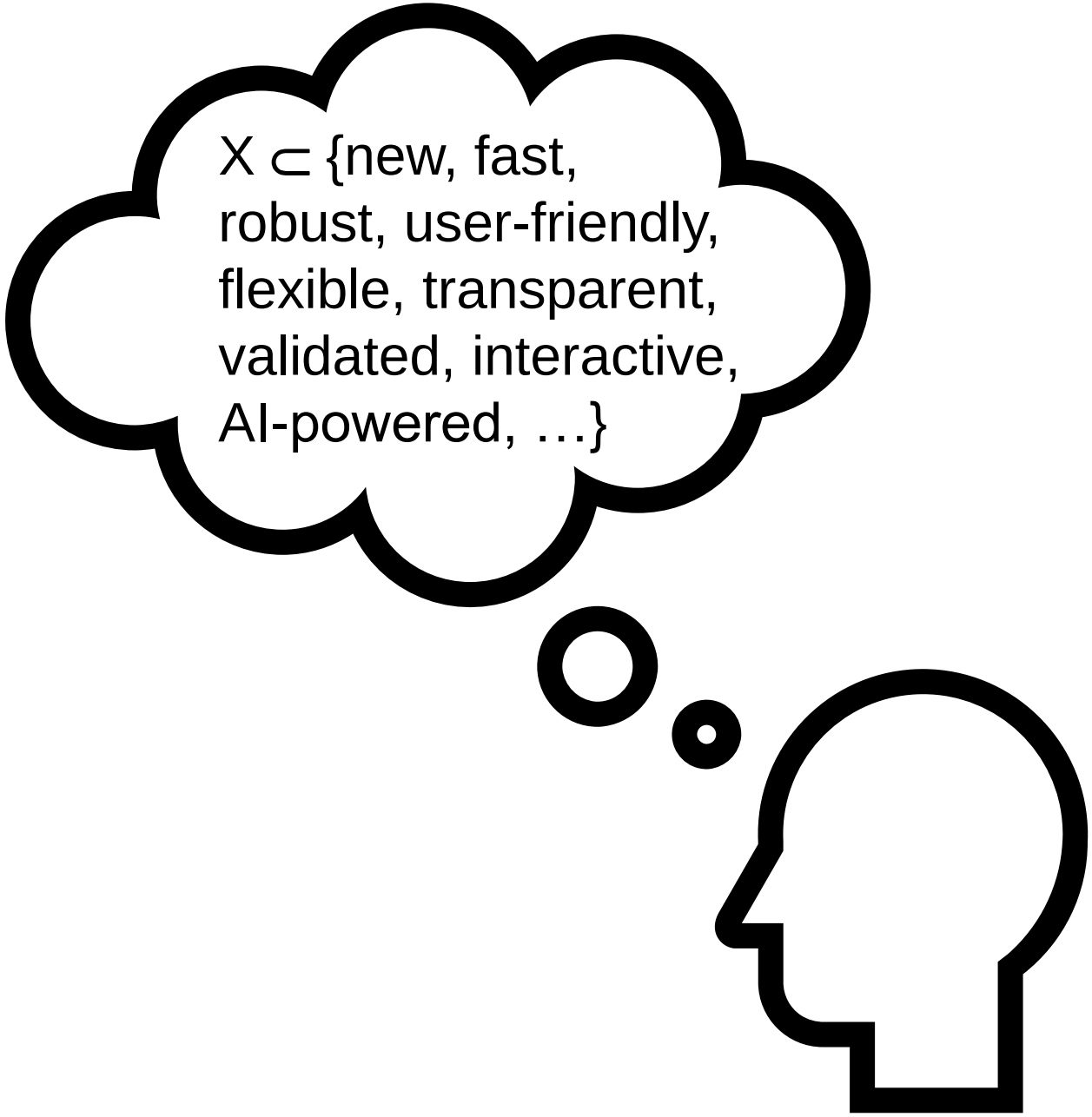
MathWorks
FINANCE
CONFERENCE 2024

Harnessing Advanced Financial Modeling Technologies with MATLAB

Alexander Diethert, MathWorks

MathWorks

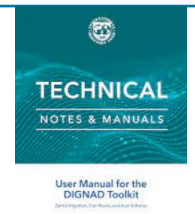
>> edit my_X_application

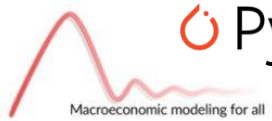

X ⊂ {new, fast,
robust, user-friendly,
flexible, transparent,
validated, interactive,
AI-powered, …}

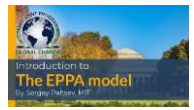
The Environmental Multi-Sector DSGE model EMuSe:
A technical documentation

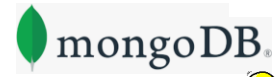
Natascha Hinterlang, Anika Martin, Oke Röhe, Nikolai Stähler, Johannes Strobel

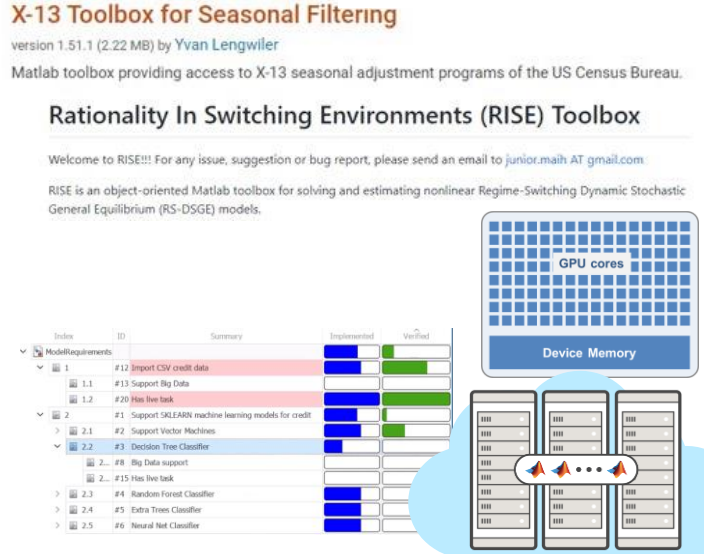
MathWorks **FINANCE CONFERENCE 2024**

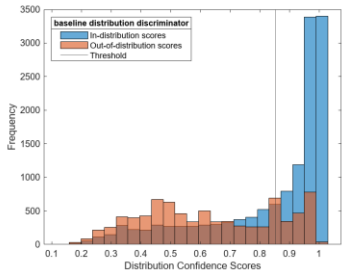


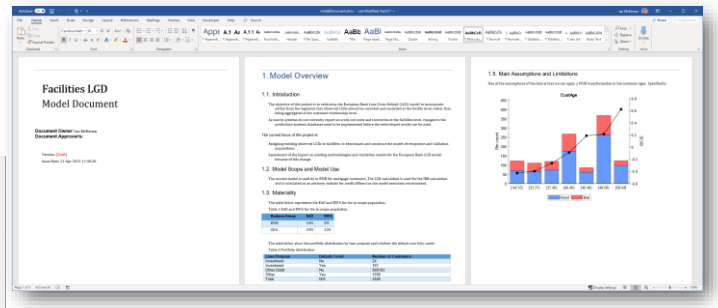


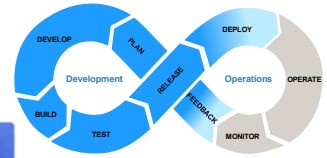


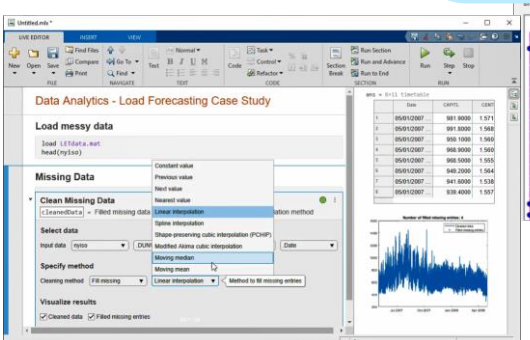


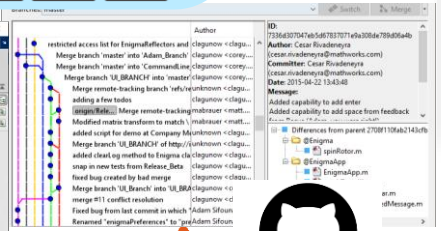






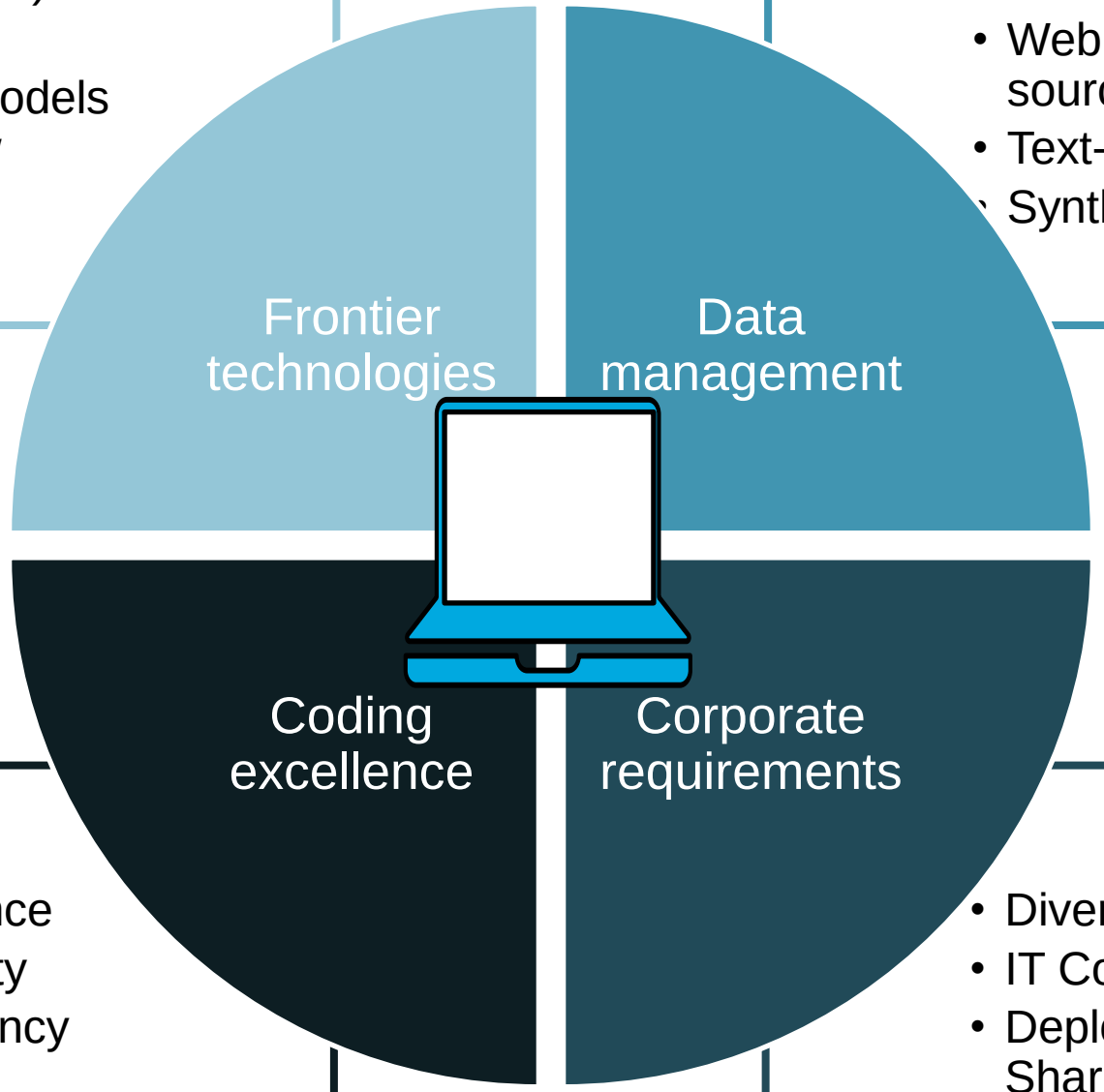






- (Generative) AI
- RegTech
- Climate Models
- Financial / Economic Research

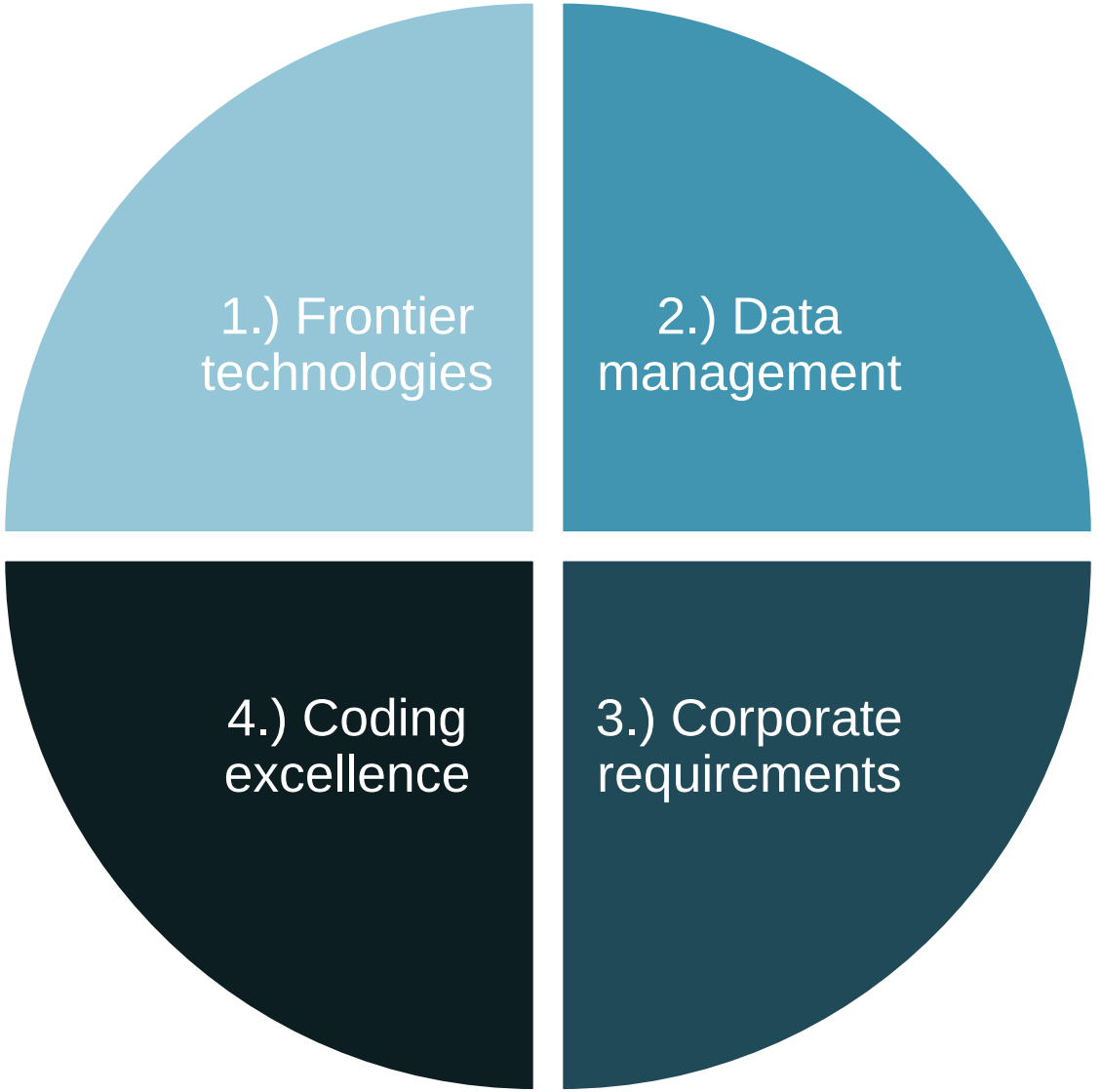
- Data vendors
- Web / public sources
- Text-based data
- Synthetic data



- Performance
- Productivity
- Transparency
- Useability

- Diversity of tools
- IT Compliance
- Deployment / Sharing with colleagues

Agenda


1.) Frontier technologies
2.) Data management
4.) Coding excellence
3.) Corporate requirements

Frontier technologies

- (Generative) AI
- RegTech
- Climate Models
- Financial / Economic Research

Frontier technologies

- (Generative) AI
- RegTech

- Climate Models

- **Financial / Economic Research**

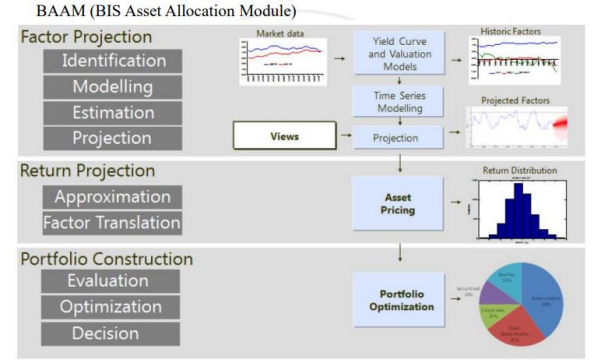
October 16 | October 17

2:30 PM CEST	Welcome
2:35 PM CEST	Keynote: Sustainable Finance with MATLAB Thierry Roncalli, *Amundi*
3:00 PM CEST	Innovations in the Delivery of AI-Powered Financial Services Paul Peeling, *MathWorks*
3:30 PM CEST	Break
3:45 PM CEST	Navigating Climate Finance: Software Solutions for Climate Risk Management Elre Oldewage, *MathWorks*
4:15 PM CEST	Counterparty Risk Assessment with Two Steps: Monte Carlo and Parallel Computing Pablo García Estébanez, *Banco Sabadell*

Examples of shared MATLAB based tools

2024 (today)

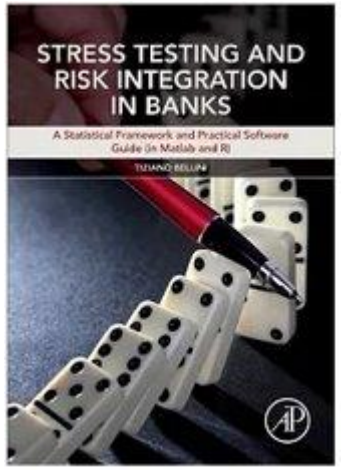
2023

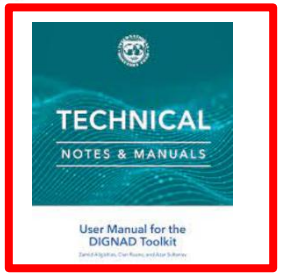


X-13 Toolbox for Seasonal Filtering

version 1.51.1 (2.22 MB) by Yvan Lengwiler

Matlab toolbox providing access to X-13 seasonal adjustment programs of the US Census Bureau.

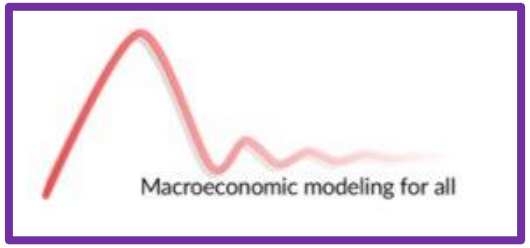




Rationality In Switching Environments (RISE) Toolbox

Welcome to RISE!!! For any issue, suggestion or bug report, please send an email to junior.maih AT gmail.com

RISE is an object-oriented Matlab toolbox for solving and estimating nonlinear Regime-Switching Dynamic Stochastic General Equilibrium (RS-DSGE) models.



ARNIE in Action: The 2013 FSAP Stress Tests for the Austrian Banking System

sdmx

The official site for the SDMX community

A global initiative to improve Statistical Data and Metadata eXchange

gpmn

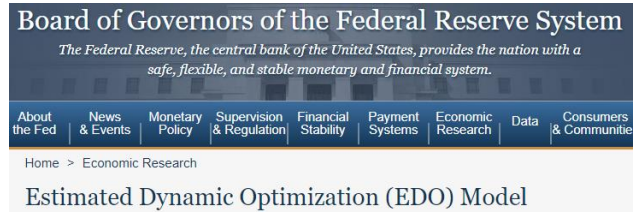
Global Projection Model Network

Systemic Risk

version 3.5.0 (8.99 MB) by Tommaso Belluzzo

A framework for systemic risk valuation and analysis.

https://github.com/TommasoBelluzzo/SystemicRisk



YADA

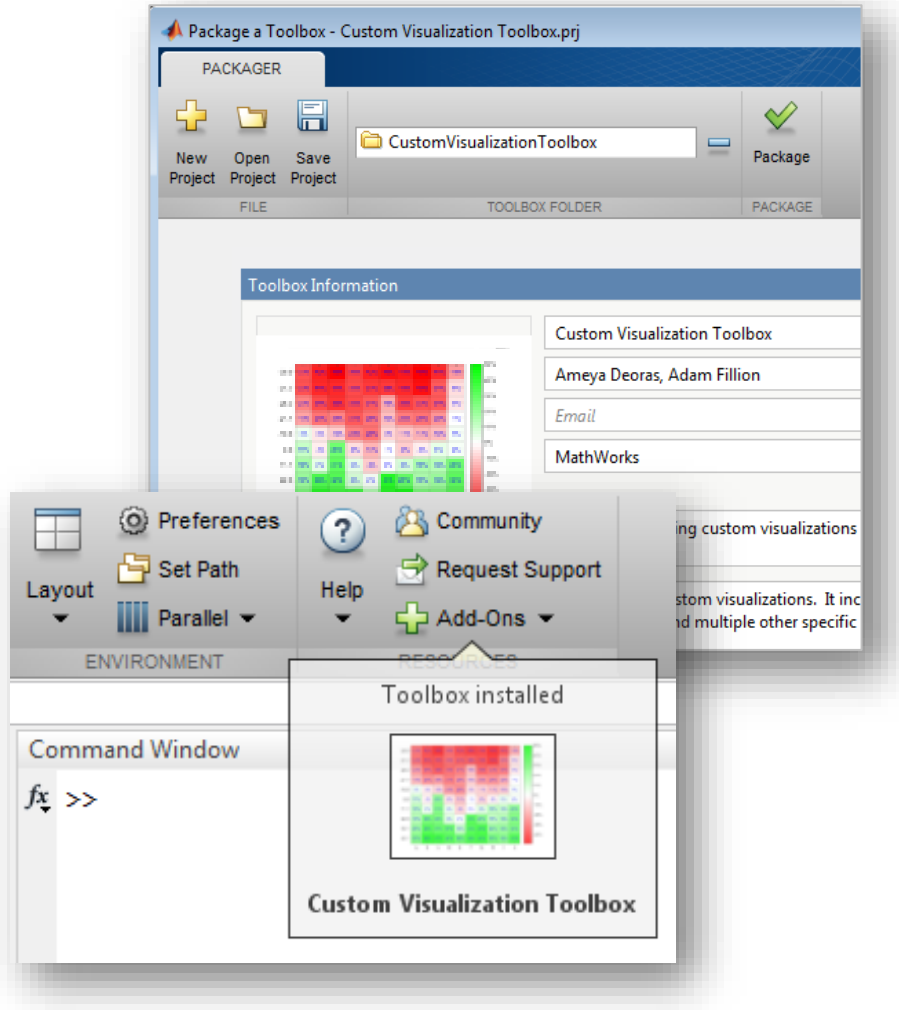
YADA is program for conducting Bayesian estimation and evaluation of Dynamic Stochastic General Equilibrium (DSGE) and Vector AutoRegressive (VAR) models. It is developed by the New Area-Wide Model (NAWM) team at the Forecasting and Policy Modelling Division (formerly at the Monetary Policy Research Division and before that at the Econometric Modelling Division within the Directorate General Research) of the European Central Bank (ECB). Unlike other DSGE estimation applications, such as Dynare, YADA is a GUI-based program.

The Environmental Multi-Sector DSGE model EMuSe: A technical documentation

Natascha Hinterlang, Anika Martin, Oke Röhe, Nikolai Stähler, Johannes Strobel

Custom Toolbox Packaging for Easy Sharing

- Package your toolbox as a single installer file
  - Contains all of the code, data, apps, documentation, and examples
  - Checks for dependent files and automatically includes them
  - Documents required products
- Included folders and files automatically appear on path when installed
- View details and uninstall toolboxes with Manage Custom Toolboxes dialog box



Example: BEAR Toolbox on File Exchange / GitHub

MathWorks

MATLAB Answers | File Exchange | Cody | AI Chat Playground | Discussions | Contests | Blogs | More

Files | Authors | My File Exchange | Publish | About

BEAR

Version 5.2.1 (14.3 MB) by Alistair Dieppe

The Bayesian Estimation, Analysis and Regression toolbox (BEAR)

https://github.com/european-central-bank/BEAR-toolbox

Follow

(1)

1.7K Downloads

Updated 14 May 2024

View License on GitHub

Share | Open in MATLAB Online | Download

Overview | Functions | Examples | Version History | Reviews (1) | Discussions (3)

! We just added some major changes into the main functionality of BEAR to improve its usability. To access the previous version of the code use the legacyCode branch

View BEAR 5.2 on File Exchange

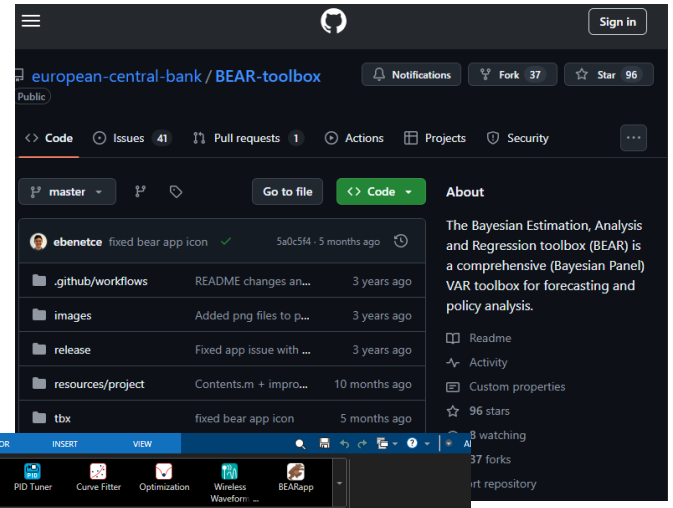
GitHub® Actions

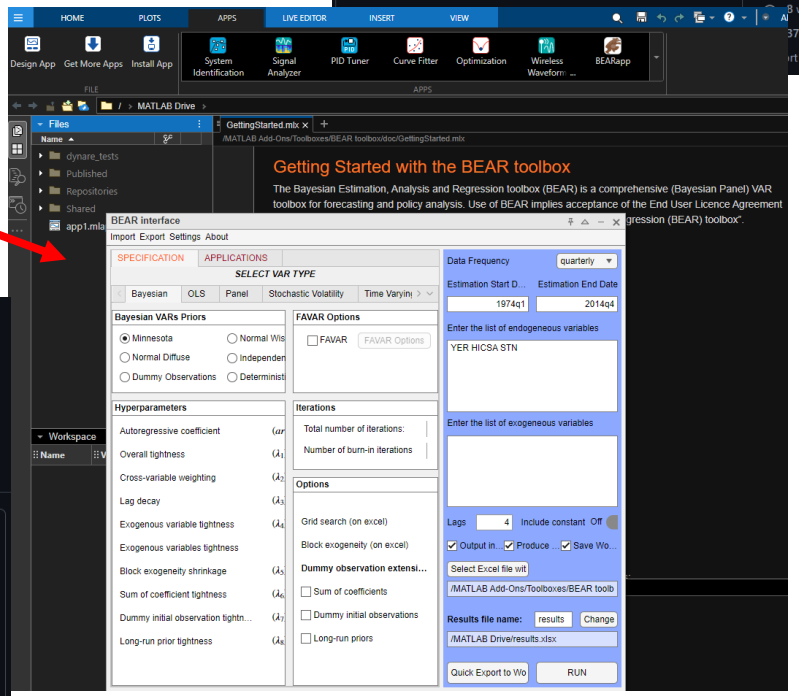
MATLAB passing

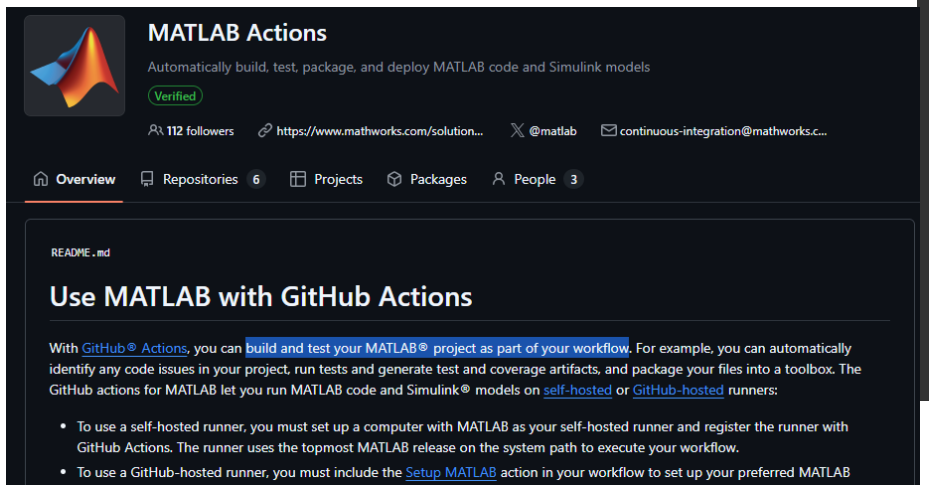
The BEAR toolbox

Table of Contents

- Introduction







Data Management

- Data vendors
- Web / public sources
- Text-based data
- Synthetic data

Connectors to MATLAB available out of the box

As part of Datafeed Toolbox

	Market Data Type				
Data Service Provider	**Real Time**	**Current Market**	**Intraday Tick / Time Series**	**Historical / End-of-Day**	**News / Times Series**
Bloomberg Desktop	✓	✓	✓	✓	
Bloomberg Server	✓	✓	✓	✓	
Bloomberg B-PIPE	✓	✓	✓	✓	
Datastream Web Services				✓	
FactSet Data Server	✓	✓			
Federal Reserve Economic Data (FRED)				✓	
Haver Analytics				✓	
IHS Markit		✓		✓	
Money.Net	✓	✓	✓	✓	
Quandl				✓	
Refinitiv Machine Readable News					✓
Refinitiv Tick History			✓	✓	
SIX Financial Information		✓	✓	✓	
Twitter					✓

Examples from the Community

Ice for MATLAB

Develop powerful, distributed MATLAB applications using the Ice Framework

SDMX

Version 3.4.0 (263 KB) by Attilio Mattiocco

Provides functions to retrieve data and metadata from providers that disseminate data by means of SDMX web services.
https://github.com/amattioc/SDMX

Climate IAM Explorer

Version 1.3.4 (297 KB) by Edu Benet Cerda STAFF

App to explore Integrated Assessment Model results
https://github.com/mathworks/Climate-IAM-Explorer

Climate Data Store Toolbox for MATLAB

Version 2.2.6.0 (1.08 MB) by Rob Purser STAFF

MATLAB(R) Tools to access the Climate Data Store (https://cds.climate.copernicus.eu/)
https://github.com/mathworks/climatedatastore

Meteomatics Weather API Connector

Version 4.0.0.1 (3.63 MB) by Martin Fengler

This package contains routines to query meteorological and maritime data from the Meteomatics Weather API.
https://www.meteomatics.com/en/api/getting-started/

Climate Data Toolbox for MATLAB

Version 1.01 (109 MB) by Chad Greene

A set of low-level functions and tutorials for analyzing and displaying Earth science data.
http://www.chadagreene.com/CDT/CDT_Contents.html

Use MATLAB APIs

Command Window

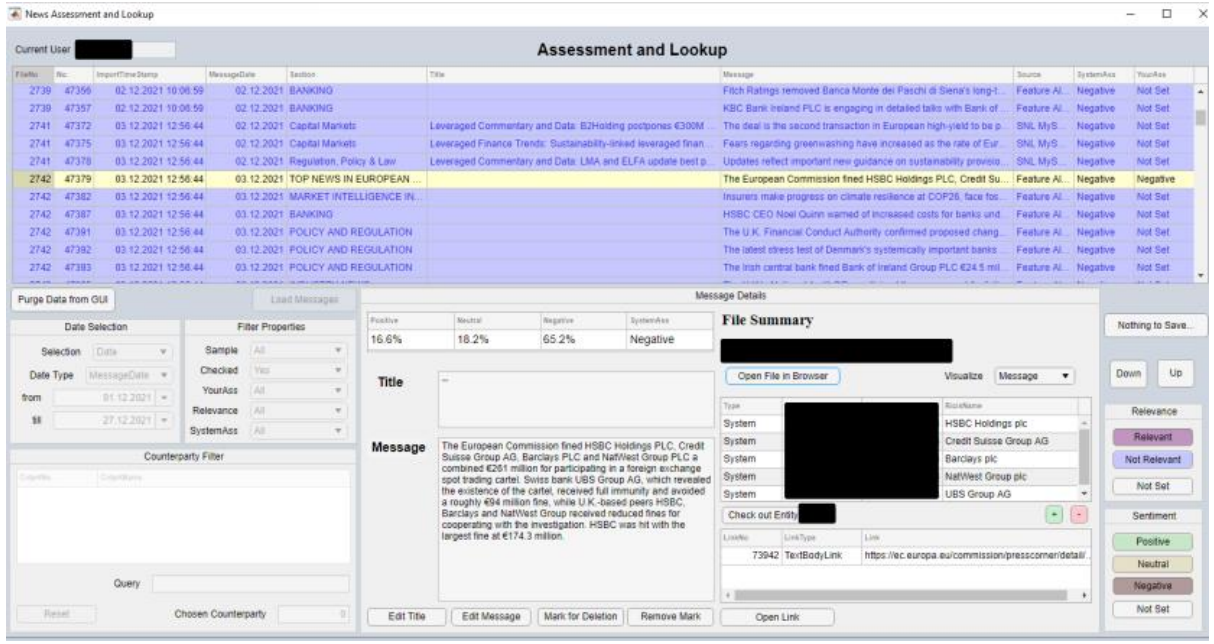
```
>> url =
"https://www.mathworks.com/company/events/conferences/
mathworks-finance-conference/2024.html";
>> text = webread(url);
>> text = extractHTMLText(text);
>> extractBefore(text,"Register")

ans =

    'October 16-17 | Online
```

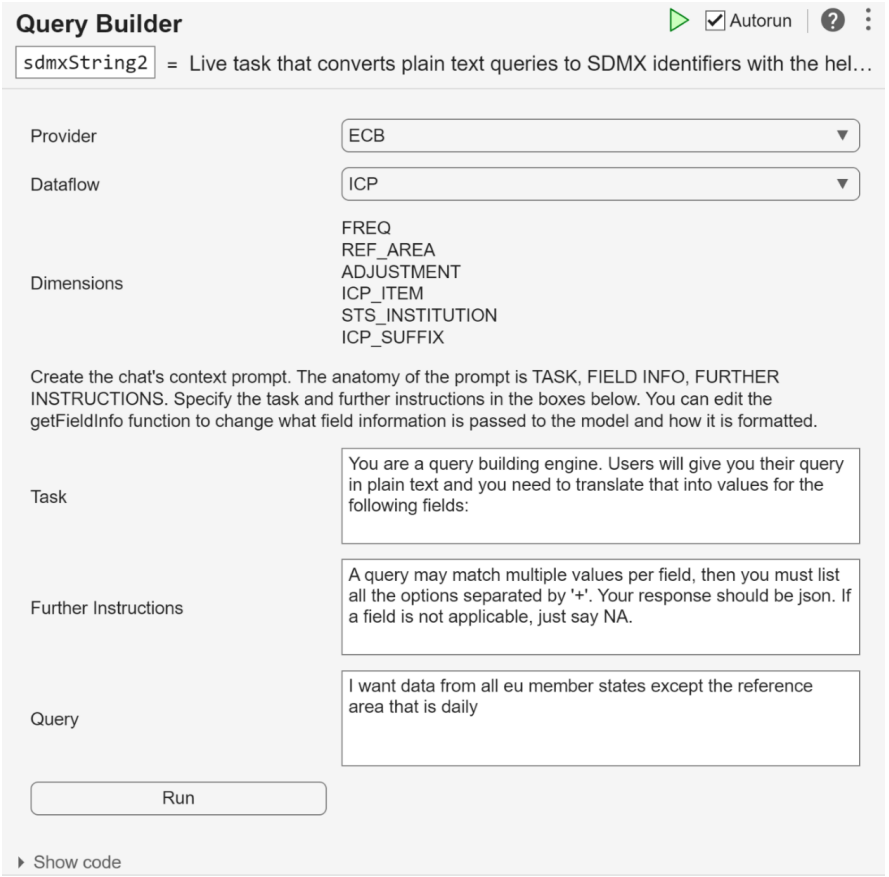
Example projects using text data

Webscraping of news and financial sentiment analysis



Presented by Deutsche Bundesbank
Source: https://www.bis.org/ifc/publ/ifcb59_22.pdf

MathWorks PoC: generating identifiers for data accessible through SDMX using textual queries and a large language model



Creating synthetic data: *synthesizeTabularData*

synthesizeTabularData

R2024b

Synthesize tabular data

Since R2024b

collapse all in page

Syntax

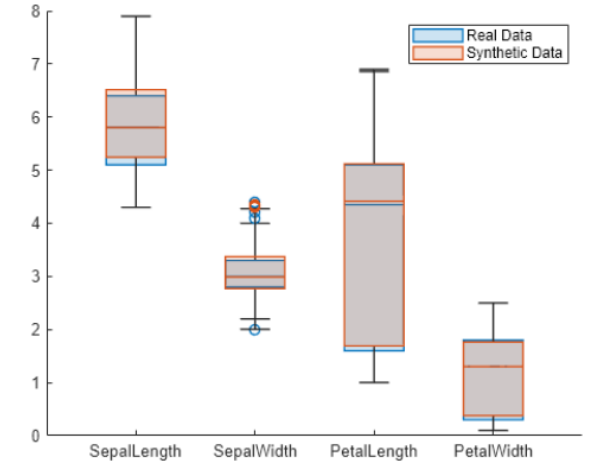
```
syntheticX = synthesizeTabularData(X,n)
syntheticX = synthesizeTabularData(X,n,Name=Value)
```

Description

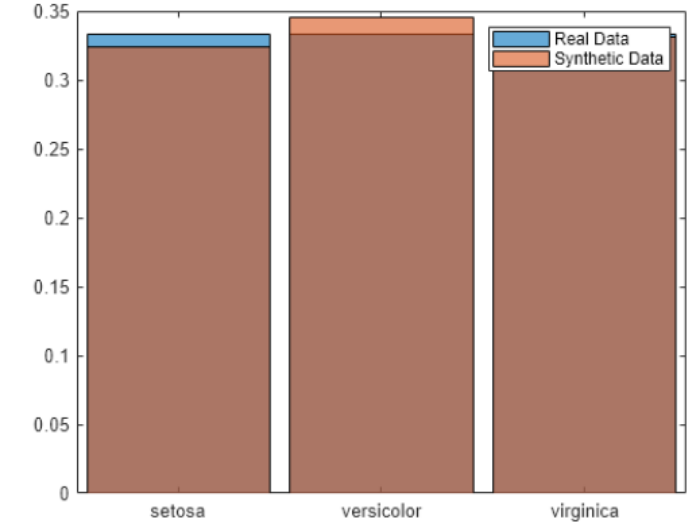
`syntheticX = synthesizeTabularData(X,n)` generates `n` observations of synthetic data using the existing data `X`. The function returns the synthetic data `syntheticX`. example

`syntheticX = synthesizeTabularData(X,n,Name=Value)` specifies additional options using one or more name-value arguments. For example, you can specify the bin method, the variables to use, and the options for computing in parallel. example

Works with numeric data…



… and with categorical data

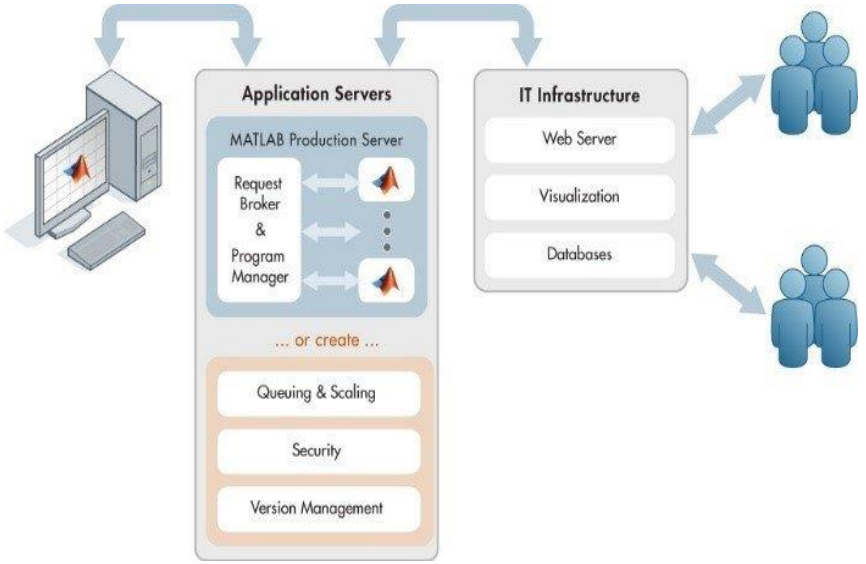


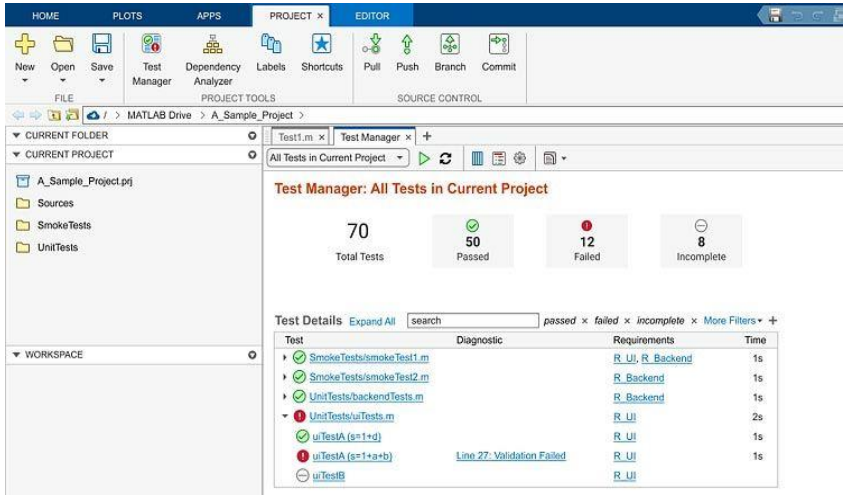
Corporate Requirements

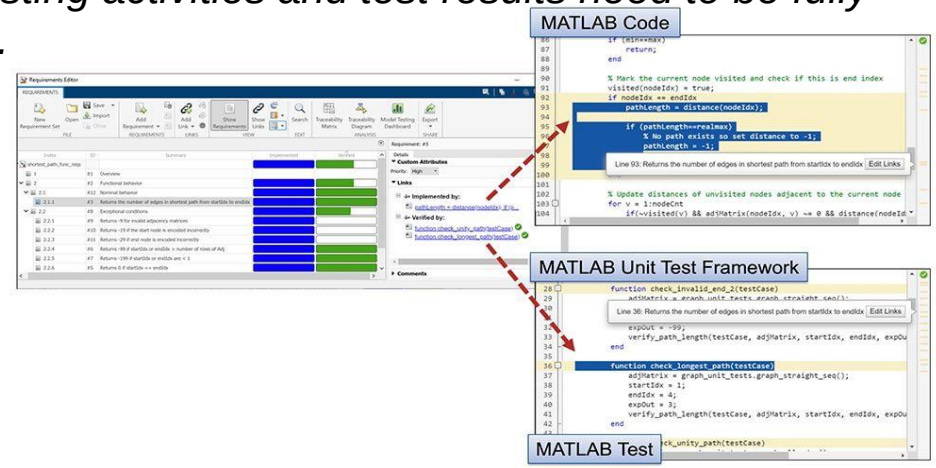
- Diversity of tools
- IT Compliance
- Deployment / Sharing with colleagues

Important aspects of IT Governance

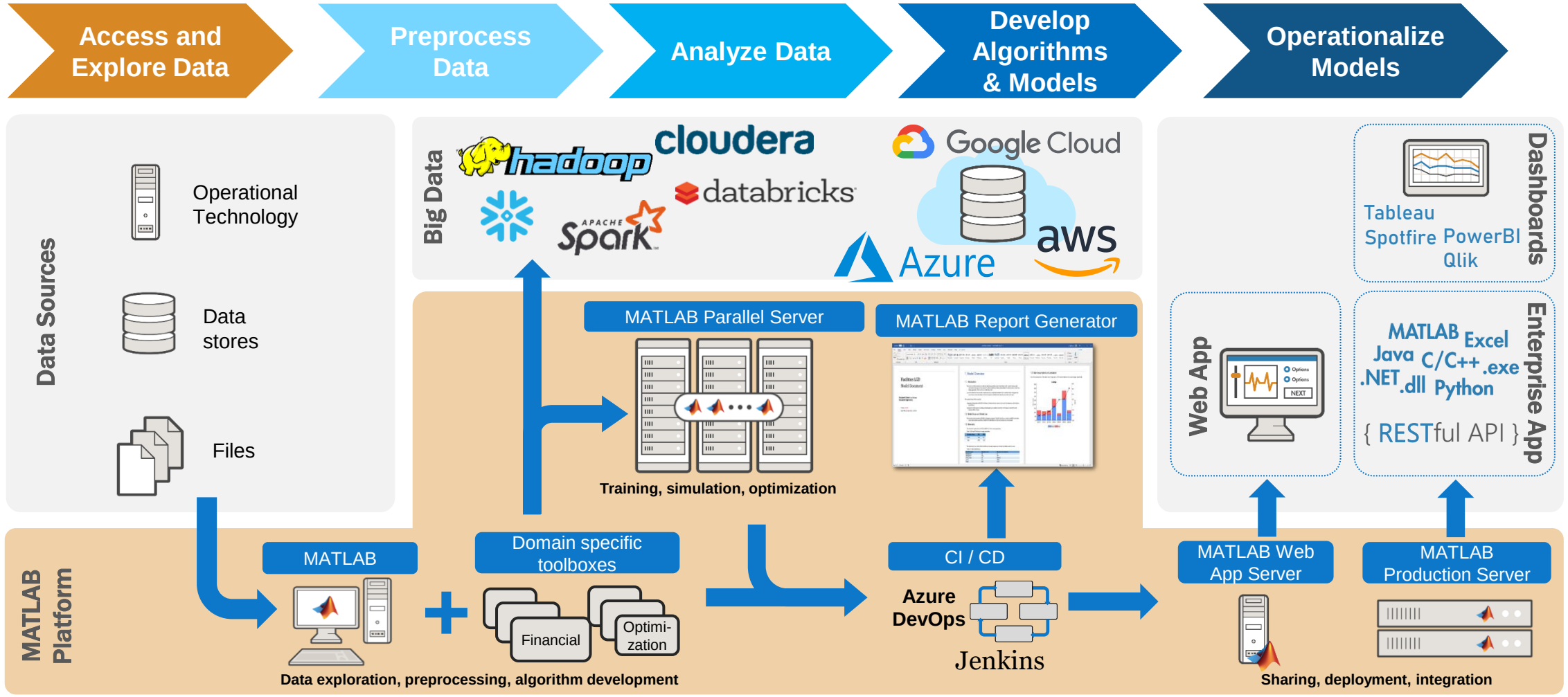
- **Environment Segregation**: *A strict separation between development, testing and production environment must be ensured.*
- **Application Encryption and Security:** *The programs deployed into production shall be encrypted and not subject to modifications outside the defined IT process.*
- **User Access Control:** *User access rights shall be granted consistently with established roles and policies to enable function separation to avoid conflict of interests.*
- **Testing:** *IT Systems must be fully tested before their deployment into production systems.*
- **Tests Documentation:** *All testing activities and test results need to be fully documented and reported on.*







Integration in complex IT environments



Sharing Applications through Apps – Real World Examples

Both examples are taken from presentations at the MathWorks Finance Conference 2023.

Corporate Requirements

- Performance
- Productivity
- Transparency
- Useability

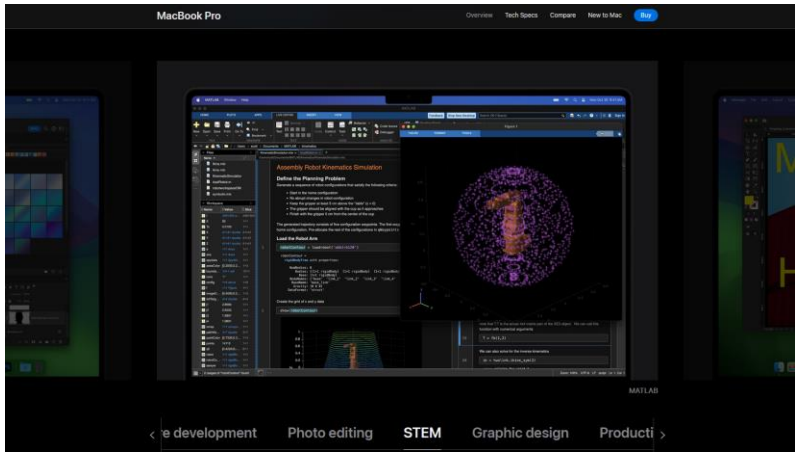
Native support for Apple Silicon

- Run MATLAB natively on M series chips
  - Faster startup time
  - Faster linear algebra
  - Reduced battery usage
  - Reduced memory usage

[Apple Release Event](#) – Oct 2023

[MacBook Pro promo video](#)

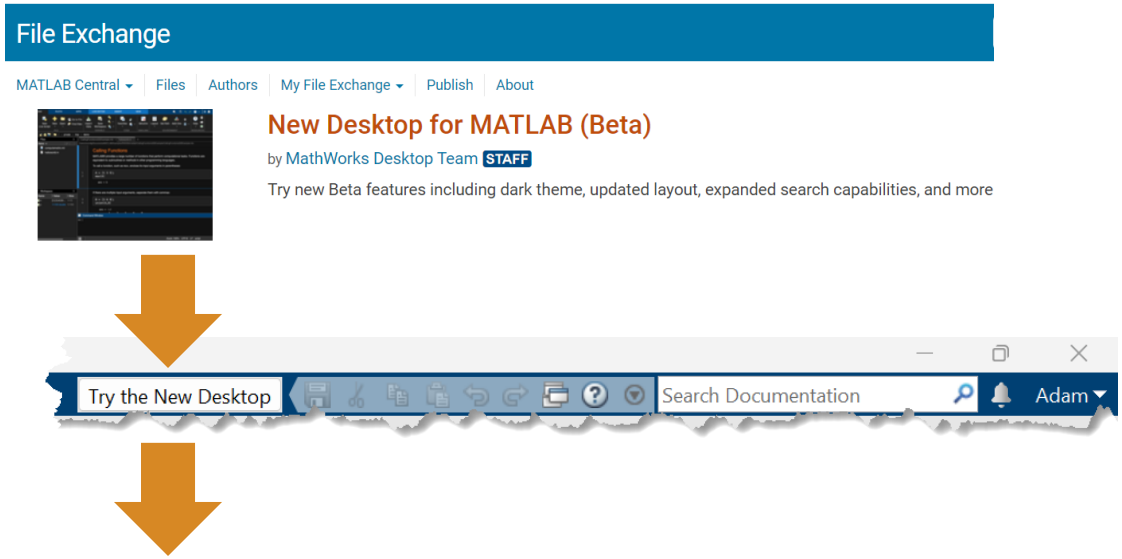
[MacBook Pro home page](#)

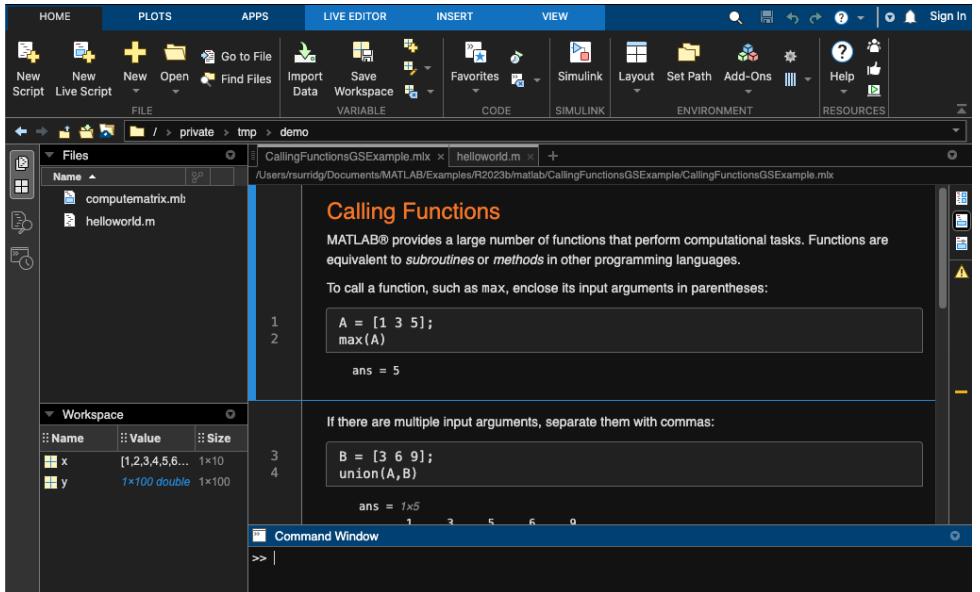


New Desktop for MATLAB is in open beta

R2024b

- Find on File Exchange or Add-Ons menu
- Previews of upcoming features
- Integrated feedback for functionality requests, performance issues, and bugs

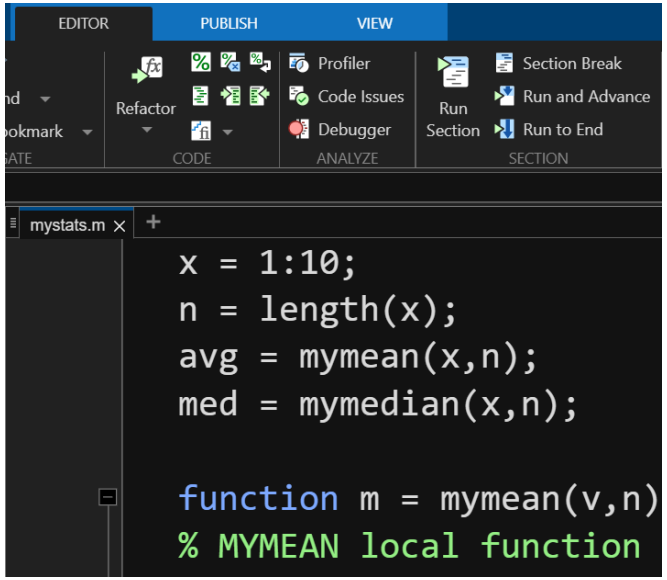




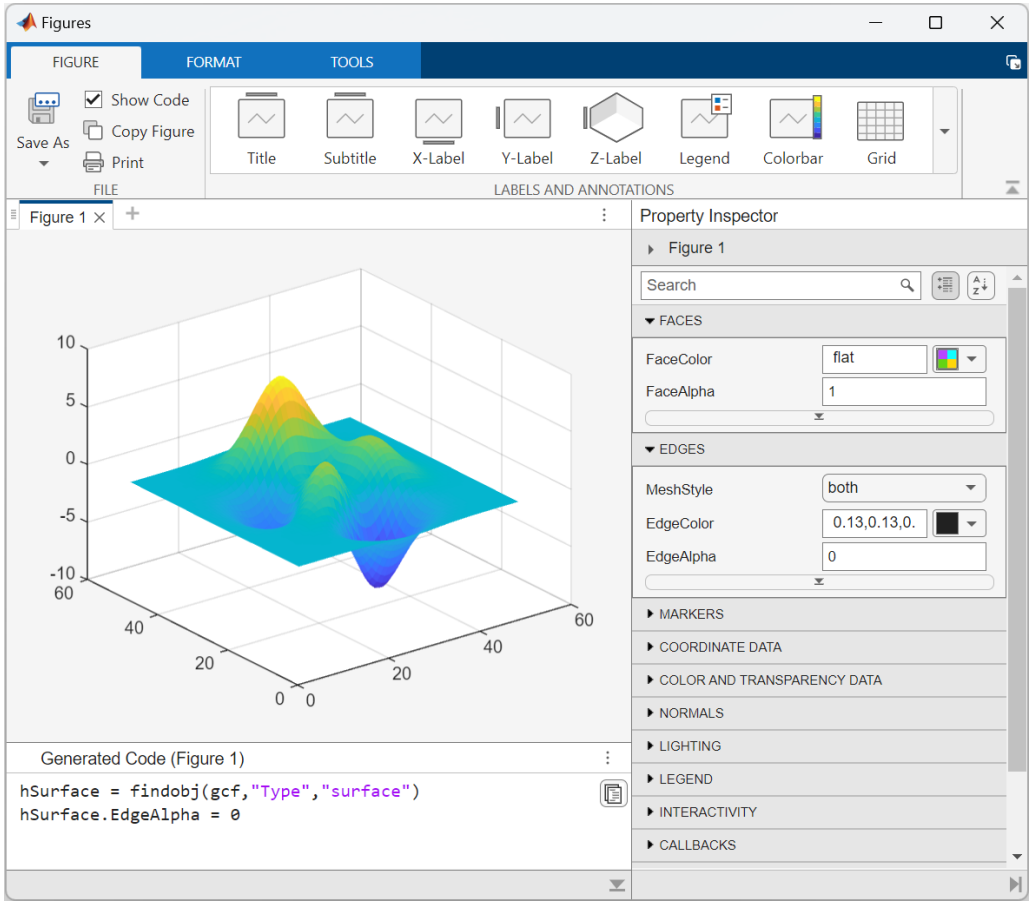
New Desktop unlocks enhanced productivity features

Already available in MATLAB Online

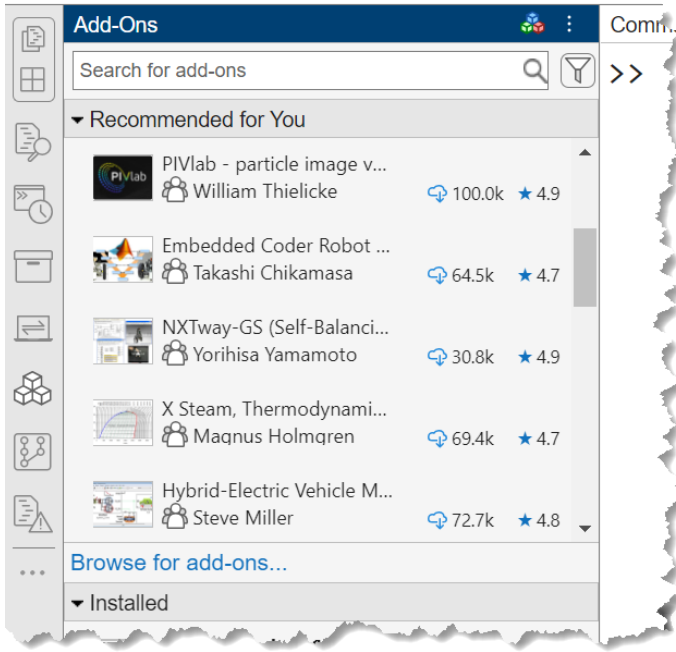
Dark Mode



Enhanced Figure Window



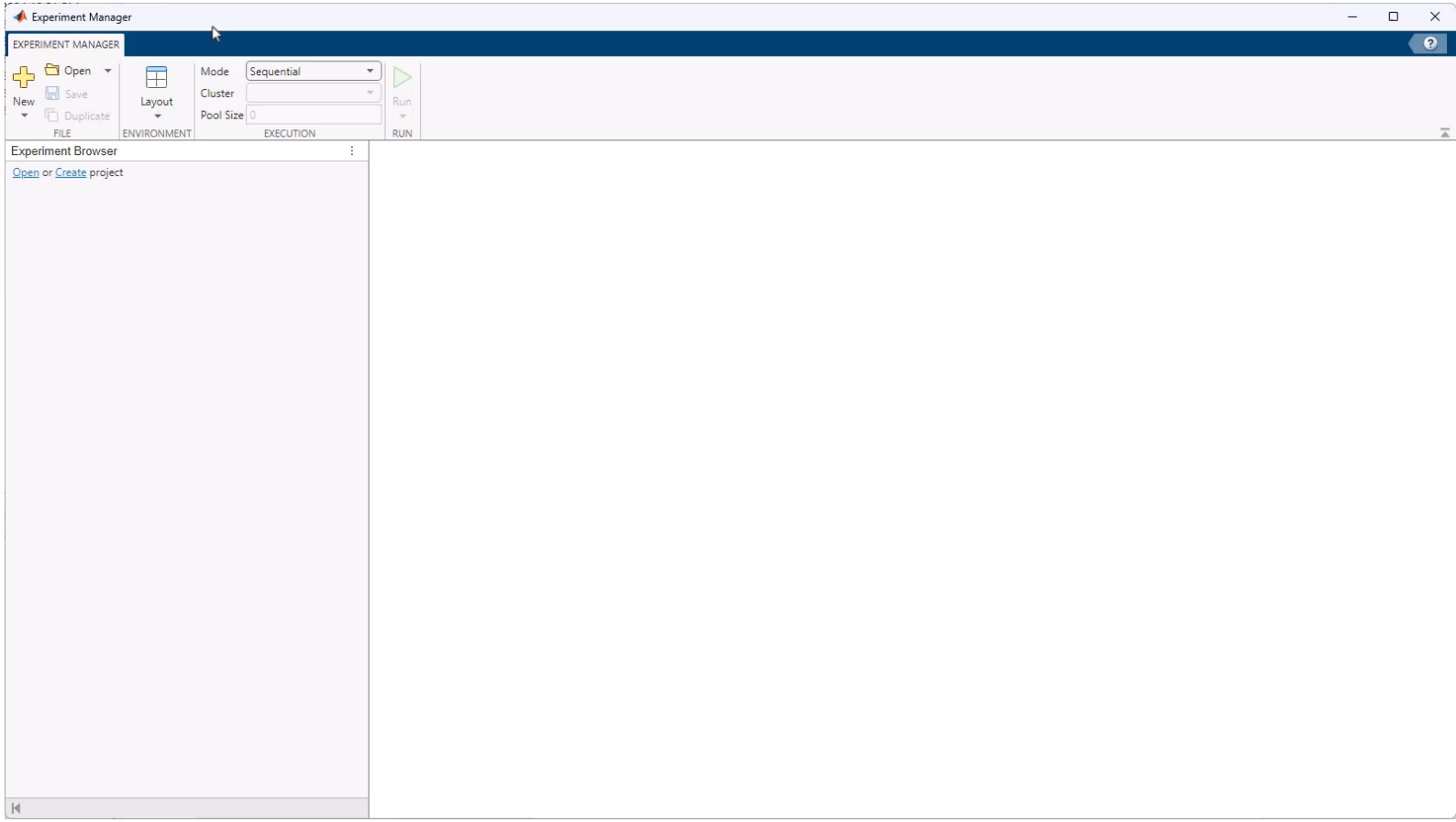
New Side Panels



- Source control
- Debugging
- Add-On management
- Many more…

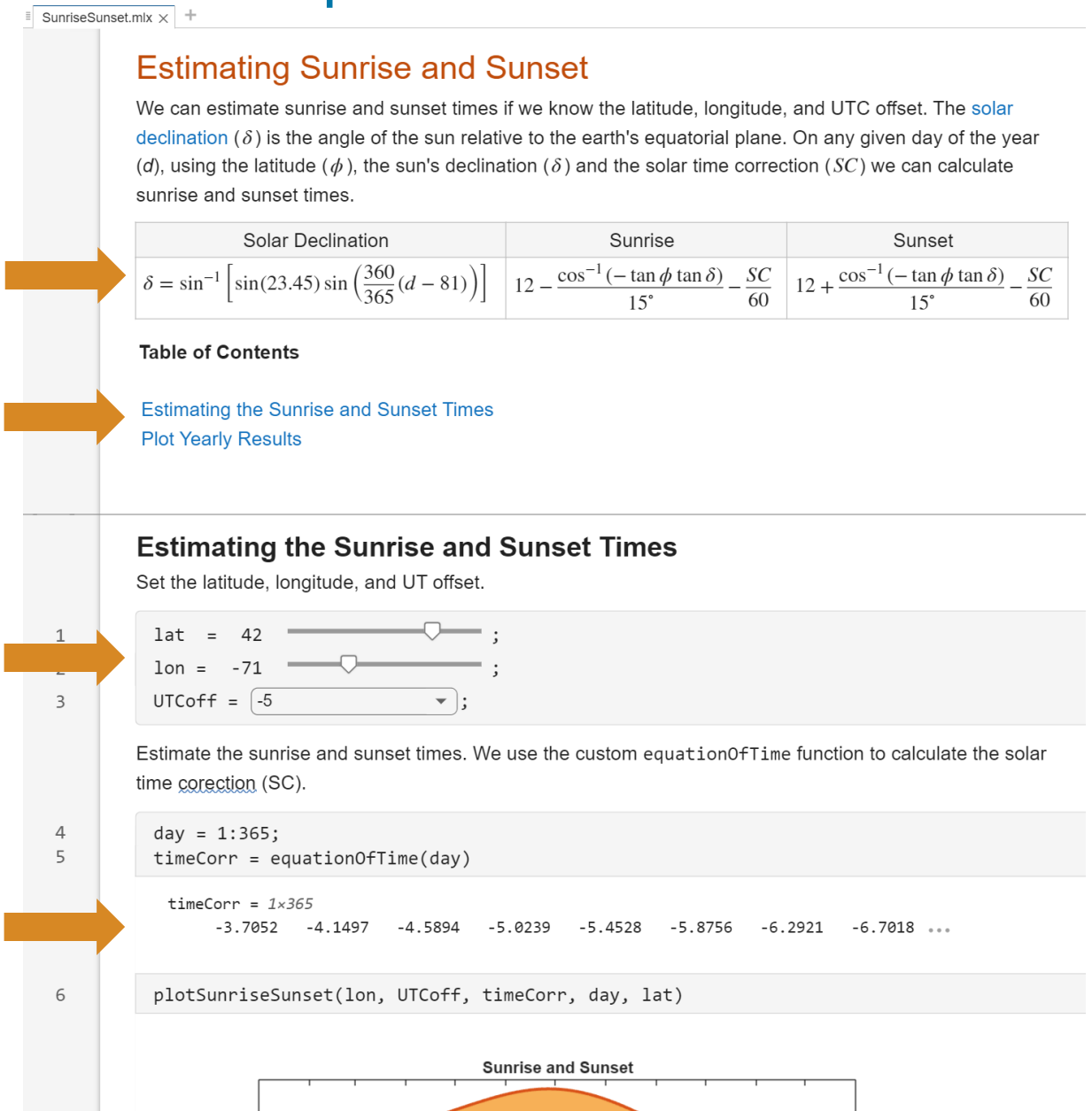
Use Experiment Manager to perform computational experiments

- Create and manage experiments
- Parameter sweeps and hyperparameter tuning
- Parallel and batch processing
- Pre-built experiments for machine learning and AI

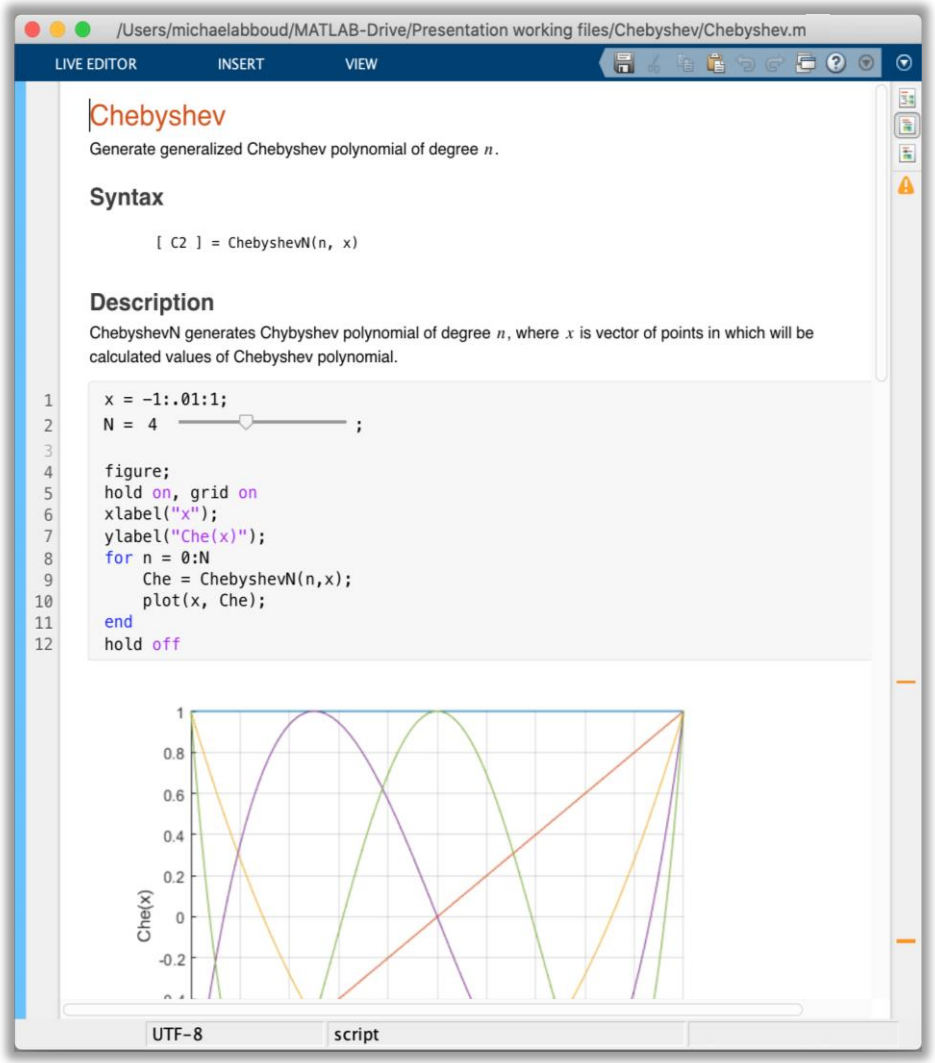


Create interactive, human readable scripts in the Live Editor

- Make scripts readable
  - Richly formatted text
  - Interleave code & output
- Add interactivity
  - Hyperlinks and table of contents
  - Live Controls to adjust parameters
- Share with non-MATLAB users
  - Export as report (pdf, docx, etc.)
  - Share through GitHub and MATLAB Online



New feature: Save Live Scripts as marked-up text files

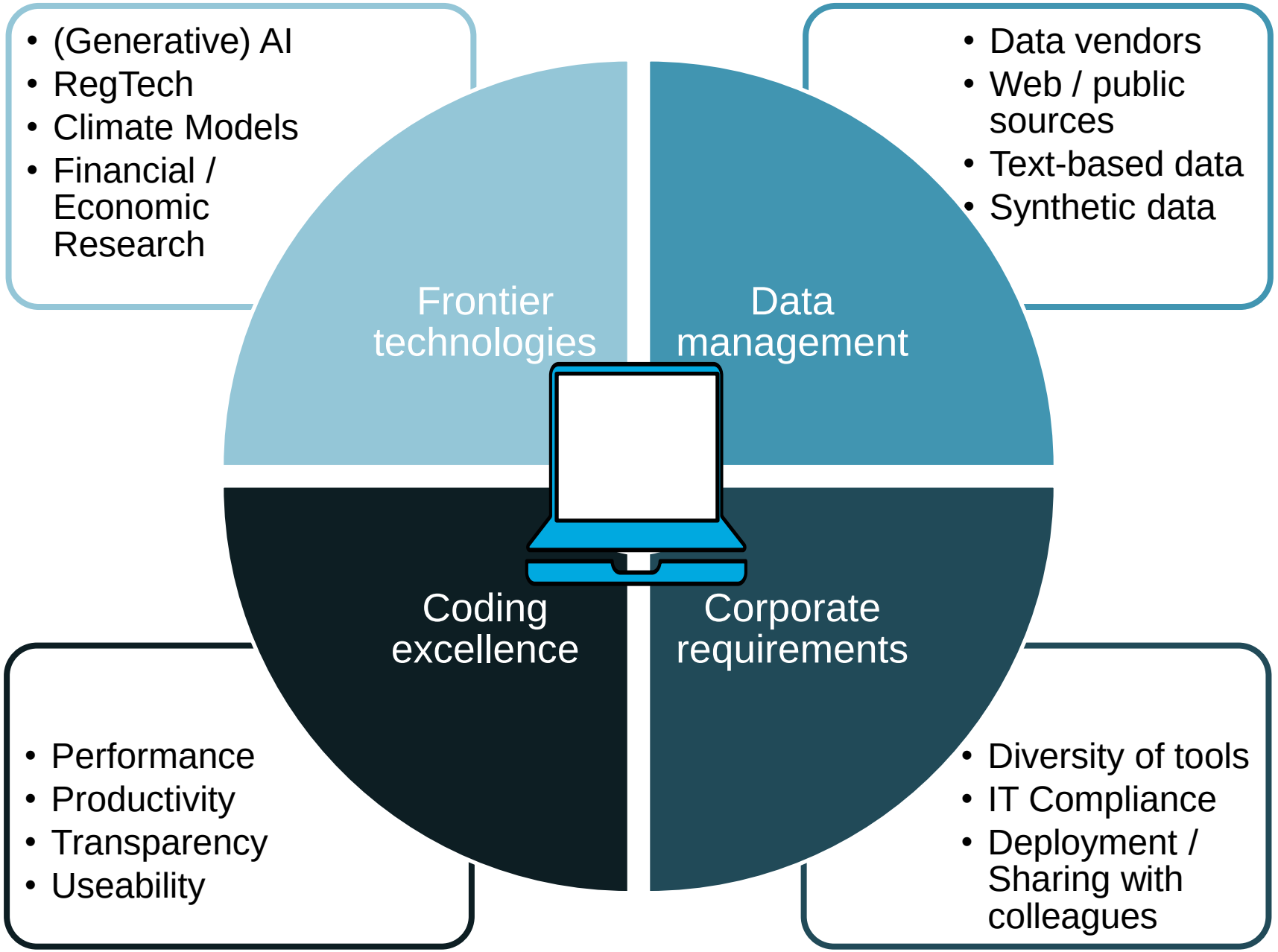


Within MATLAB

View code and diffs in source control!

Edit your code outside of MATLAB!

Outside of MATLAB


• (Generative) AI
• RegTech
• Climate Models
• Financial / Economic Research
• Data vendors
• Web / public sources
• Text-based data
• Synthetic data
Frontier technologies
Data management
Coding excellence
Corporate requirements
• Performance
• Productivity
• Transparency
• Useability
• Diversity of tools
• IT Compliance
• Deployment / Sharing with colleagues

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Thank you

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