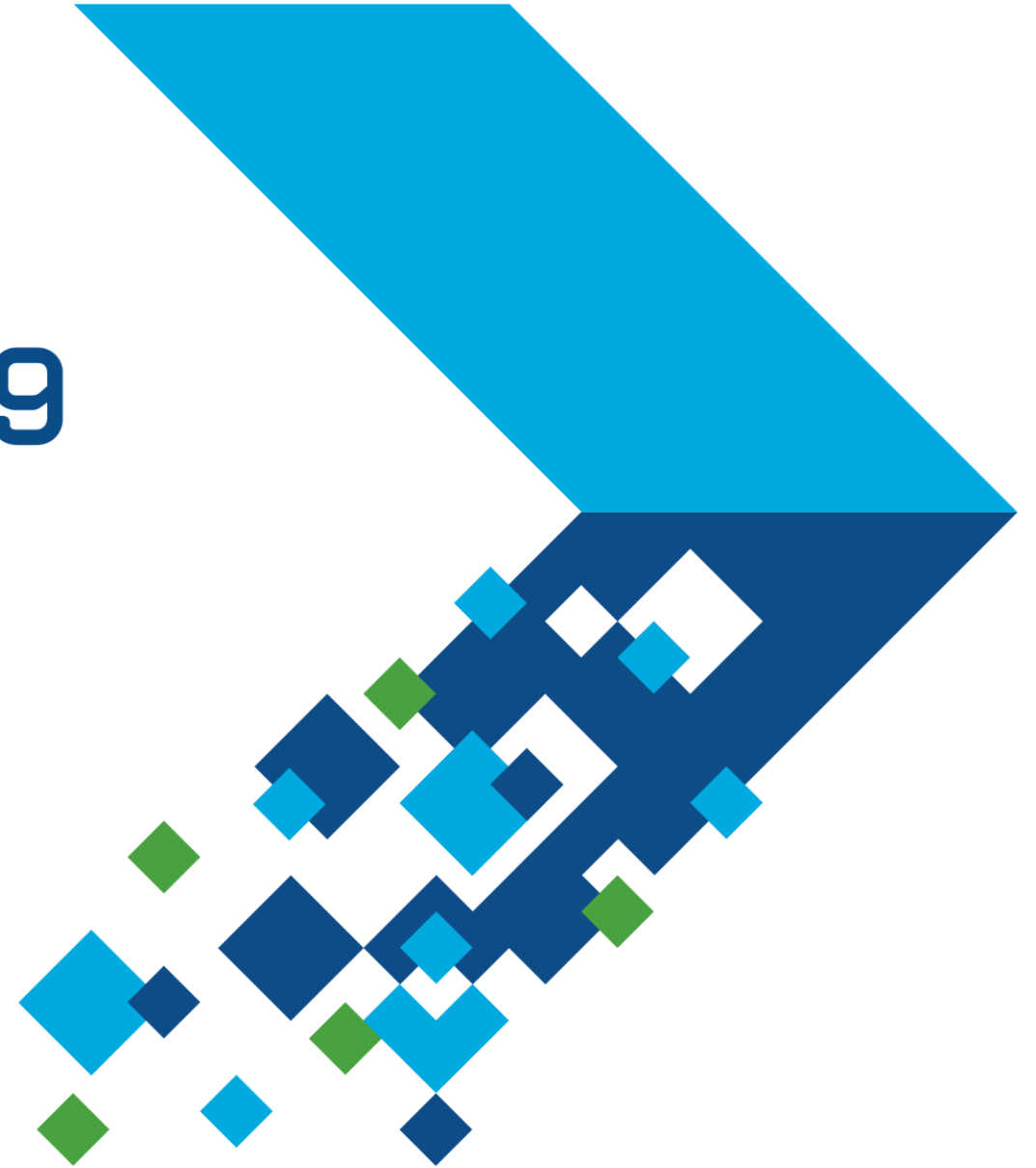


# MATLAB EXPO 2019

## Fit für die MATLAB EXPO

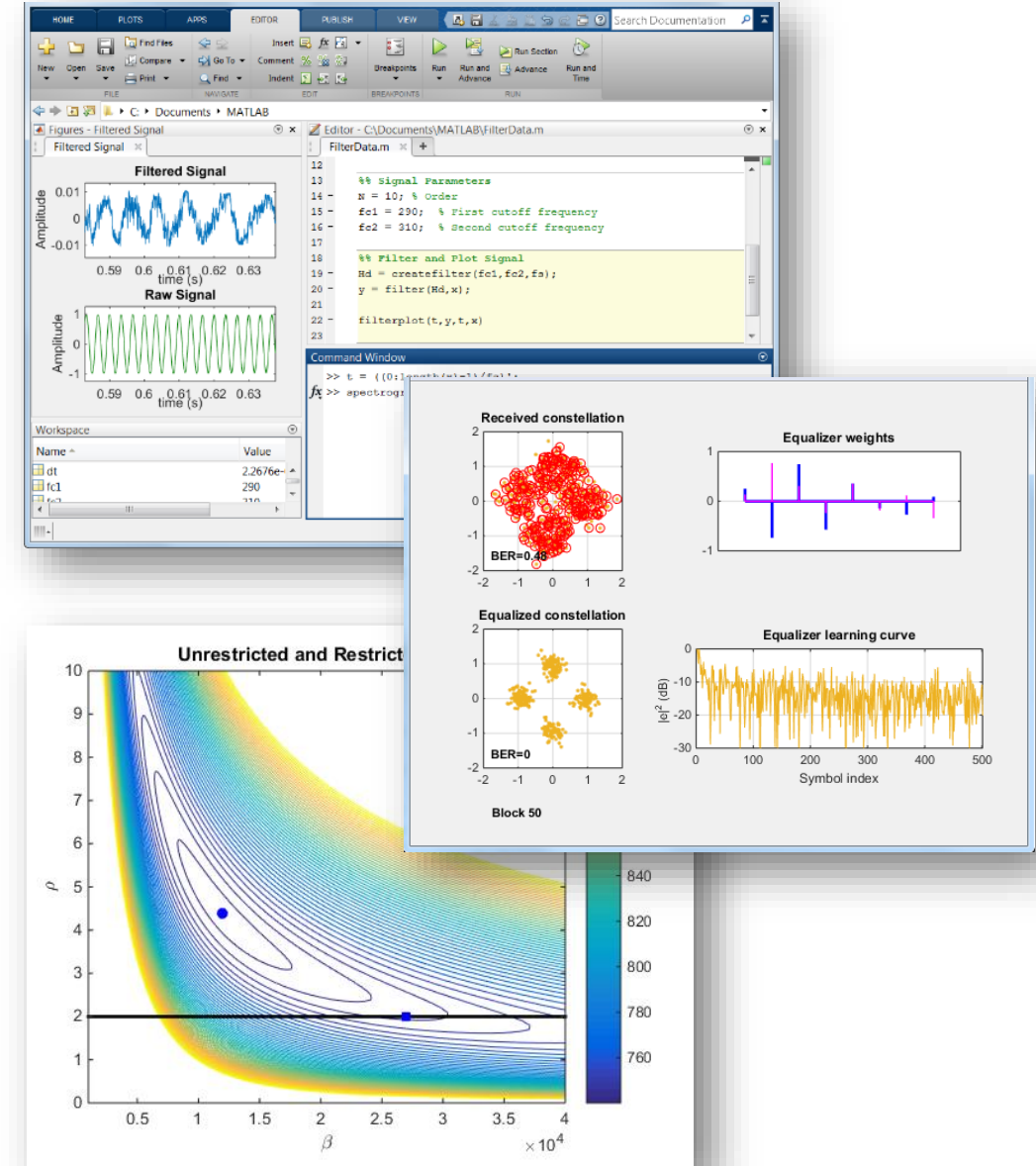
Eine kurze Einführung in MATLAB

Sebastian Bomberg

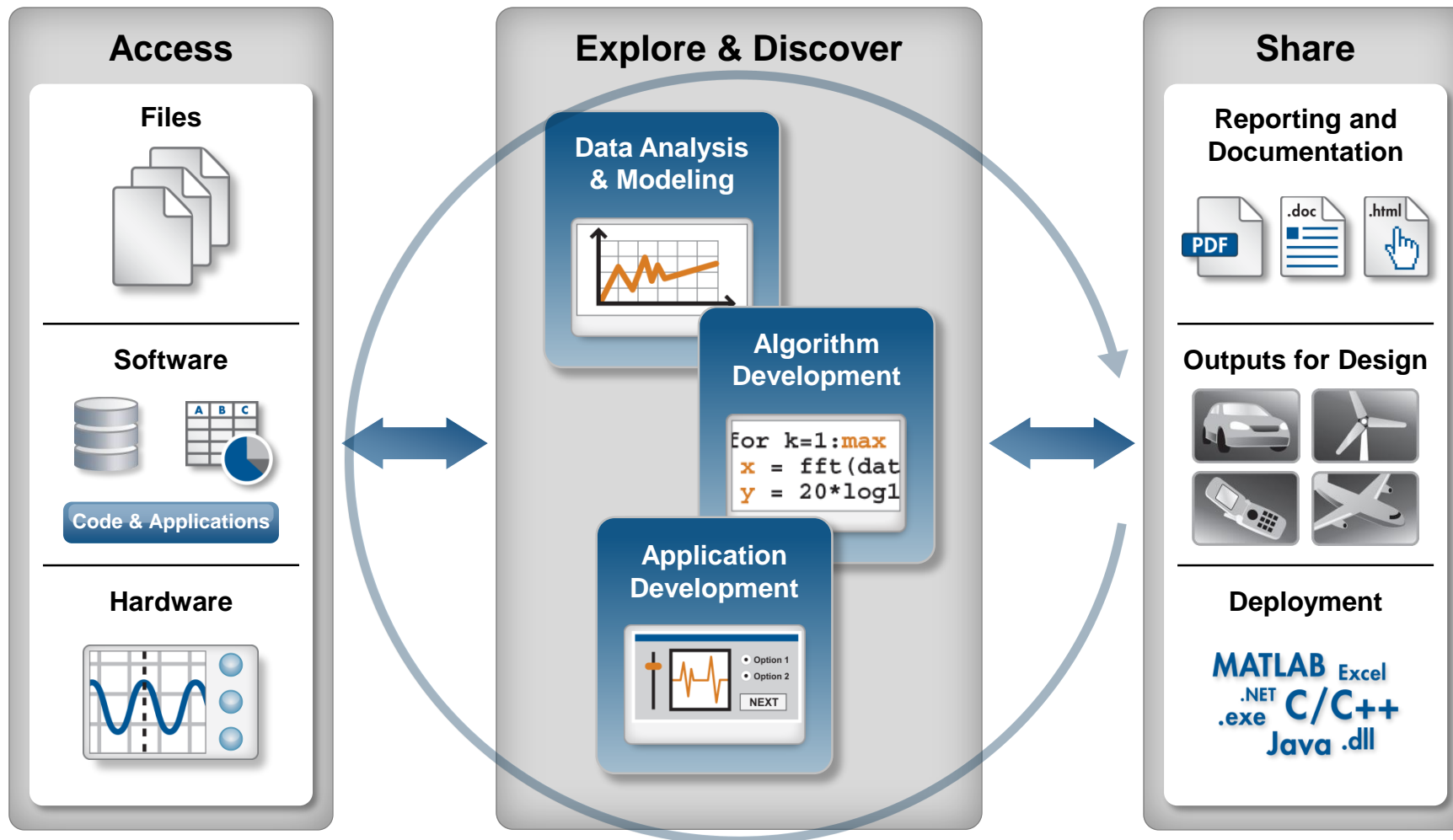


# What is MATLAB?

- High-level language
- Interactive development environment
- Used for:
  - Numerical computation
  - Data analysis and visualization
  - Algorithm development and programming
  - Application development and deployment



# Technical Computing Workflow

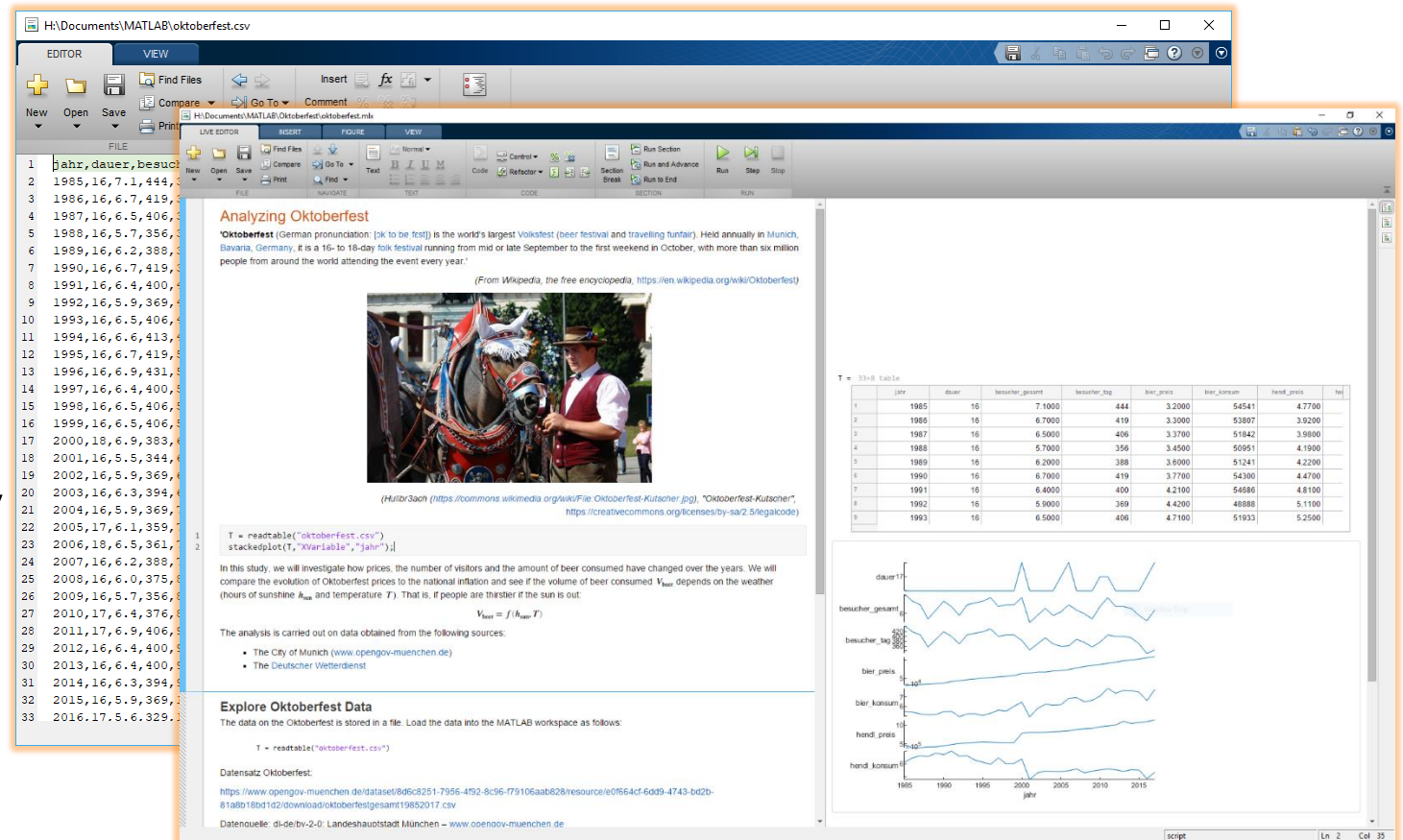


# Demo: Analyzing Oktoberfest

- Do visitors to Oktoberfest drink more in sunny weather?

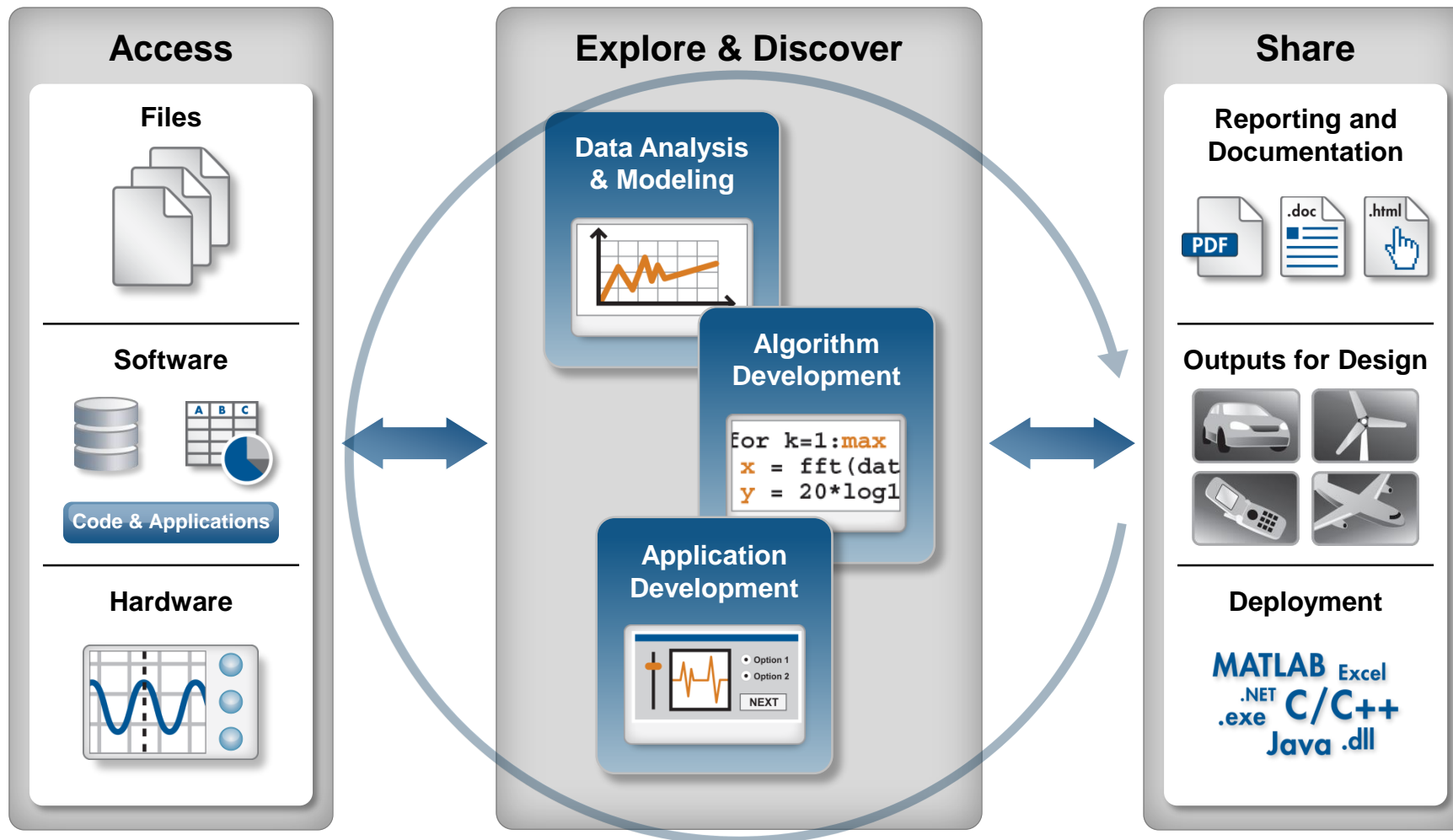
- Approach:

- Access data in a csv file
- Organize data
- Explore the data interactively
- Automate analysis
- Present analysis interactively
- Document results



# Live Demo

# Technical Computing Workflow



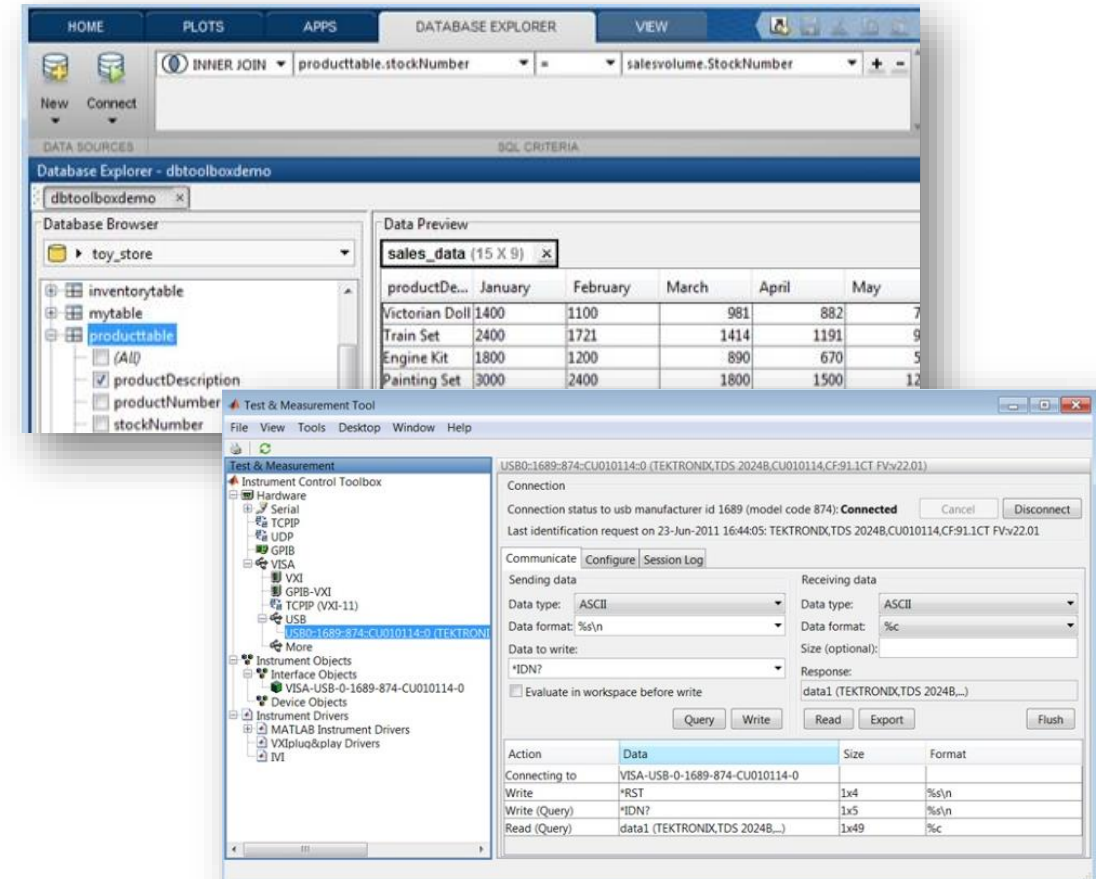
# Accessing Data from MATLAB

## Access

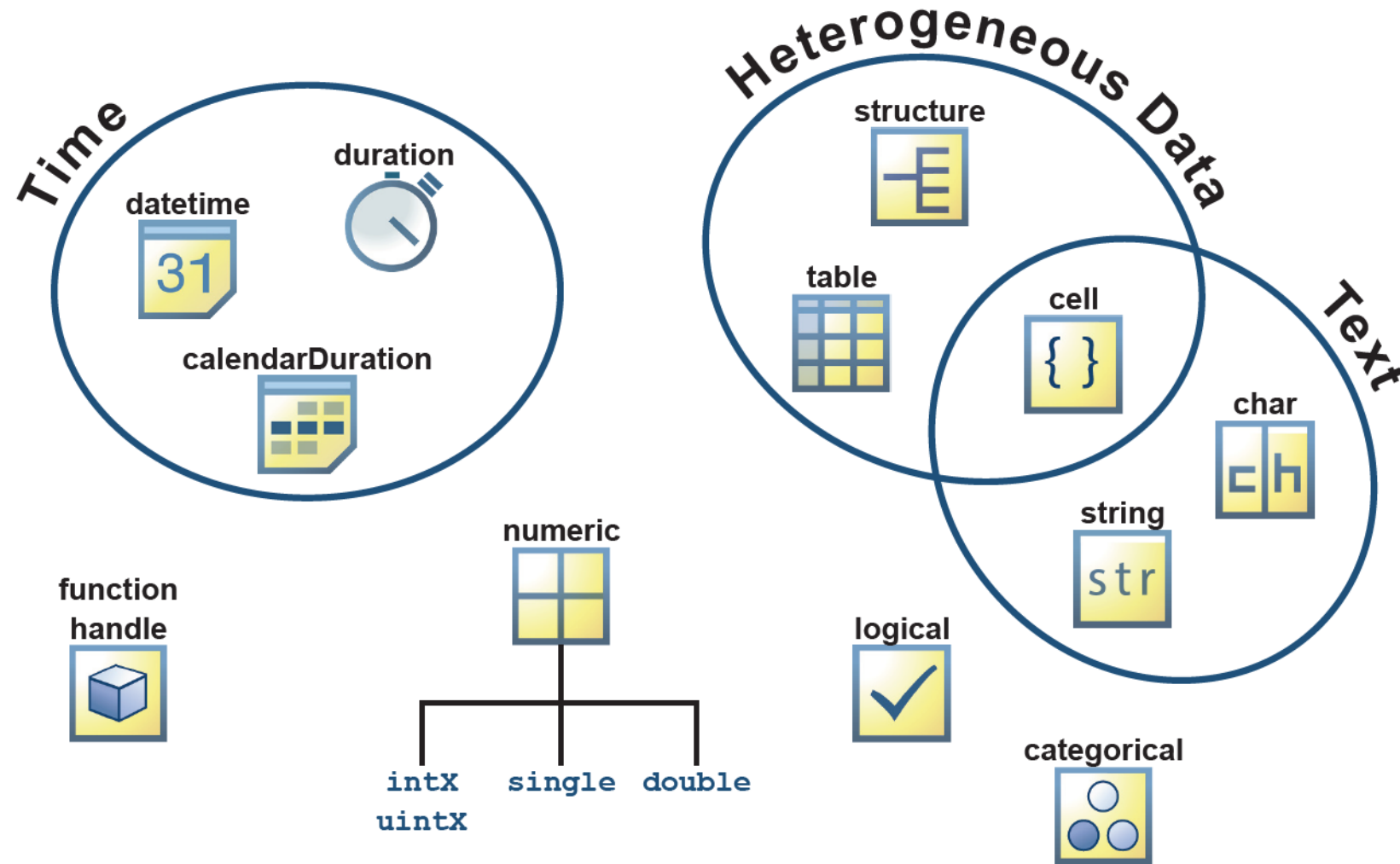
## Explore & Discover

## Share

- Files
  - Spreadsheet, text, or binary
  - Audio and video, image
  - Scientific formats and XML
- Applications and languages
  - C/C++, Java, FORTRAN
  - COM, .NET, shared libraries
  - Databases (*Database Toolbox*)
- Measurement hardware
  - Data acquisition hardware (*Data Acquisition Toolbox*)
  - Stand-alone instruments and devices (*Instrument Control Toolbox*)

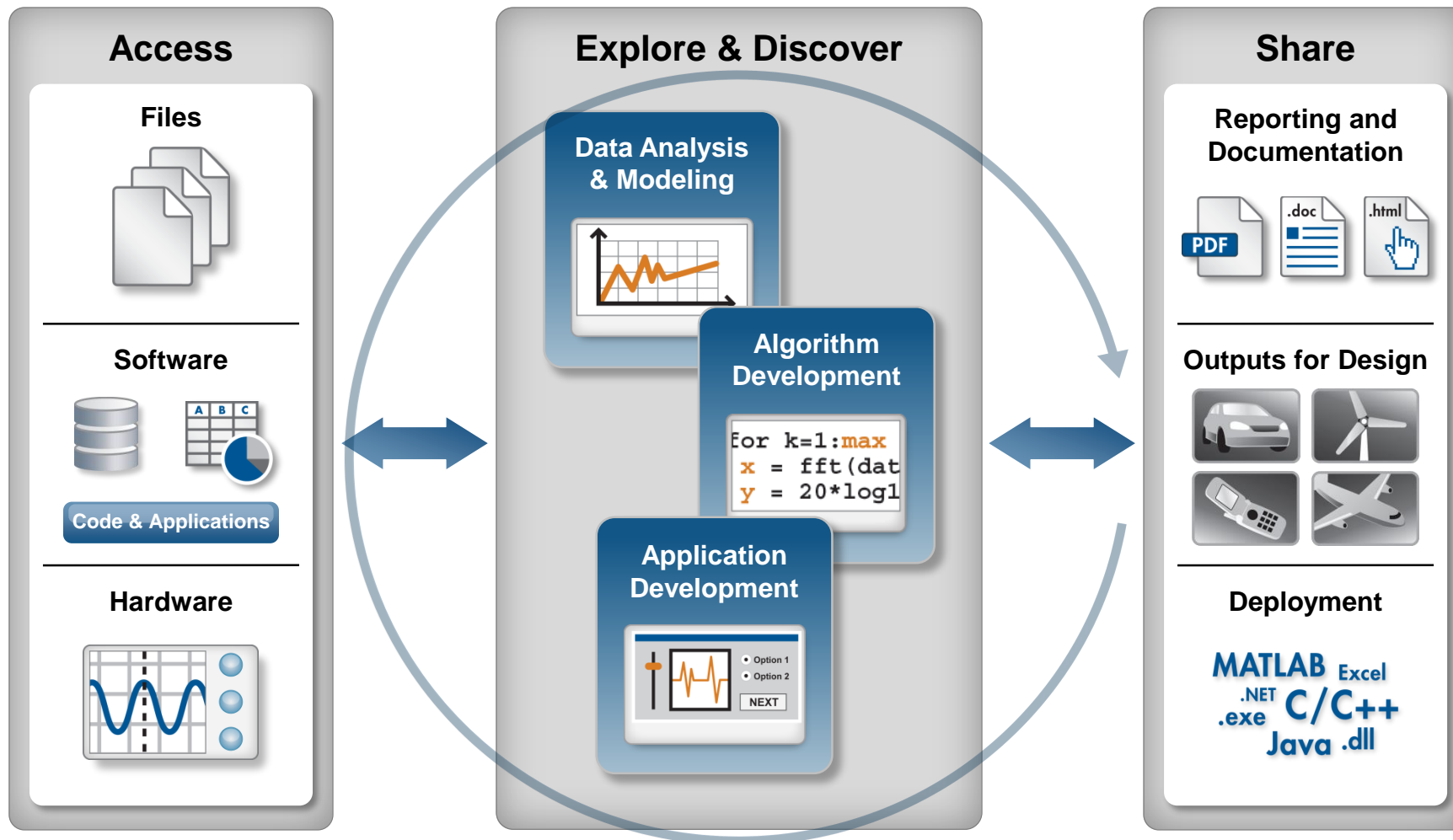


# Organize Data in MATLAB





# Technical Computing Workflow



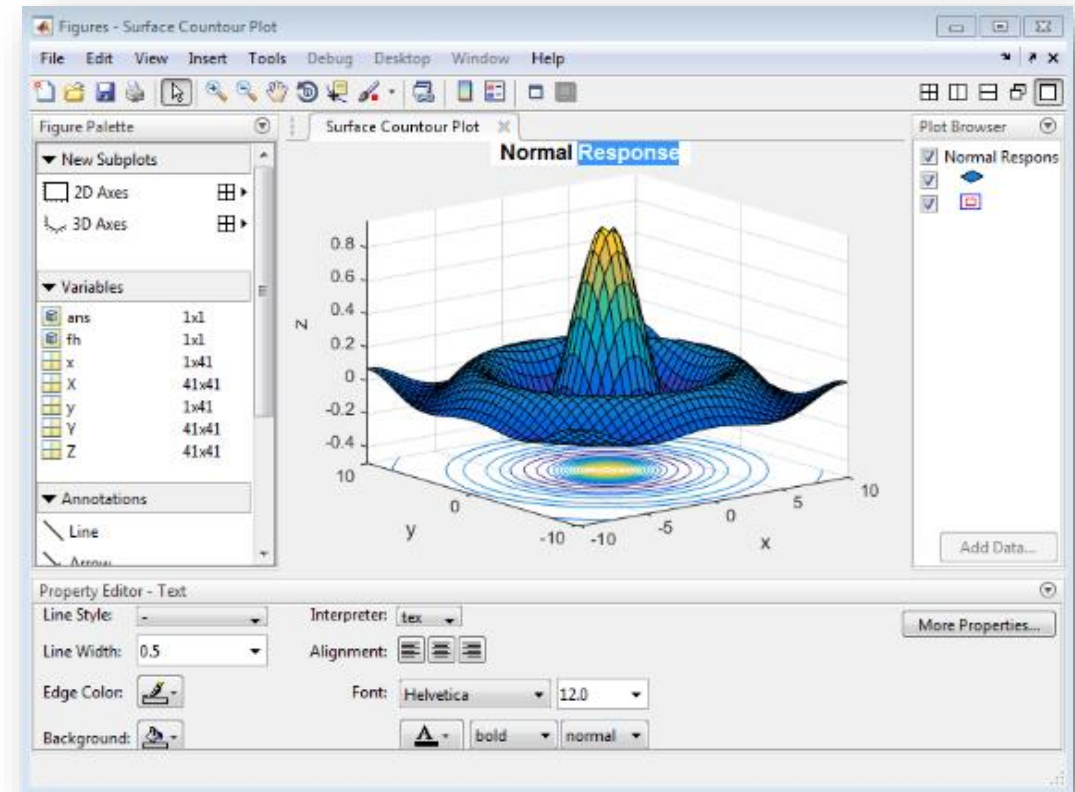
# Data Analysis and Visualization in MATLAB

Access

Explore & Discover

Share

- Built-in engineering and mathematical functions
  - Interpolation, filtering, smoothing, Fourier analysis
- Extensive plotting capabilities
  - 2-D, 3-D, and volume visualization
  - Tools for creating custom plots



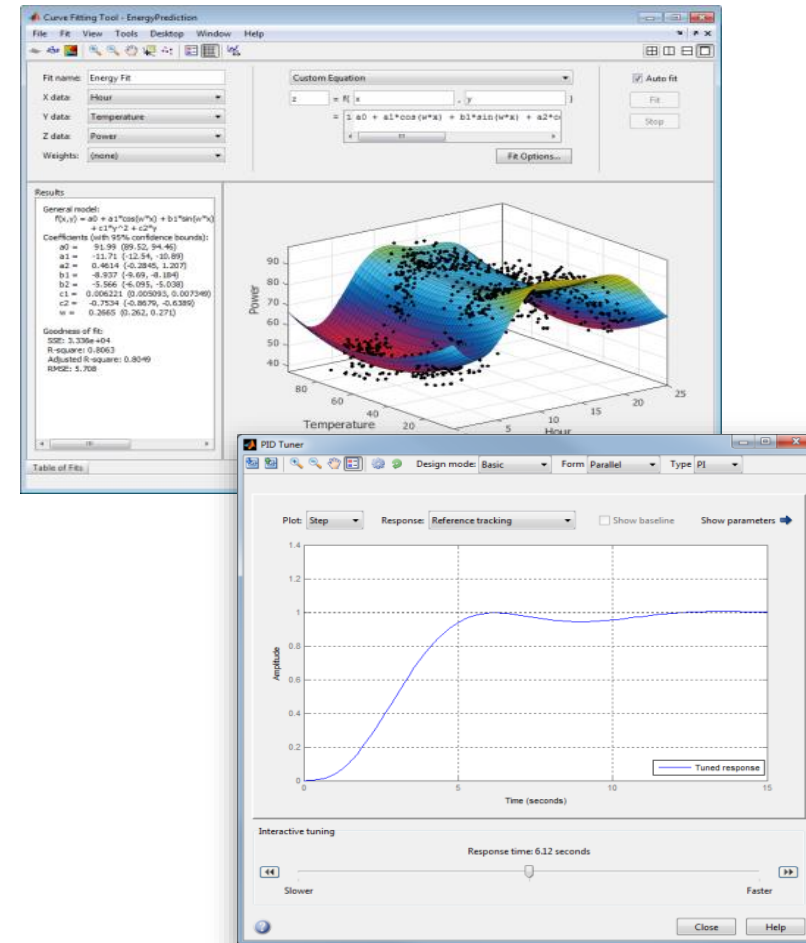
# Expanding the Capabilities of MATLAB

Access

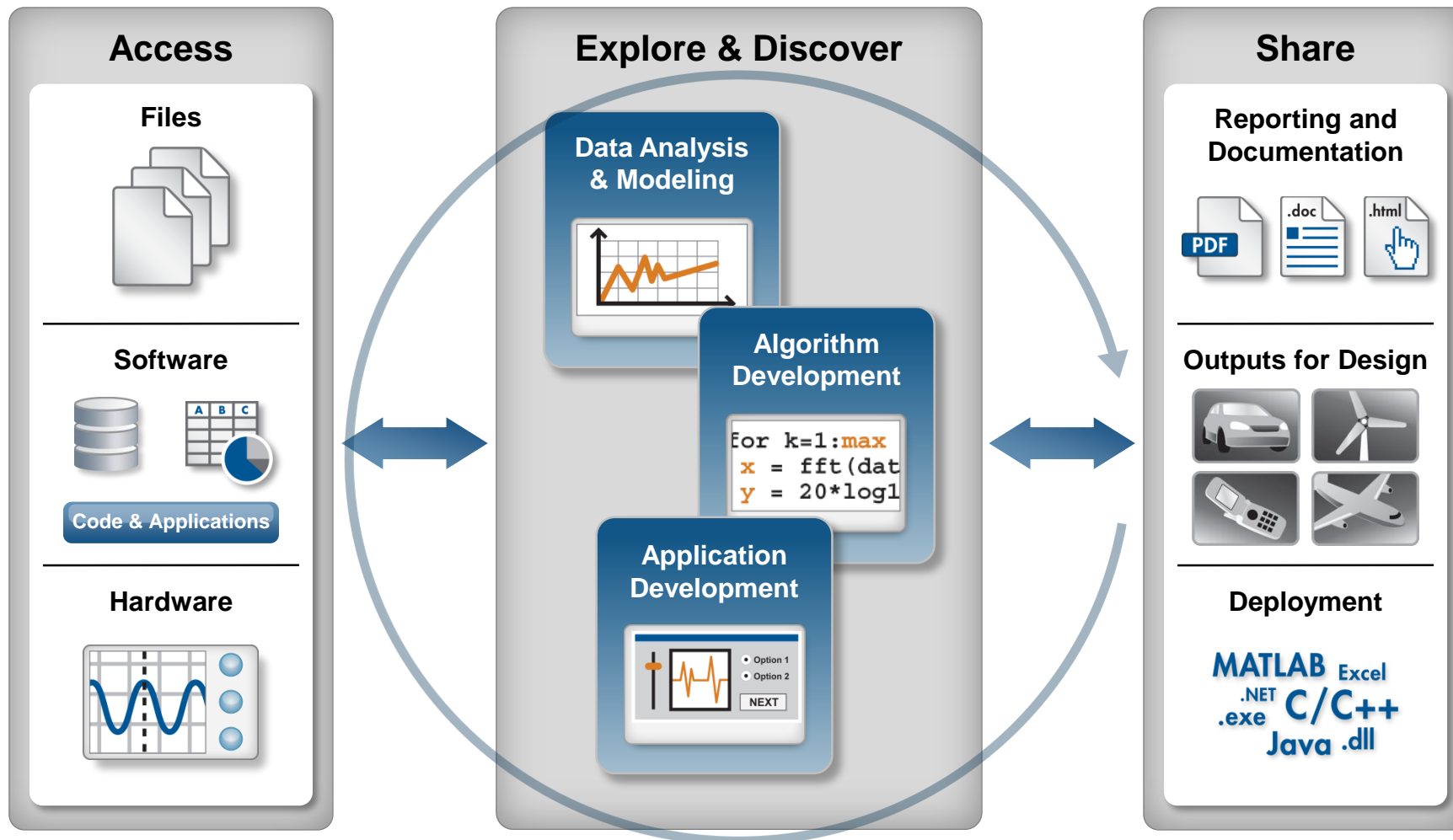
Explore & Discover

Share

- MathWorks add-on tools for:
  - Math, statistics, and optimization
  - Control system design and analysis
  - Signal processing and communications
  - Image processing and computer vision
  - Parallel computing and more...
  
- Partner products provide:
  - Additional interfaces
  - Domain-specific analysis
  - Support for niche applications



# Technical Computing Workflow



# Live Scripts – Interactive Documents

- Structured document
- Executable MATLAB code
- Results
- Formatted text

H:\Documents\MATLAB\Oktoberfest\oktoberfest.mlx

**LIVE EDITOR** INSERT FIGURE VIEW


FILE NAVIGATE TEXT CODE SECTION RUN

New Open Save Print Find Files Go To Text Code Refactor Section Break Run Run and Advance Run to End Run Step Stop

## Analyzing Oktoberfest

**Oktoberfest** (German pronunciation: [ɔkˈtə beː ˈfɛst]) is the world's largest Volksfest (beer festival and travelling funfair). Held annually in Munich, Bavaria, Germany, it is a 16- to 18-day folk festival running from mid or late September to the first weekend in October, with more than six million people from around the world attending the event every year.

(From Wikipedia, the free encyclopedia, <https://en.wikipedia.org/wiki/Oktoberfest>)



(Huilbr3ach (<https://commons.wikimedia.org/wiki/File:Oktoberfest-Kutscher.jpg>), "Oktoberfest-Kutscher", <https://creativecommons.org/licenses/by-sa/2.5/legalcode>)

```
1 T = readtable("oktoberfest.csv")
2 stackedplot(T,"xVariable","jahr");
```

In this study, we will investigate how prices, the number of visitors and the amount of beer consumed have changed over the years. We will compare the evolution of Oktoberfest prices to the national inflation and see if the volume of beer consumed  $V_{\text{beer}}$  depends on the weather (hours of sunshine  $h_{\text{sun}}$  and temperature  $T$ ). That is, if people are thirstier if the sun is out:

$$V_{\text{beer}} = f(h_{\text{sun}}, T)$$

The analysis is carried out on data obtained from the following sources:

- The City of Munich ([www.opengov-muenchen.de](http://www.opengov-muenchen.de))
- The Deutscher Wetterdienst

### Explore Oktoberfest Data

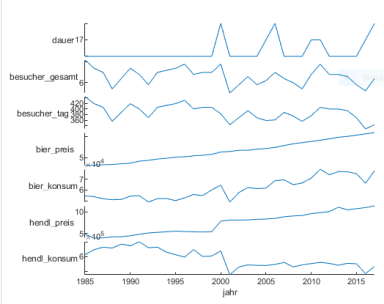
The data on the Oktoberfest is stored in a file. Load the data into the MATLAB workspace as follows:

```
T = readtable("oktoberfest.csv")
```

Datensatz Oktoberfest:  
<https://www.opengov-muenchen.de/dataset/8d6c8251-7956-4f52-8c96-f79106aab828/resource/e0f654cf-6dd9-4743-bd2b-81a8b18bd1d2/download/oktoberfestgesamt19852017.csv>  
 Datenquelle: dl-de/bv-2-0: Landeshauptstadt München – [www.opengov-muenchen.de](http://www.opengov-muenchen.de)

T = 33x8 table

	jahr	dauer	besucher_gesamt	besucher_tag	bier_preis	bier_konsum	handl_preis	handl_konsum
1	1985	16	7.1000	444	3.2000	54541	4.7700	
2	1986	16	6.7000	419	3.3000	53807	3.9200	
3	1987	16	6.5000	406	3.3700	51842	3.9800	
4	1988	16	5.7000	356	3.4500	50951	4.1900	
5	1989	16	6.2000	388	3.6000	51241	4.2200	
6	1990	16	6.7000	419	3.7700	54300	4.4700	
7	1991	16	6.4000	400	4.2100	54686	4.8100	
8	1992	16	5.9000	369	4.4200	48888	5.1100	
9	1993	16	6.5000	406	4.7100	51933	5.2500	



script Ln 2 Col 35

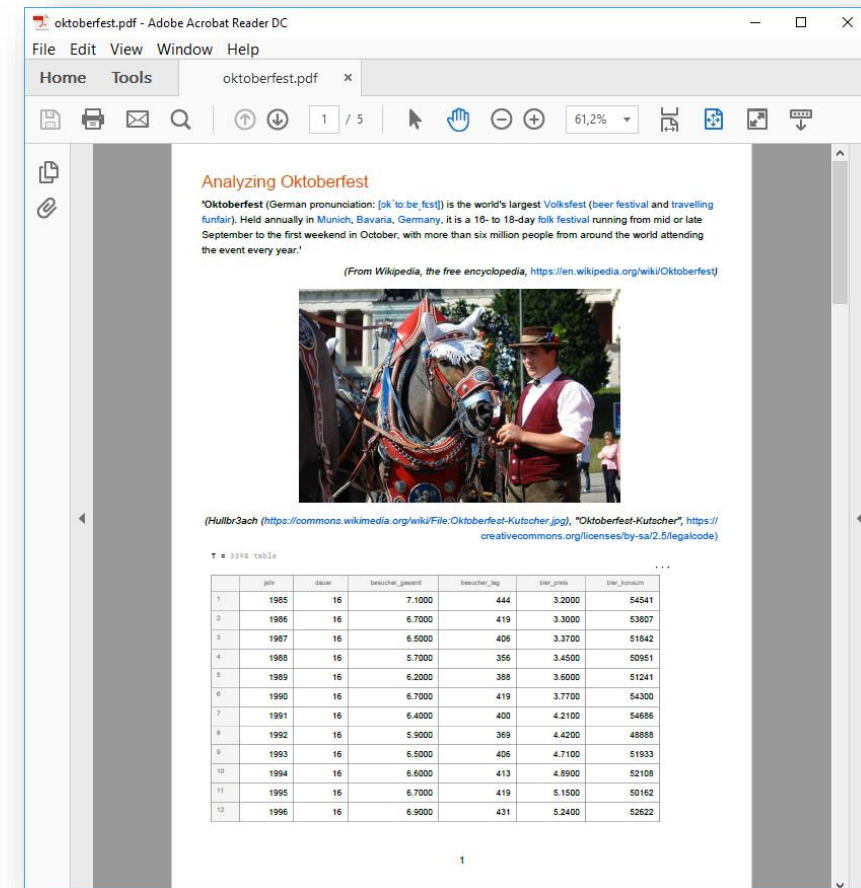
# Sharing Results from MATLAB

## Access

## Explore & Discover

## Share

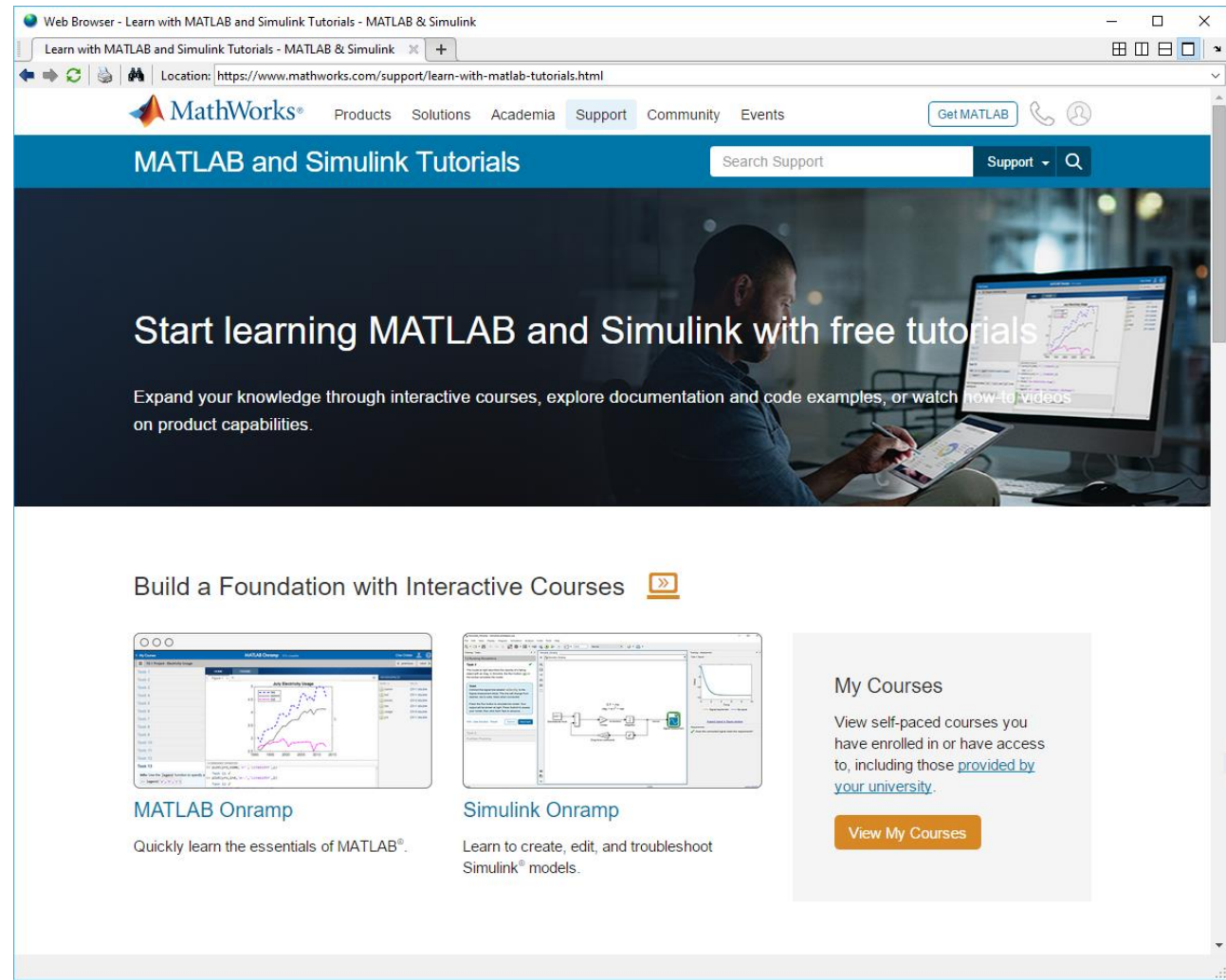
- Automatically generate reports
  - Save Live Script as PDF, HTML, LaTeX
  - Publish MATLAB files
  - Customize reports using MATLAB Report Generator
- Package as an app or a custom toolbox
- Deploy applications to other environments





# Learn more (about) MATLAB

- Documentation
- Webinars
- Training



<https://www.mathworks.com/support/learn-with-matlab-tutorials.html>

# Questions?



MATLAB EXPO 2019

