Sunday	3	2	1	
46	01/01/2017 11:00	Sunday	2	0	2	
47	01/01/2017 11:15	Sunday	4	0	4	
48	01/01/2017 11:30	Sunday	1	0	1	
49	01/01/2017 11:45	Sunday	1	1	0	
50	01/01/2017 12:00	Sunday	2	1	1	
51	01/01/2017 12:15	Sunday	1	0	1	

Importing Data: Interactive or Generate Code

- Interactively import data with the Import Tool:

Access

Files

Software

Code & Applications

Hardware

The screenshot shows the MATLAB Import Tool interface. The 'IMPORT' tab is active, and the 'VIEW' sub-tab is selected. The 'Delimited' radio button is chosen, with 'Comma' as the column delimiter. The range is set to 'A2:E18337' and the variable names row is '1'. The 'Output Type' is set to 'Table'. A 'Replace' checkbox is checked, and 'unimportable cells with NaN' is selected. A dropdown menu is open, showing options: 'Import Data', 'Generate Script', and 'Generate Function'. The main area displays a table named 'bikeData' with the following columns: Timestamp, Day, Total, Westbound, and Eastbound. The data rows show timestamps from 24/06/2015 00:00:00 to 24/06/2015 04:45:00, all on Wednesday.

bikeData				
Timestamp	Day	Total	Westbound	Eastbound
24/06/2015 00:00:00	Wednesday	4	1	3
24/06/2015 00:15:00	Wednesday	3	3	0
24/06/2015 00:30:00	Wednesday	4	3	1
24/06/2015 00:45:00	Wednesday	2	2	0
24/06/2015 01:00:00	Wednesday	2	2	0
24/06/2015 01:15:00	Wednesday	0	0	0
24/06/2015 01:30:00	Wednesday	0	0	0
24/06/2015 01:45:00	Wednesday	1	1	0
24/06/2015 02:00:00	Wednesday	1	1	0
24/06/2015 02:15:00	Wednesday	0	0	0
24/06/2015 02:30:00	Wednesday	0	0	0
24/06/2015 02:45:00	Wednesday	0	0	0
24/06/2015 03:00:00	Wednesday	1	1	0
24/06/2015 03:15:00	Wednesday	0	0	0
24/06/2015 03:30:00	Wednesday	0	0	0
24/06/2015 03:45:00	Wednesday	0	0	0
24/06/2015 04:00:00	Wednesday	0	0	0
24/06/2015 04:15:00	Wednesday	1	1	0
24/06/2015 04:30:00	Wednesday	0	0	0
24/06/2015 04:45:00	Wednesday	0	0	0

Compare with Weather Data



Home Climate Information Data Access Customer Support Contact About Search

Home > Climate Data Online > Data Tools > Find a Station

Datasets Search Tool Mapping Tool Data Tools Help

Data Tools: Find a Station

Retrieve weather records from observing stations by entering the desired location, data set, data range, and data category. Location can be specified as city, county, state, country, or ZIP code.

Enter Location
Boston, MA, United States

Select Dataset
Daily Summaries

Select Date Range
2017-08-21

Data Categories

- Air Temperature
- Evaporation
- Land
- Precipitation

STATION DETAILS

Name BOSTON, MA US
ID GHCND:USW00014739
Lat/Lon 42.3606, -71.0097

PERIOD OF RECORD

Start/End 1936-01-01 to 2017-08-21
Coverage 100%

FULL DETAILS ADD TO CART

- Historical weather data for Boston, MA.

	A	B	C	D	E	F	G
1	DATE	AvWindSpeed	Precipitation	TAVG	TMAX	TMIN	
2	01/01/2017	14.09	0.07	40	44	33	
3	02/01/2017	4.47	0	35	41	28	
4	03/01/2017	18.12	0.89	41	44	40	
5	04/01/2017	12.53	0.06	43	48	33	
6	05/01/2017	14.76	0	32	34	27	
7	06/01/2017	8.05	0.06	29	31	24	
8	07/01/2017	14.32	0.53	23	24	17	
9	08/01/2017	13.42	0.01	18	22	13	

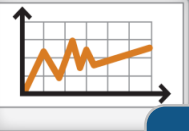
- Same time period as bicycle traffic data.
- We have data for:
 - Average wind speed (MPH)
 - Precipitation (inches per day)
 - Average daily temperature (°F)
 - Maximum daily temperature (°F)
 - Minimum daily temperature (°F)

Are bicycle counts related to the weather?

- Live Editor allows for quick and easy exploration of data

Explore & Discover

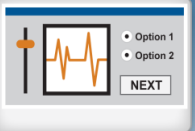
Data Analysis & Modeling



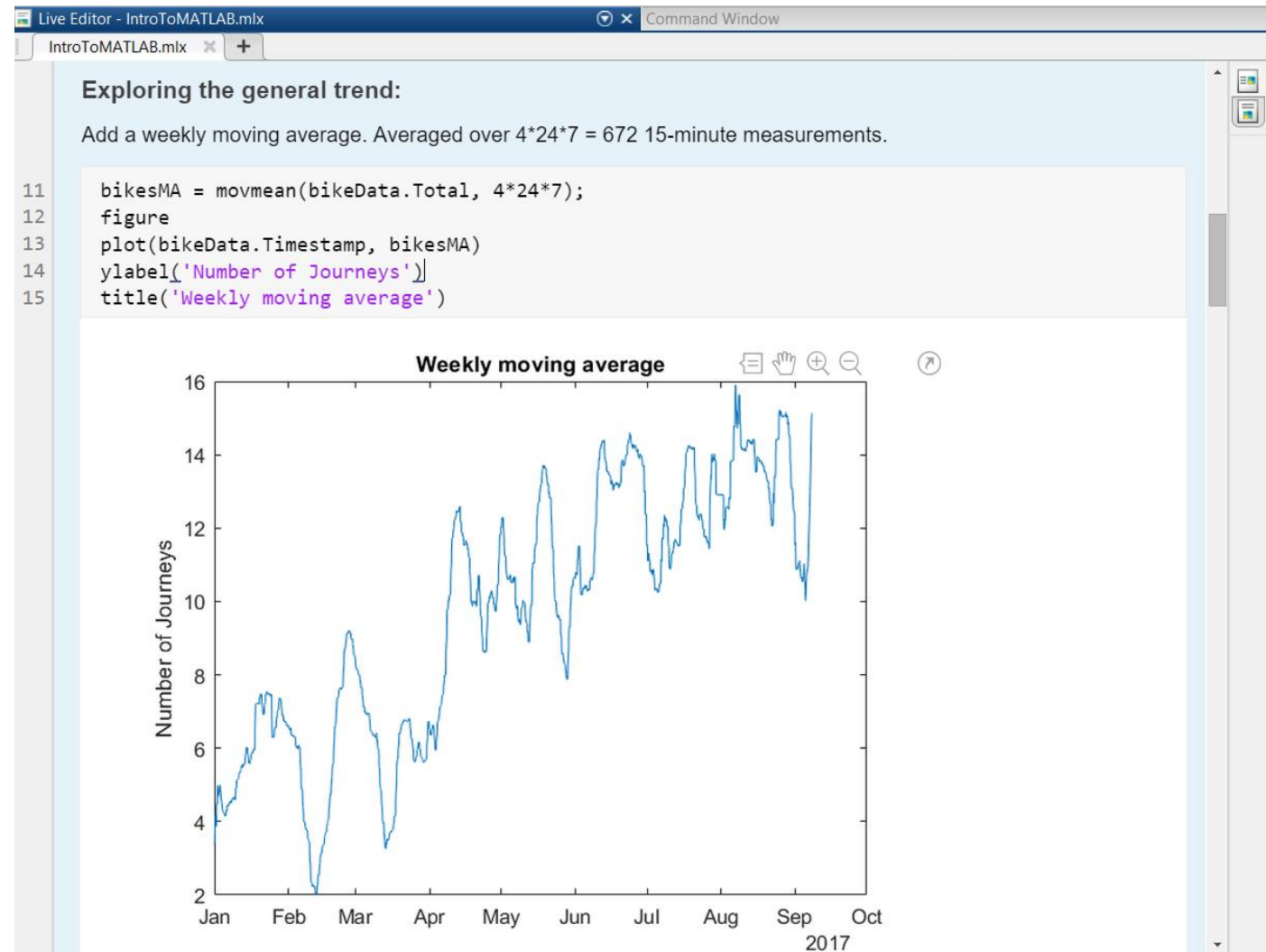
Algorithm Development

```
for k=1:max
x = fft(dat
y = 20*log1
```

Application Development



Option 1
Option 2
NEXT



Sharing Code and Applications

- Export as PDF/HTML/LaTeX

Share

Reporting and Documentation





Outputs for Design






Deployment

MATLAB

.NET
.exe

Excel

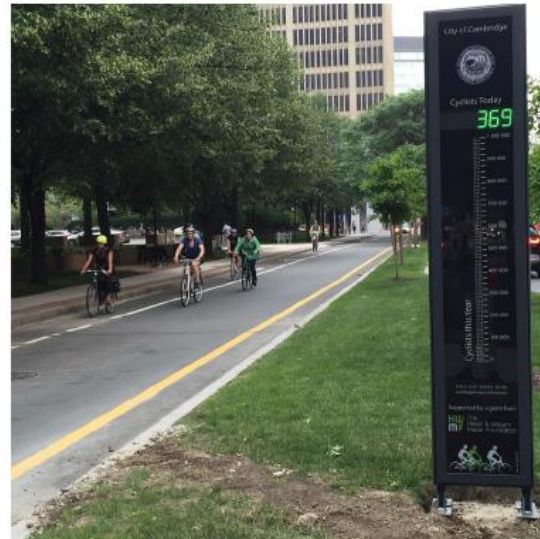
C/C++

Java .dll

Introduction to MATLAB

In this script, we will import in data from .csv files interactively, and then generate code to bring in the data programmatically.

The bicycle counts data comes from sensors on Broadway, Cambridge, Massachusetts, and counts the number of bikes travelling toward *Harvard* (**Westbound**) and toward the *city centre* (**Eastbound**) every 15 minutes.



Importing Data

Data can be imported interactively using the Import Tool.

Sharing Code and Applications

- Create stand-alone application for MATLAB and Non-MATLAB users.

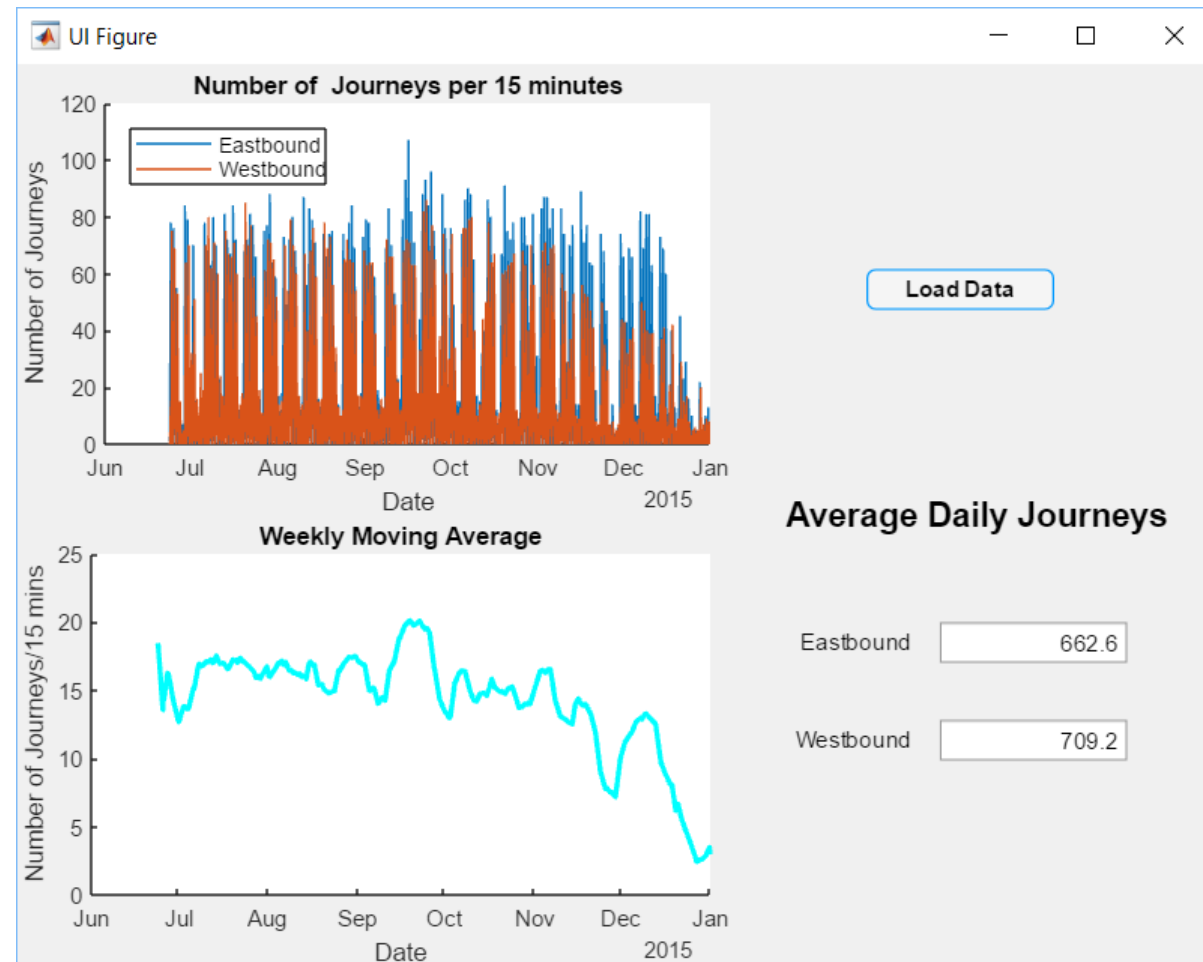
Share

Reporting and Documentation

Outputs for Design

Deployment

MATLAB Excel
 .NET C/C++
 .exe Java .dll



MATLAB Onramp

- Get started with MATLAB for free
- Two-hour interactive training course
 - Hands-on experience.
 - Work through examples and exercises
 - Immediate feedback.
- Access directly from MATLAB:

MATLAB Onramp 15% complete » MATLAB academy

Chapter 9.1 Plotting Vectors

Practice
Complete the tasks below.

Task 1

Info: Two vectors of the same length can be plotted against each other using the `plot` function.

```
>> plot(x,y)
```

Try creating a plot with `sample` on the x-axis and `mass1` on the y-axis.

[Hint](#) [Get solution](#)

Task 2
Task 3
Task 4
Task 5
Task 6
Task 7
Task 8
Further practice

Figure 1

```
>> load datafile
>> sample = data(:,1);
>> density = data(:,2);
>> v1 = data(:,3);
>> v2 = data(:,4);
>> mass1 = density.*v1;
>> mass2 = density.*v2;
```

Task 1 ✓
>> plot(sample,mass1,'*-')

Correct!
Press [Space](#) to continue, or [Esc](#) to try an alternative solution.

MATLAB R2017b

HOME | PLOTS | APPS | SHORTCUTS

FILE | VARIABLE | CODE | SIMULINK | ENVIRONMENT | RESOURCES

RESOURCES

- Community
- Request Support
- Learn MATLAB** (highlighted)

MATLAB EXPO 2017

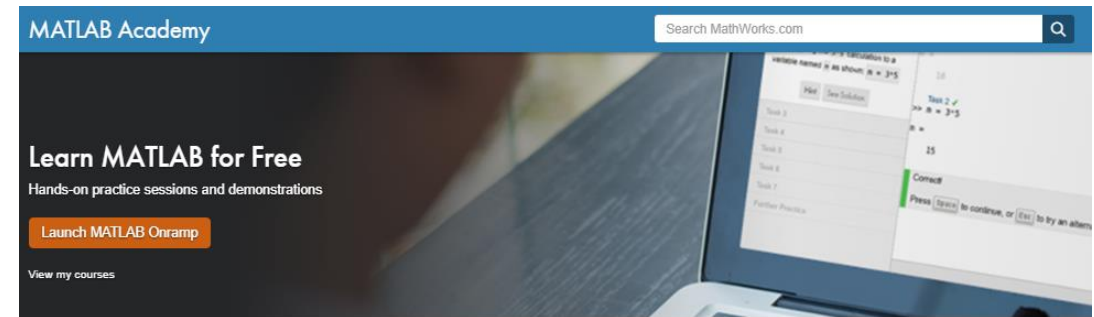
MATLAB Training – Online and in the Classroom

- Free MATLAB Onramp training.
 - Get started with MATLAB
 - Interactive training course

- Other self-paced, online courses:

<https://matlabacademy.mathworks.com/>

- Classroom training available:
 - You come to us, or we come to you.




Course Offerings

 <p>MATLAB Onramp</p>	 <p>MATLAB Fundamentals</p>	 <p>MATLAB Programming Techniques</p>	 <p>MATLAB for Data Processing and Visualization</p>
 <p>MATLAB for Financial Applications</p>	 <p>Machine Learning with MATLAB</p>		

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Get & Share Code

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Play

Explore IoT Data

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Summary and Benefits

- Easy and fast to explore ideas.
- Automatic code generation.
- Single software for entire workflow.
- Numerous resources for learning and getting help in MATLAB.