

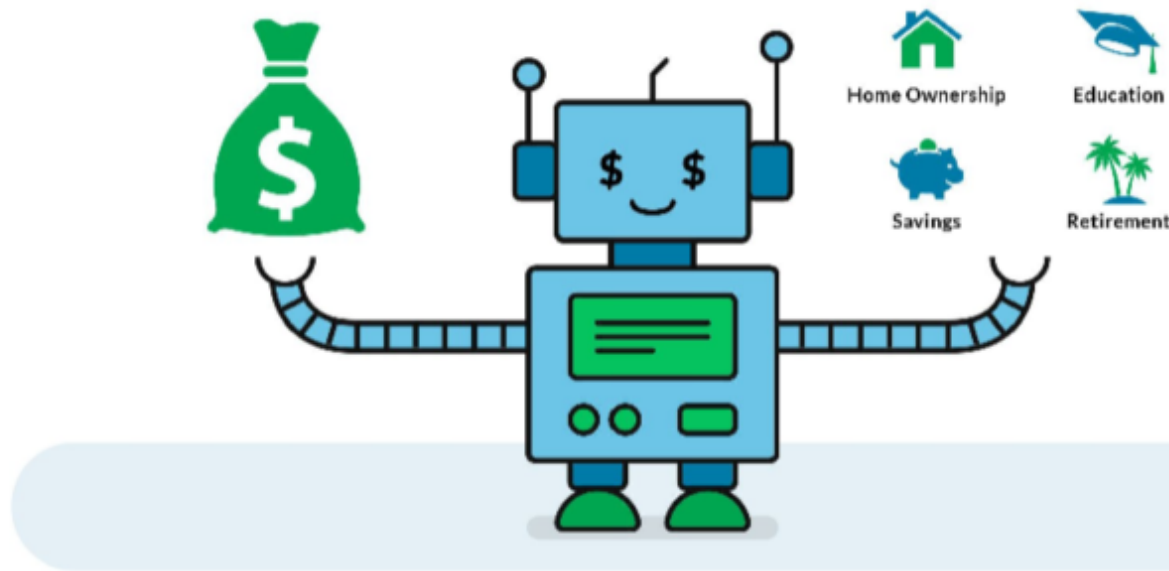
MATLAB EXPO 2019

Building and Sharing Desktop and Web Apps

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Senior Team Lead - Education Technical Evangelist
MathWorks India



Your Friendly Neighborhood Robo Advisor



Our Algorithms.

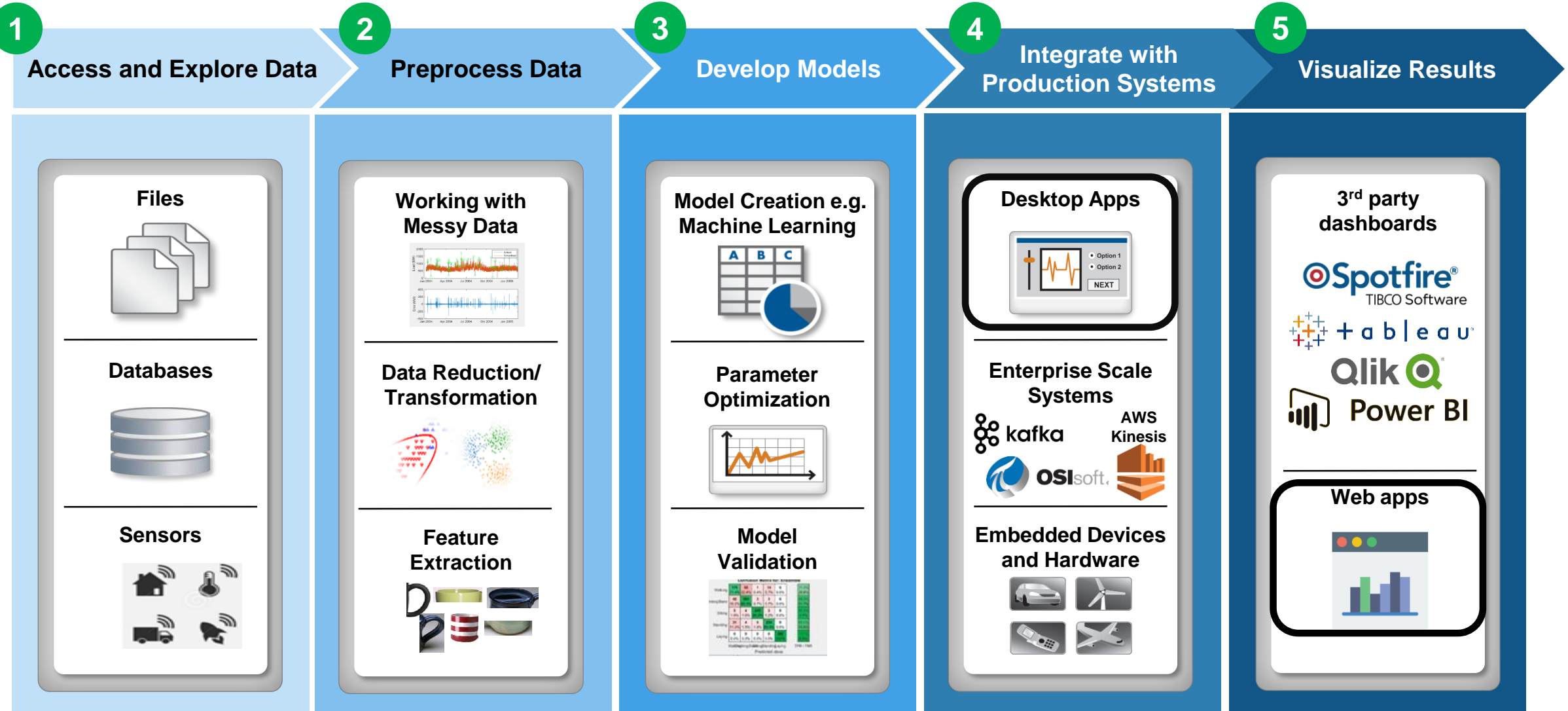
Your Money.

Low Fees.

Get Started Now

Financial Planning and Investing Automated.

Workflow

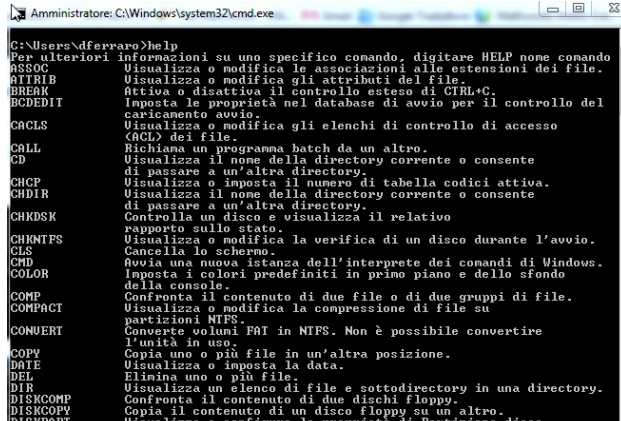


Agenda



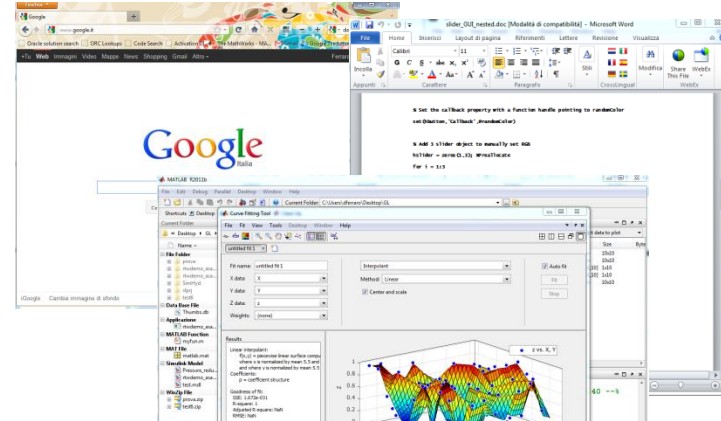
- Motivation
- Building apps using App Designer
- Sharing
 - Standalone Apps
 - Web Apps

Why do we need UIs?



```
Amministratore: C:\Windows\system32\cmd.exe
C:\Users\dferraro>help
Per ulteriori informazioni su uno specifico comando, digitare HELP nome comando
ASSOC Visualizza o modifica le associazioni alle estensioni dei file.
ATTRIB Visualizza o modifica gli attributi del file.
BREAK Attiva o disattiva il controllo esteso di CTRL+C.
BCDEDIT Imposta le proprietà nel database di avvio per il controllo del
caricamento avvio.
CACLS Visualizza o modifica gli elenchi di controllo di accesso
(ACL) dei file.
CALL Richiama un programma batch da un altro.
CD Visualizza il nome della directory corrente o consente
di passare a un'altra directory.
CHCP Visualizza o imposta il numero di tabella codici attiva.
CHDIR Visualizza il nome della directory corrente o consente
di passare a un'altra directory.
CHKDSK Controlla un disco e visualizza il relativo
rapporto sullo stato.
CHKNTFS Visualizza o modifica la verifica di un disco durante l'avvio.
CLS Cancella lo schermo.
CMD Avvia una nuova istanza dell'interprete dei comandi di Windows.
COLOR Imposta i colori predefiniti in primo piano e dello sfondo
della console.
COMP Confronta il contenuto di due file o di due gruppi di file.
COMPACT Visualizza o modifica la compressione di file su
partizioni NTFS.
CONVERT Converte volumi FAT in NTFS. Non è possibile convertire
l'unità in uso.
COPY Copia uno o più file in un'altra posizione.
DATE Visualizza o imposta la data.
DEL Elimina uno o più file.
DIR Visualizza un elenco di file e sottodirectory in una directory.
DISKCOMP Confronta il contenuto di due dischi floppy.
DISKCOPY Copia il contenuto di un disco floppy su un altro.
```

VS



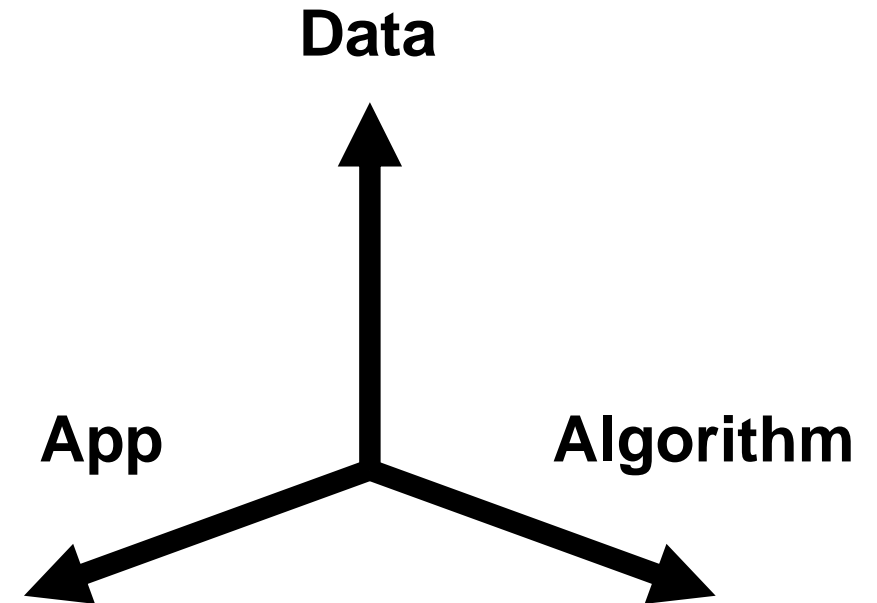
Write commands in
a text based environment

Work in an “user-friendly”
application

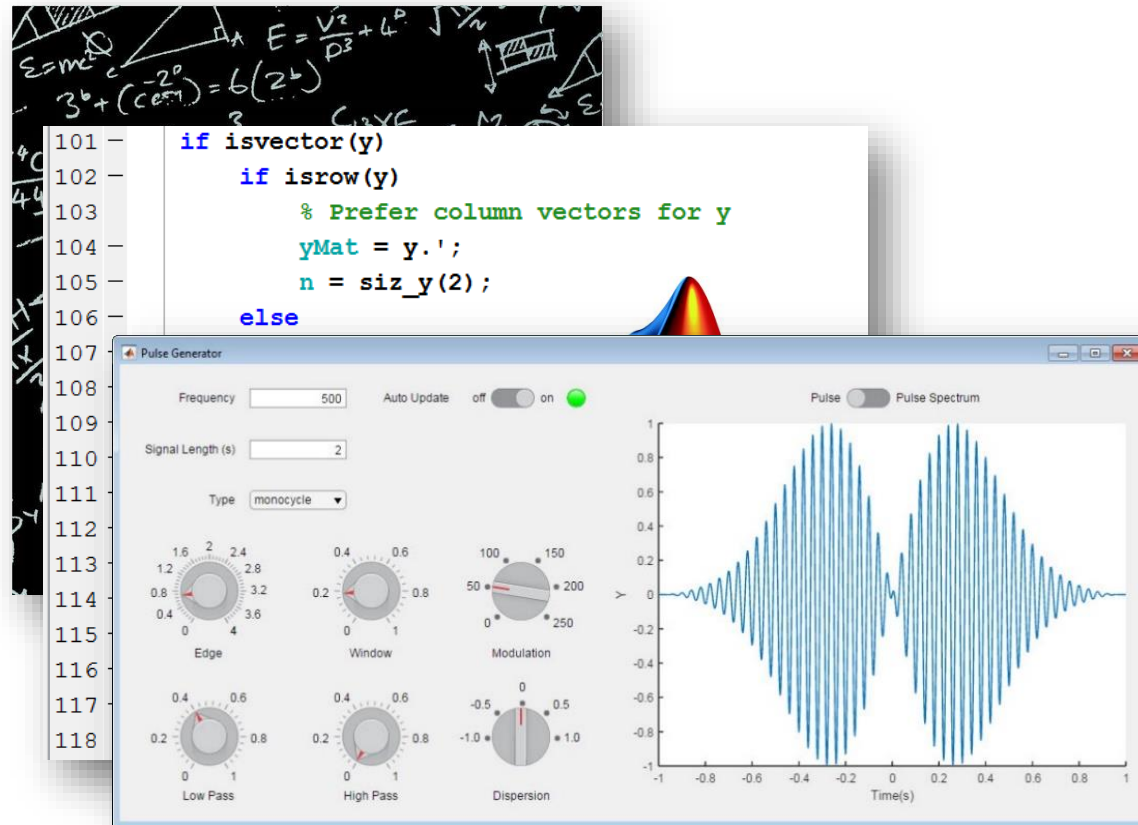
Easier User Interaction
Increased Usability

Simple, modular app architecture

- **Data**
 - Effectively and understandably organize your data
 - Robust to changes
 - Enable your algorithms
- **Algorithm**
 - Well documented
 - Modularized components for reuse
 - Allow for easily traceable data modifications
- **App**
 - Should **DRIVE** your algorithms, not **BE** your algorithms



Layers of an application



Your Challenge



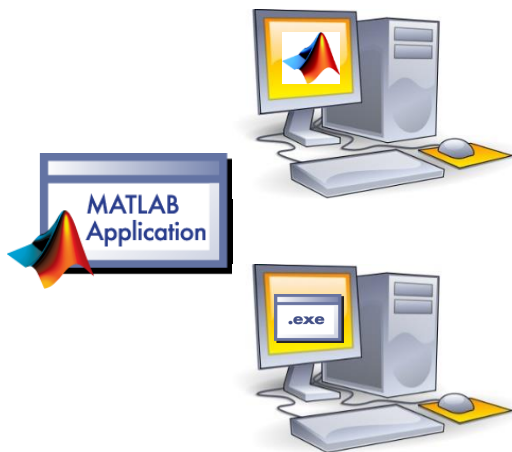
MATLAB Algorithm



UI

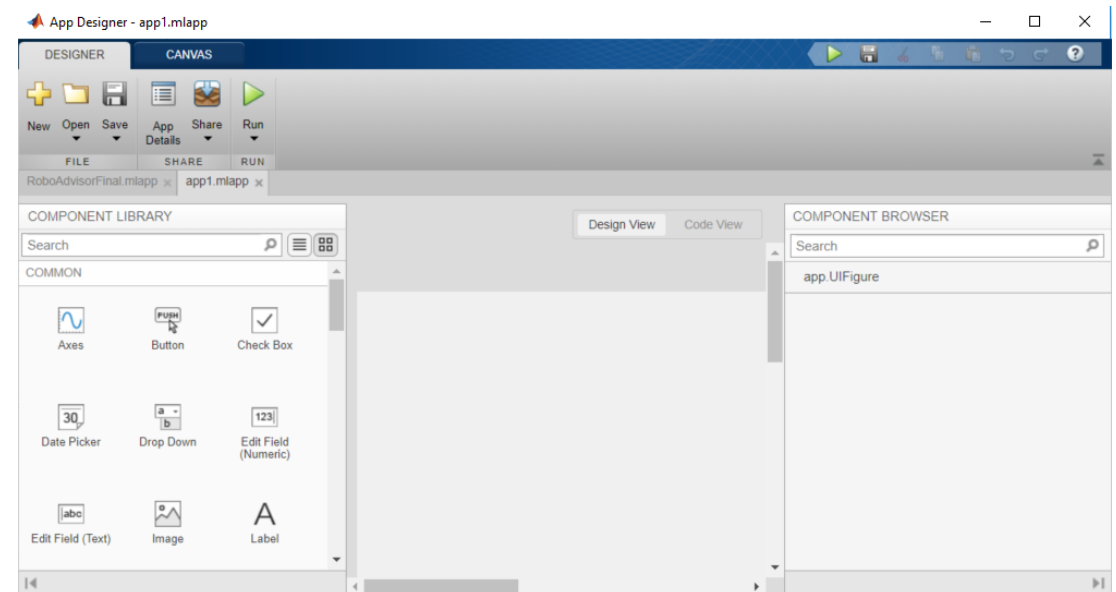
Three good reasons to develop MATLAB Apps

- 1) Make your application **Usable** and **Accessible** in and outside your company via desktop and web
- 2) Write your code and your apps in a **Single Environment** (you do not need to know any additional language).
- 3) Using App Designer, you can easily develop your UI in a **Graphic Interactive Environment**



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```
1 function myGUI
2 % Let's start by creating a new figure
3 figure('Name','Color GUI','Renderer','zbuffer');
4
5
6
7 axes('Units','normalized','Position',[0.1 0.1 0.5 0.8],'Color',[0 0 0],...
8      'XTick',[],'YTick',[]);
9
10 % Let's add some UICONTROL - Random Color button
11
12 hbutton = uicontrol('Style','pushbutton','Units','normalized',...
13                   'Position',[0.7 0.1 0.2 0.1],'String','Random Color');
14
15 % Set a CALLBACK
16
17 set(hbutton,'Callback',@randomColor)
```



A2A Develops Comprehensive Risk Management Solution for Energy Markets

Challenge

Manage and mitigate risk across markets in a large utility company

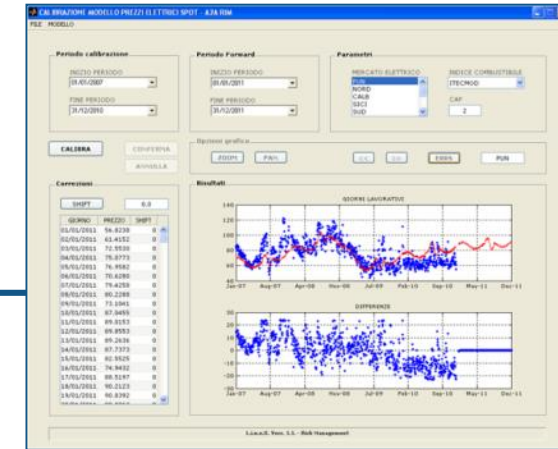
Solution

Use MATLAB and companion toolboxes to process data, develop risk and pricing models, and deploy an interactive dashboard for analysts

Results

- Hour-long calculations completed in 30 seconds
- Development time halved
- Pricing model development accelerated

[Link to user story](#)



A2A's GUI for calibrating and forecasting electricity spot price, a component of the Risk Management Dashboard.

“Using Java™ or another lower-level language we estimate that it would have taken twice as long in our current operation environment.”

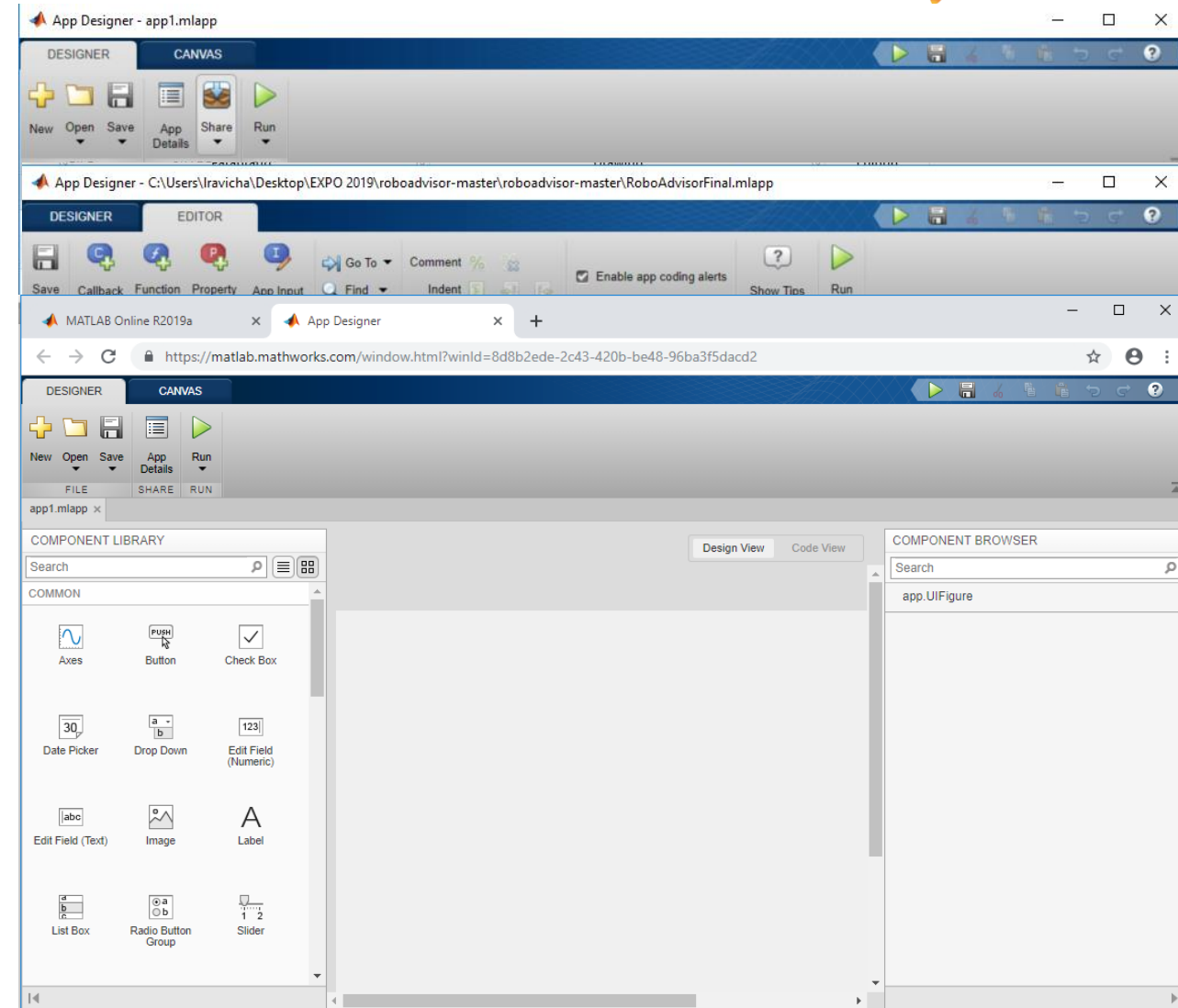
Simone Visonà
A2A

Agenda

- Motivation
- » ▪ Building apps using App Designer
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App Designer

- Intuitive Design environment
- Comprehensive UI component set
- Improved code and coding tools
- Run and author App Designer apps in a web browser
- Package apps using MATLAB Compiler and host them using MATLAB Web App Server
- GUIDE to App Designer migration tool (File Exchange)



Building an app using App Designer - Workflow

Command Window

New to MATLAB? See resources for [Getting Started](#).

 $f_{\mathbf{x}} \gg$

Workspace

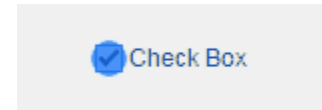
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App Testing Framework

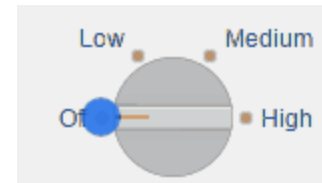
Write automated tests for App Designer apps

- Verify app behavior with tests that programmatically perform gestures on a UI component

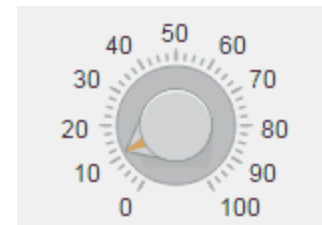
```
testCase.press(myApp.checkbox)
```



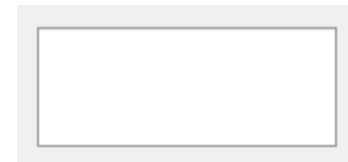
```
testCase.choose(myApp.discreteKnob, "Medium")
```




```
testCase.drag(myApp.continuousKnob, 10, 90)
```



```
testCase.type(myApp.editfield, myTextVar)
```



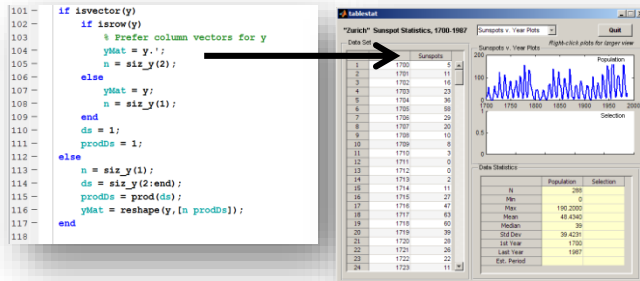
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App is built – What next?

Users of an application

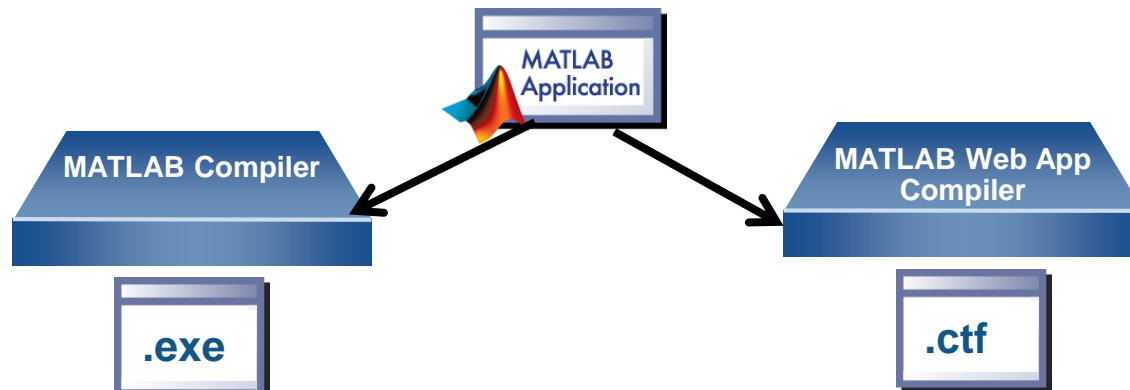
Developers of
the application



Deploy the UI as a
MATLAB App
in MATLAB



Use the UI
without MATLAB



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New Script



New Live Script



New



Open



Find Files



Compare



Import Data



Save Workspace



New Variable



Open Variable



Clear Workspace



Favorites



Analyze Code



Run and Time



Clear Commands



Simulink



Layout



Preferences



Set Path



Parallel



Add-Ons



Help



Community



Request Support



Learn MATLAB

RESOURCES

C:\Users\eshashah\Desktop\Getting Started with App Designer

Command Window

New to MATLAB? See resources for [Getting Started](#).

fx >>

Workspace

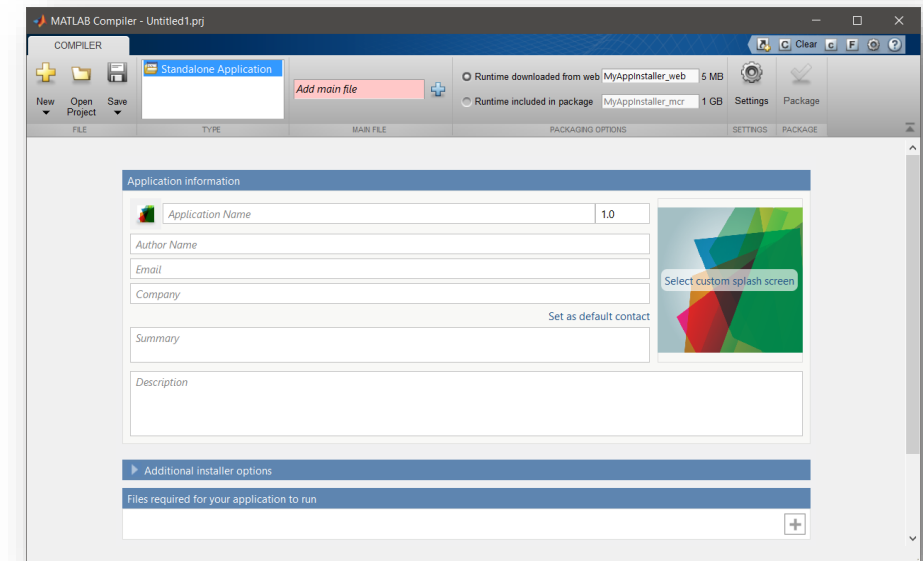
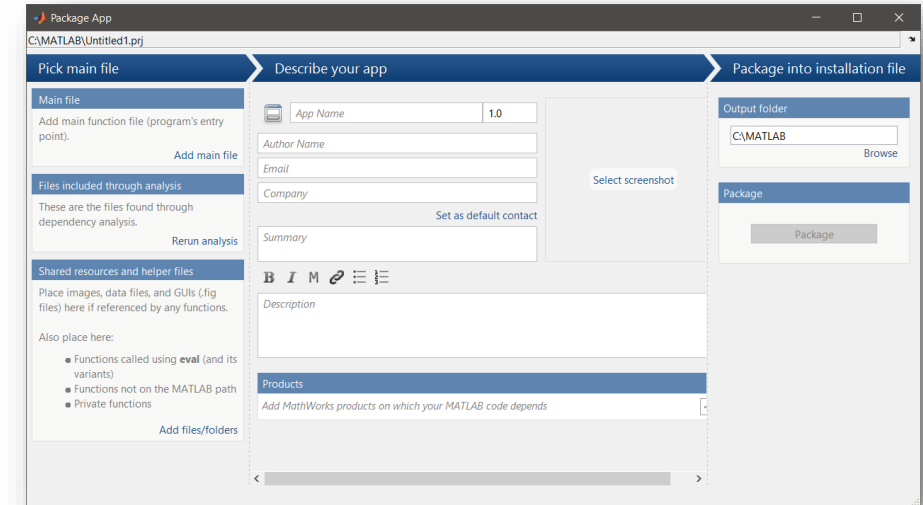
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Command History

Packaging and Deploying Apps

- App Packaging
 - Automatically includes all necessary files
 - Documents required products
 - Creates single installation file for easy distribution and installation into the MATLAB apps gallery

- App Deployment using MATLAB Compiler
 - Standalone executable
 - No MATLAB license required to run deployed app
 - Royalty-free distribution
 - Web App
 - Allow users to run App Designer Apps from a browser

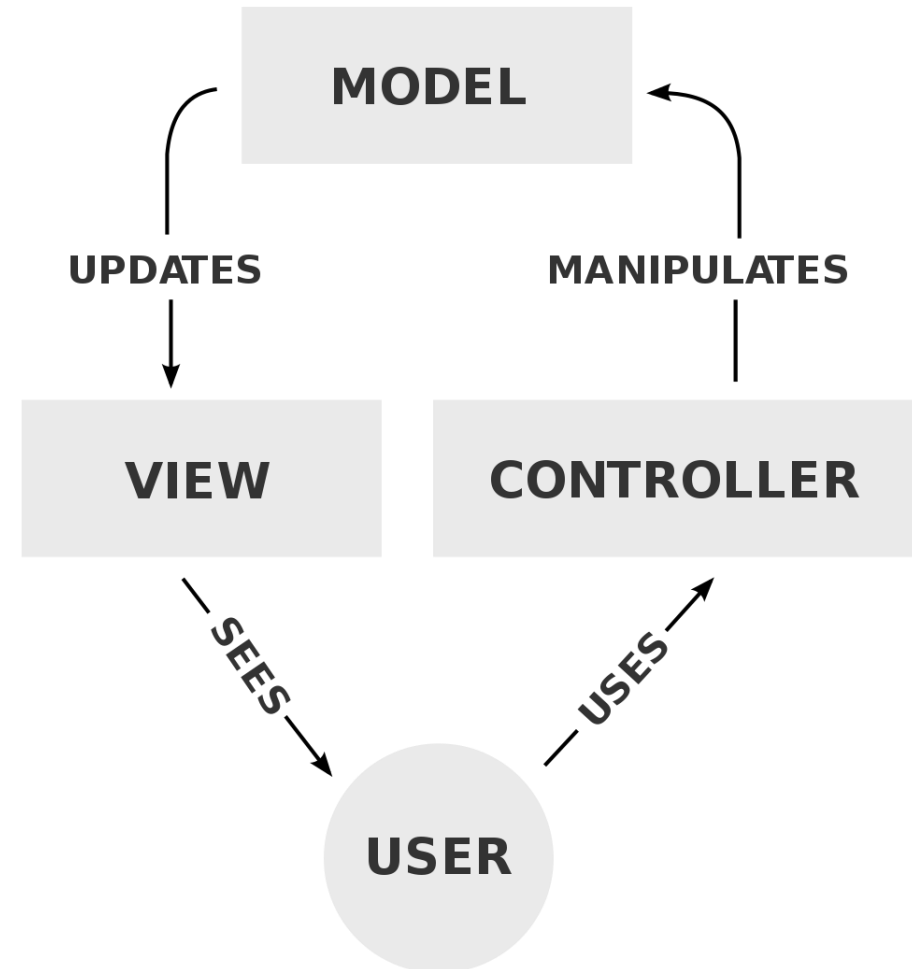


Web App Workflow

- Install MATLAB Web App Server
- Configure MATLAB Web App Server
- Run `webAppCompiler` at the MATLAB command line to get .CTF file
- Navigate to `for_redistribution` folder & copy `webAppArchiveName.ctf` to app folder
- Go to <http://webAppServer:PortNumber/webapps/home/index.html> where `webAppServer` is your web app server URL, and `PortNumber` is the port specified when configuring the server.

Model-View-Controller app architecture

- Model-View-Controller architecture
 - The user interacts with the controller
 - The user sees the view
 - The model translates the controller input to update the view
- This architecture allows you to incrementally adjust, update, or replace components of the app in a safe and maintainable way



Ruukki Metals Improves Steel Manufacturing Processes with Standalone and Web-Based MATLAB Applications

Challenge

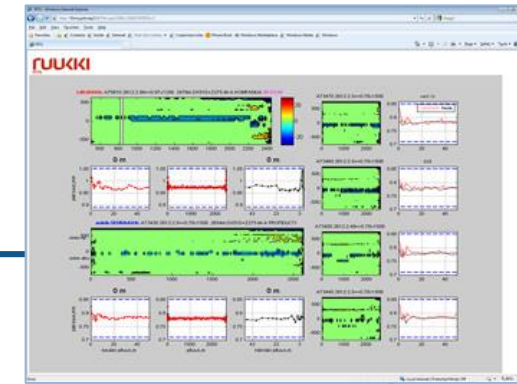
Enable operators to correctly set up steel coil processing lines in the manufacturing plant.

Solution

Build applications in MATLAB that enables operators to select and apply the proper settings, analyze production metrics from multiple databases, track individual coils, and refine the process

Results

- Off-gauge coil length reduced from several meters to less than 50 centimeters
- Process efficiency increased
- Waste reduced



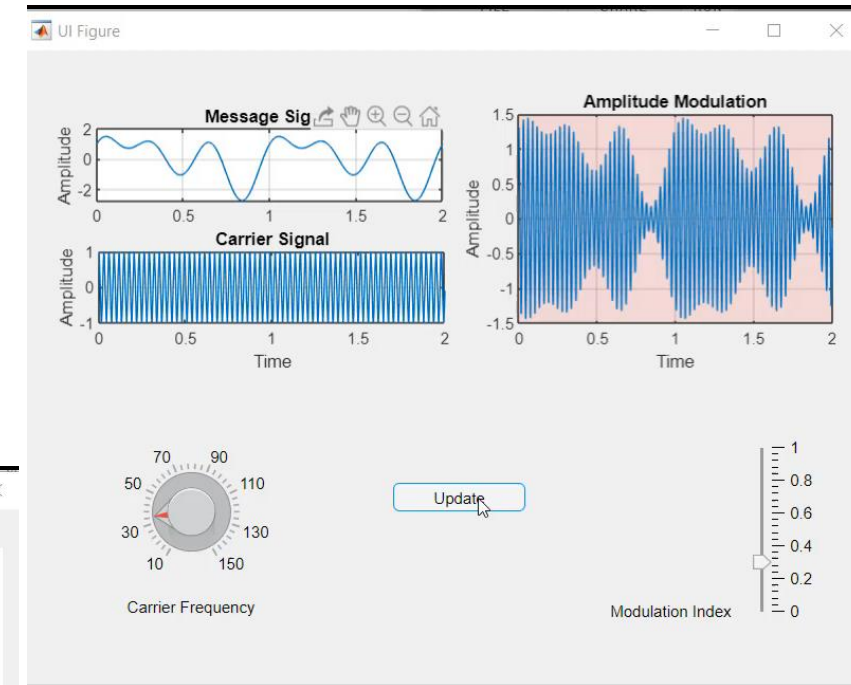
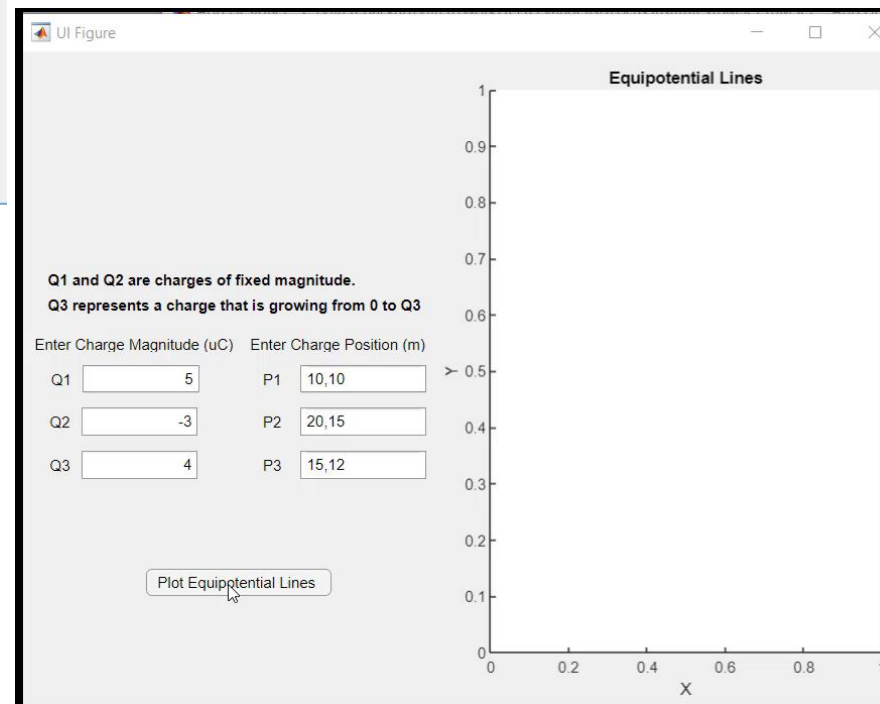
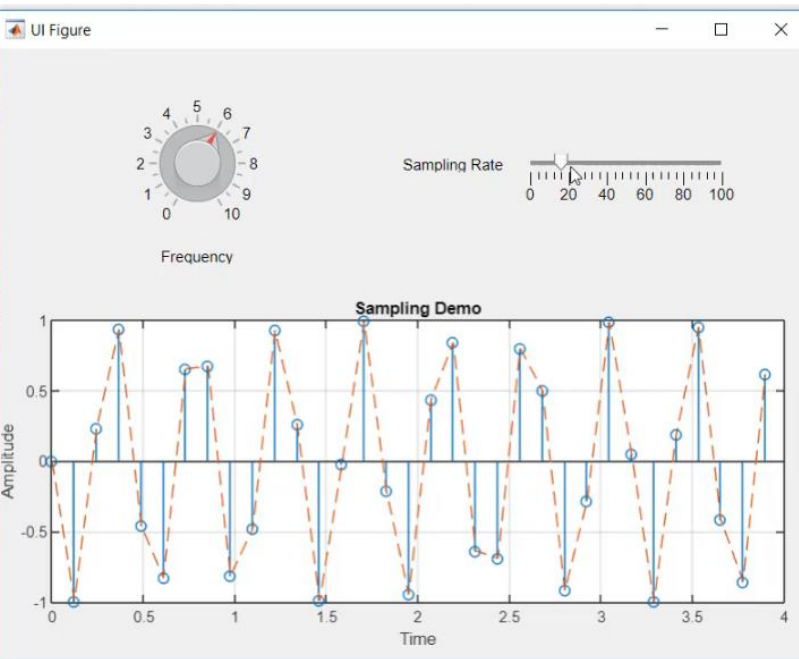
Ruukki's web-based MATLAB application.

“Since deploying this application and the standalone executable that we created with MATLAB and MATLAB Compiler, we have seen fewer misalignments, less scrap, and significant increases in efficiency and consistency at the plant.”

Mika Judin
Ruukki Metals

[Link to article](#)

Use in Academia for Conceptual Understanding



Key Takeaways

- App Designer workflow
- Share apps via MATLAB Compiler and MATLAB Web App Compiler

Call to Action

- App Designer
 - <https://in.mathworks.com/products/matlab/app-designer.html>
 - <https://www.mathworks.com/help/releases/R2019a/matlab/app-designer.html>
- Web Apps
 - <https://www.mathworks.com/help/releases/R2019a/compiler/web-apps.html>
- GUIDE to App Designer Migration Tool
 - <https://in.mathworks.com/matlabcentral/fileexchange/66087-guide-to-app-designer-migration-tool-for-matlab>

Training: Building Interactive Applications in MATLAB

This one-day course demonstrates how to create an interactive user interface for your applications (apps) in MATLAB®. Attendees will learn about user interface controls, such as push buttons, sliders, and menus, and how to use them to create a robust and user-friendly interface for your MATLAB app. Topics include:

- Laying out apps in the App Designer environment
- Creating callback functions for interactive components
- Creating and updating graphical objects in apps
- Making app components responsive to user behavior
- Creating apps with multiple windows



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- <http://bit.ly/expo19-feedback>
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