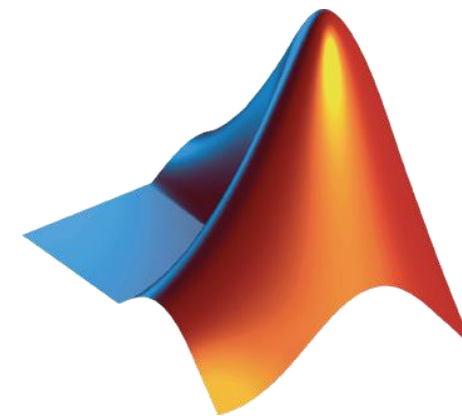
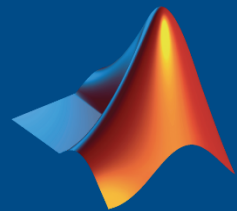


使用 MATLAB 进行低代码数据分析

许悦伊
MathWorks 中国





MathWorks®

Accelerating the pace of engineering and science

The leading developer of mathematical computing software
for engineers and scientists.

我们的软件被用来设计我们赖以生存的产品



Automobiles



Commercial Aircraft



Smartphones



Consumer Goods

这些突破改变了我们的生活、学习和工作方式



太阳能汽车



先进的假肢

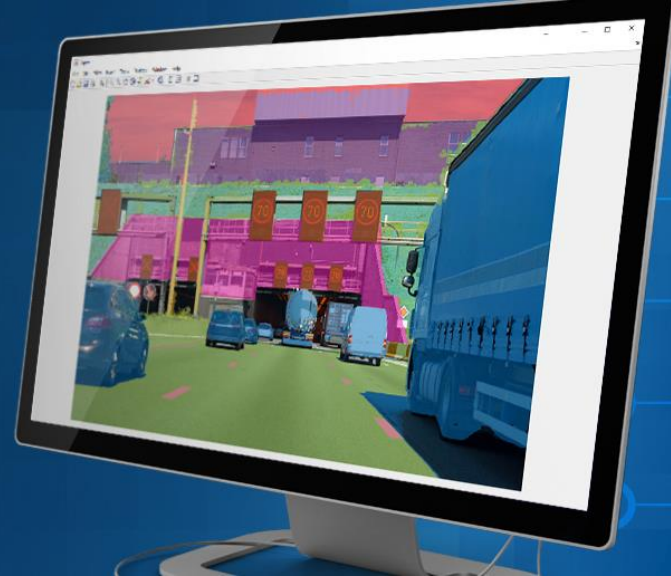


自主机器人



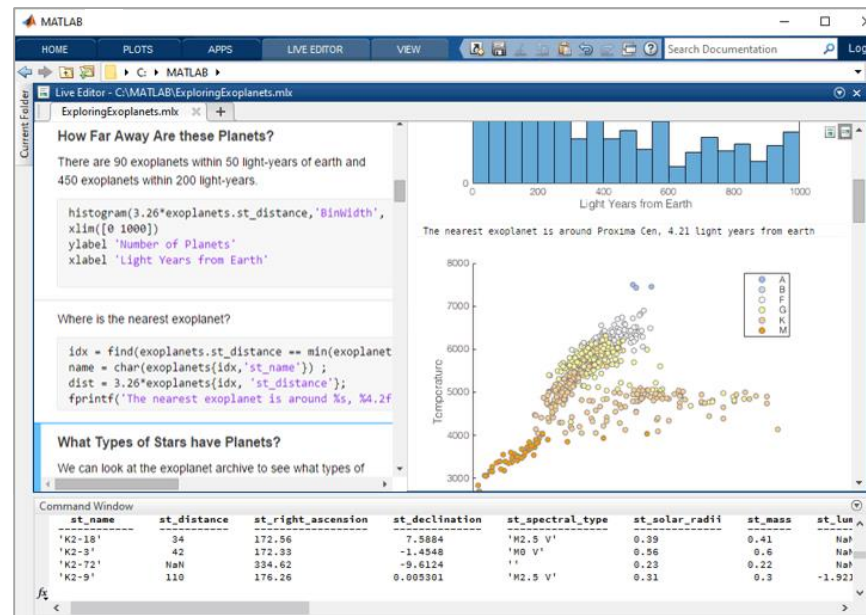
清洁能源

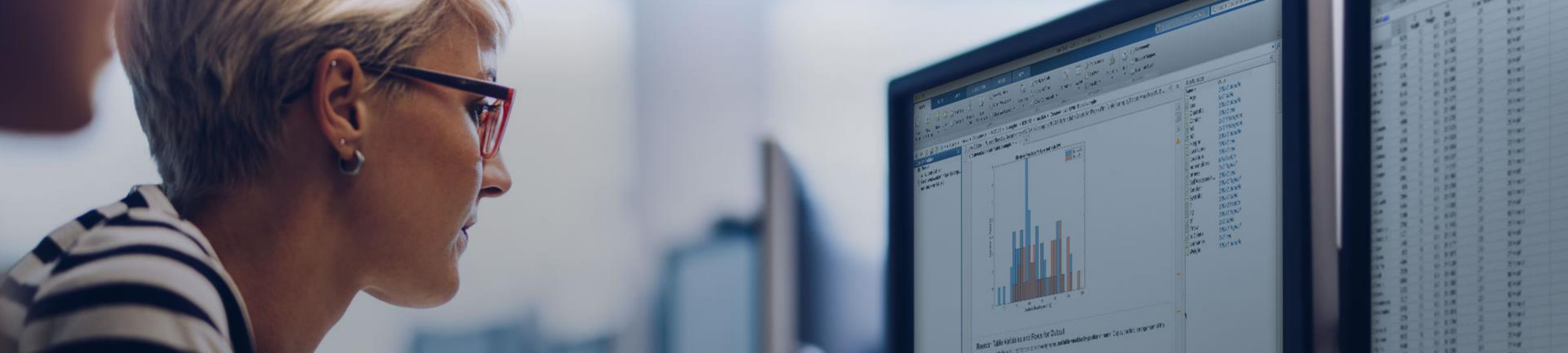
Our Products MATLAB® & SIMULINK®



- MATLAB是一种用于算法开发、数据分析、可视化和数值计算的编程环境。
- Simulink是一个用于系统设计、仿真和测试的图形化环境。
- 为特定领域提供120余种附加产品。

Computer Simulation Toolbox





- 全世界上百万的工程师和科学家都在使用 MATLAB 和 Simulink



五百万+

用户分布于190余个国家



十万+

商业机构、政府机构以及学校



世界前10名的汽车与航天公司

Fortune: 2021 Global 500 auto companies
FlightGlobal: 2020 Top 100 aero companies*

*Excluding companies that are subject to embargos, sanctions, or other controls

我们的客户 / 主要行业



航天国防



汽车



生物科学



生物技术与制药



通信



电子



能源生产



金融服务



工业机械



医疗设备



过程工业



神经科学



轨道交通



半导体



软件与互联网

MATLAB 校园版客户端安装指南

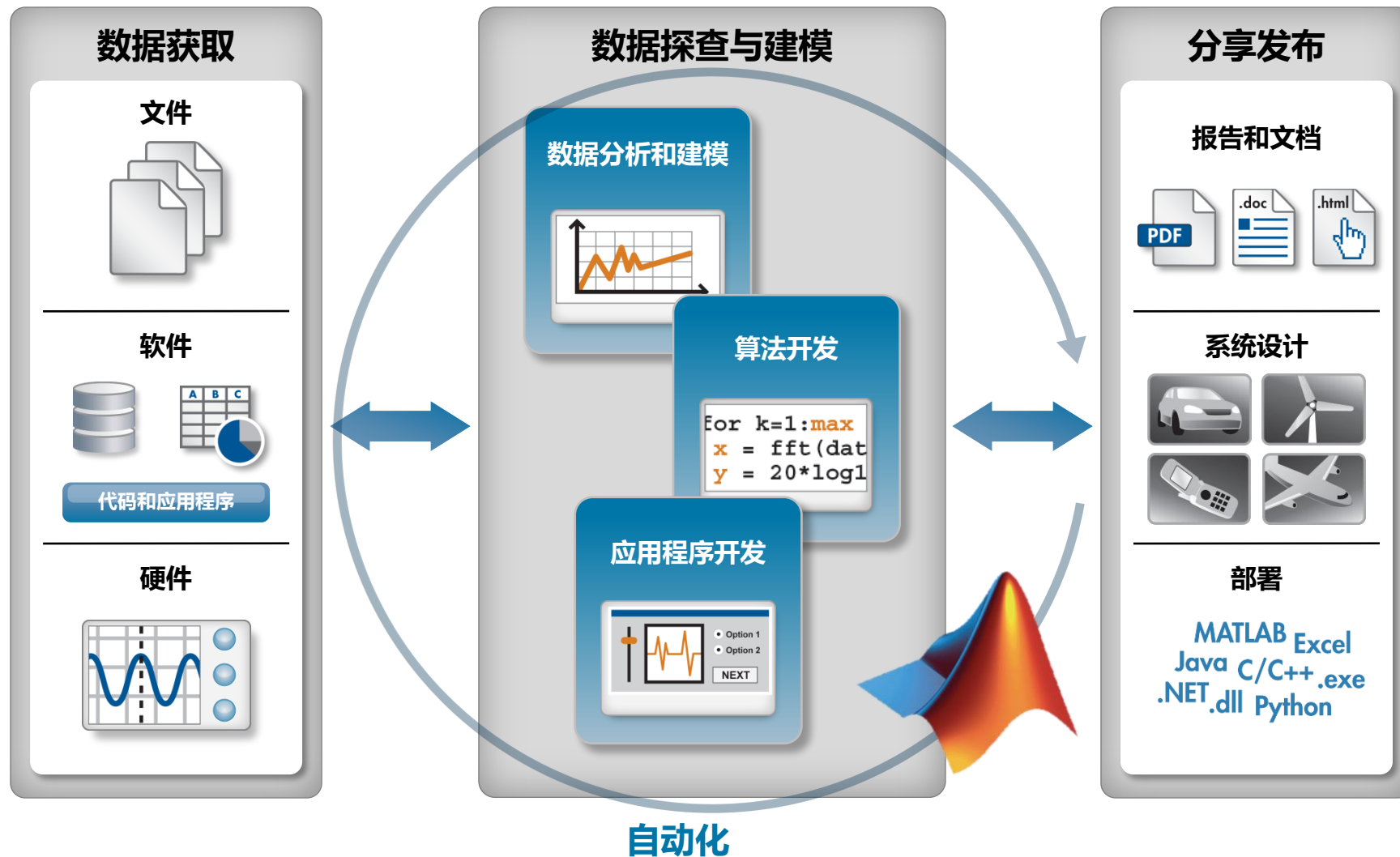


扫描二维码获取南京大学专属
微信页面，获取安装指南及更
多学习资源

今日日程

- 低代码数据分析
- 示例：模拟飞行传感器数据
- 学习资源

基于 MATLAB 的数据科学工作流程



什么是“低代码”工具？

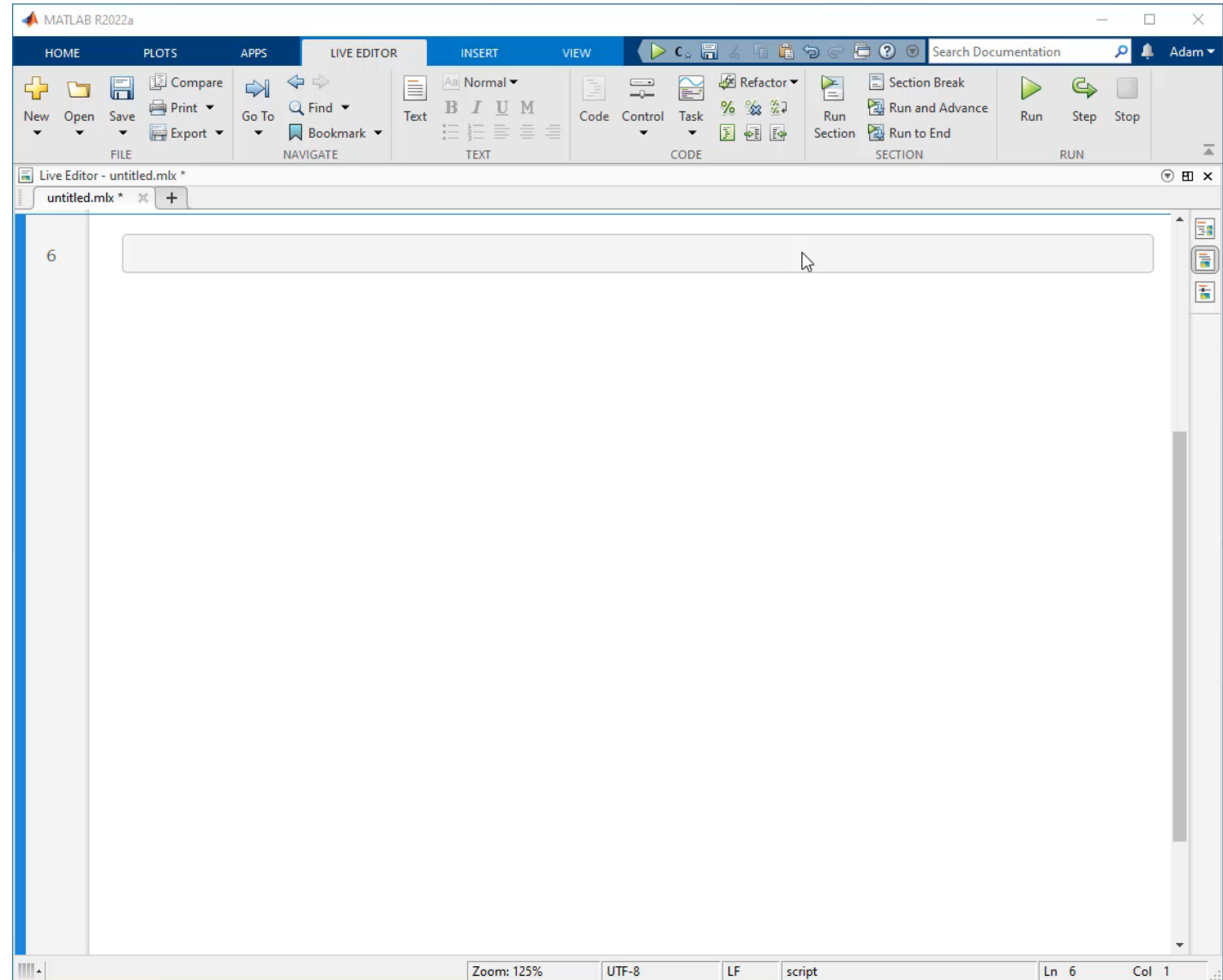
我们可以使用低代码工具进行：

- 快速软件开发
- 尽量避免手写代码

低代码工具的优点：

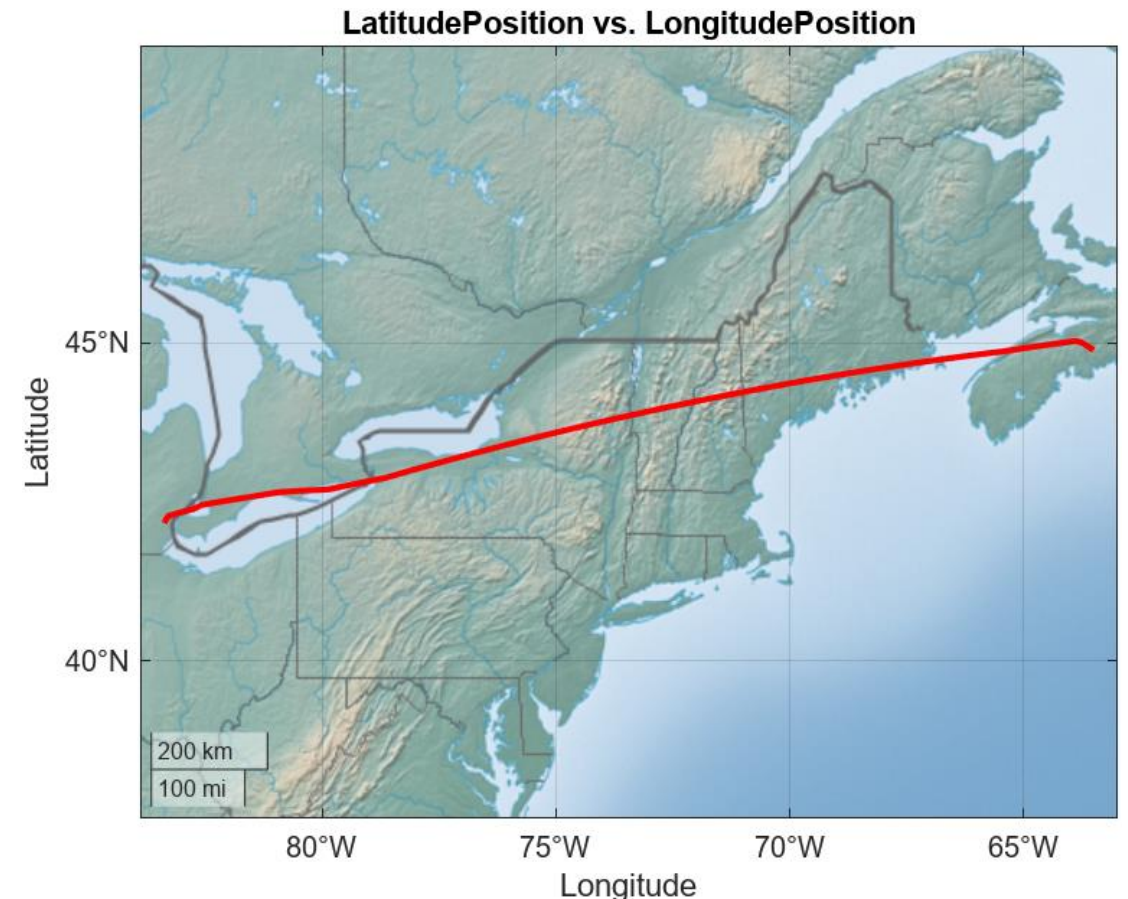
- 易于上手
- 在过程中学习编程
- 先解决任务，再编写代码

不仅仅是为初学者准备



案例分析：飞机传感器数据建模

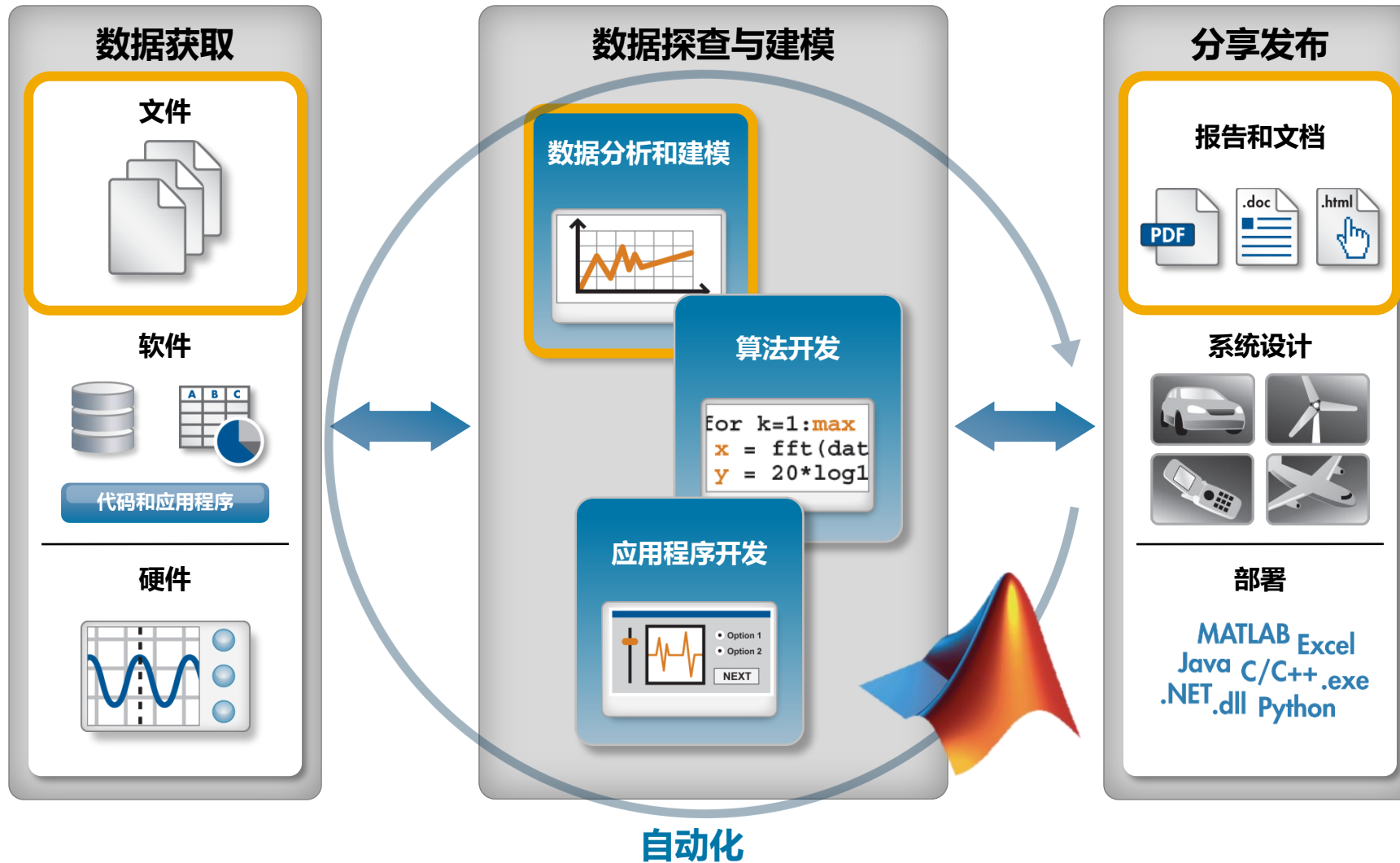
- **目标：**
 - 创建一个虚拟传感器模型，用于非可观测或成本高的状态。
不可观测或者观测成本高的情况
- **输入数据：**
 - 含有1次飞行的13个传感器数据的Excel表格
- **解决途径：**
 - 可视化并且探索数据
 - 清洗传感器异常数据
 - 训练回归模型来预测其他状态
 - 在一个报告中分享结果
- **数据来源：**
 - [NASA Dash Link: Sample Flight Data](#)



基于 MATLAB 的数据科学工作流程

使用的产品:

- MATLAB
- Statistics and Machine Learning Toolbox



使用低代码工具容易地获取文件、数据库、以及硬件数据

获取

导入数据工具

- 文本、CSV 以及 Excel文件

探查与建模

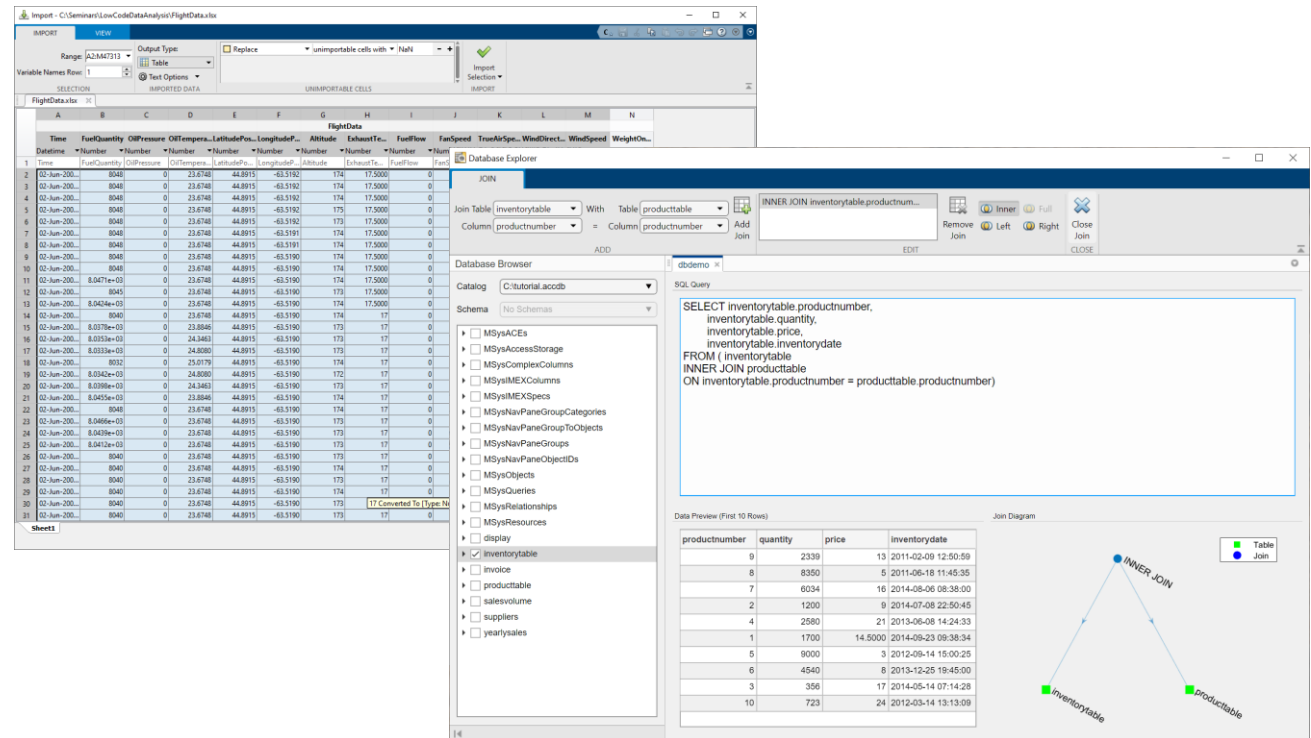
数据库探查器：Database Explorer (Database Toolbox)

- ODBC & JDBC SQL 数据库

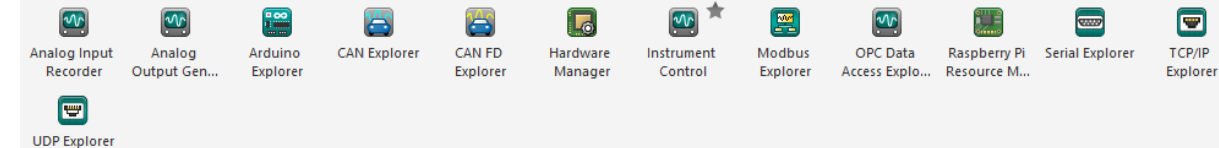
分享

测量硬件以及工业数据

- 数据获取硬件(*Data Acquisition Toolbox*)
- 独立运行的设备及硬件 (*Instrument Control Toolbox*)
- OPC UA and Aveva PI 服务器, Modbus 设备 (*Industrial Communication Toolbox*)
- CAN, J1939, 和 XCP (*Vehicle Network Toolbox*)

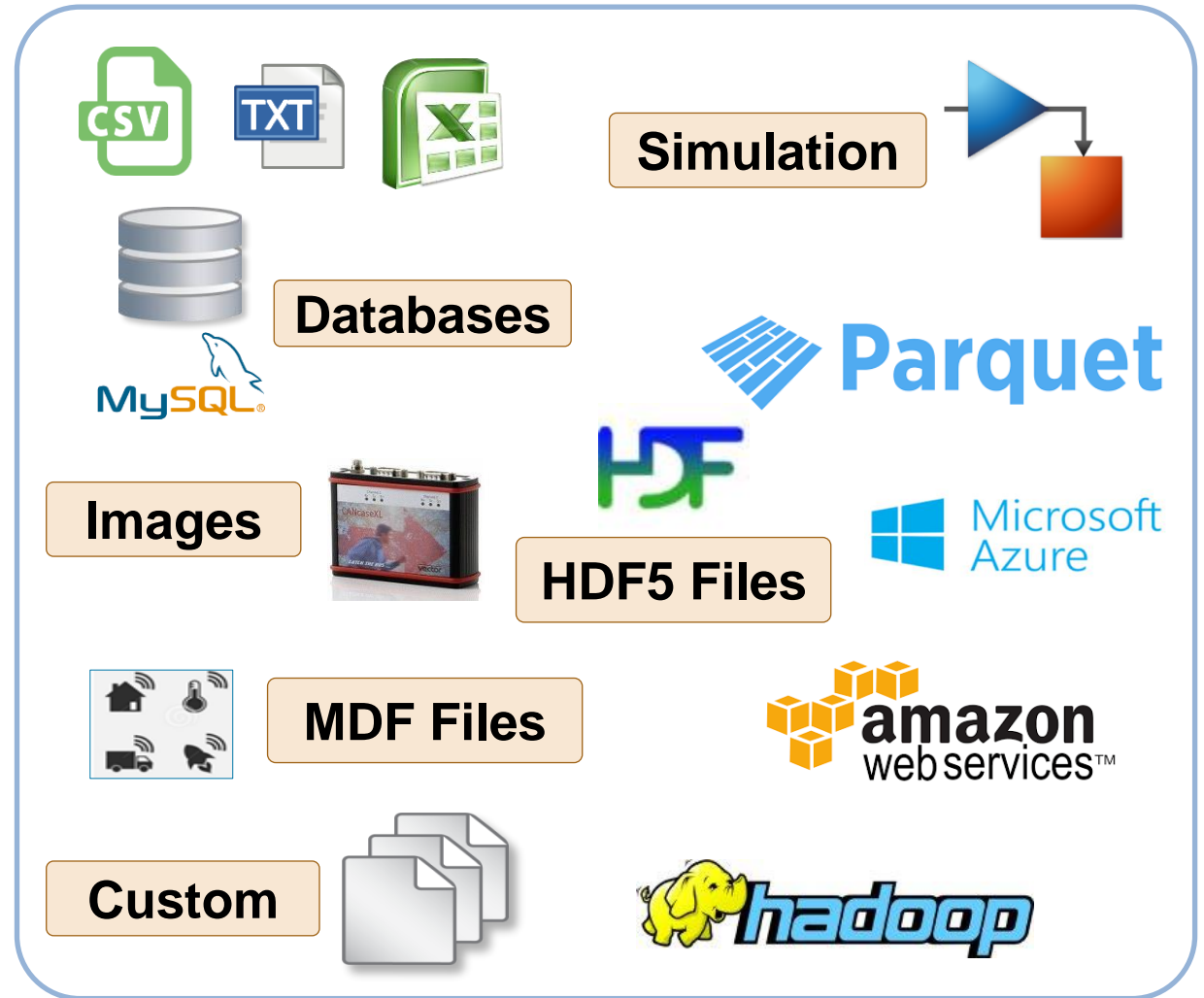


TEST AND MEASUREMENT



获取不同格式，保存在不同地点的数据

- 数据种类
 - 观测数据
 - 时序数据
 - 图像及声音数据
 - N维数据
- Location of data 数据保存地点
 - SQL & NoSQL 数据库
 - HDFS
 - AWS S3
 - Azure Blob Storage



在数据分析、工程以及 AI 领域有超过100个低代码工具

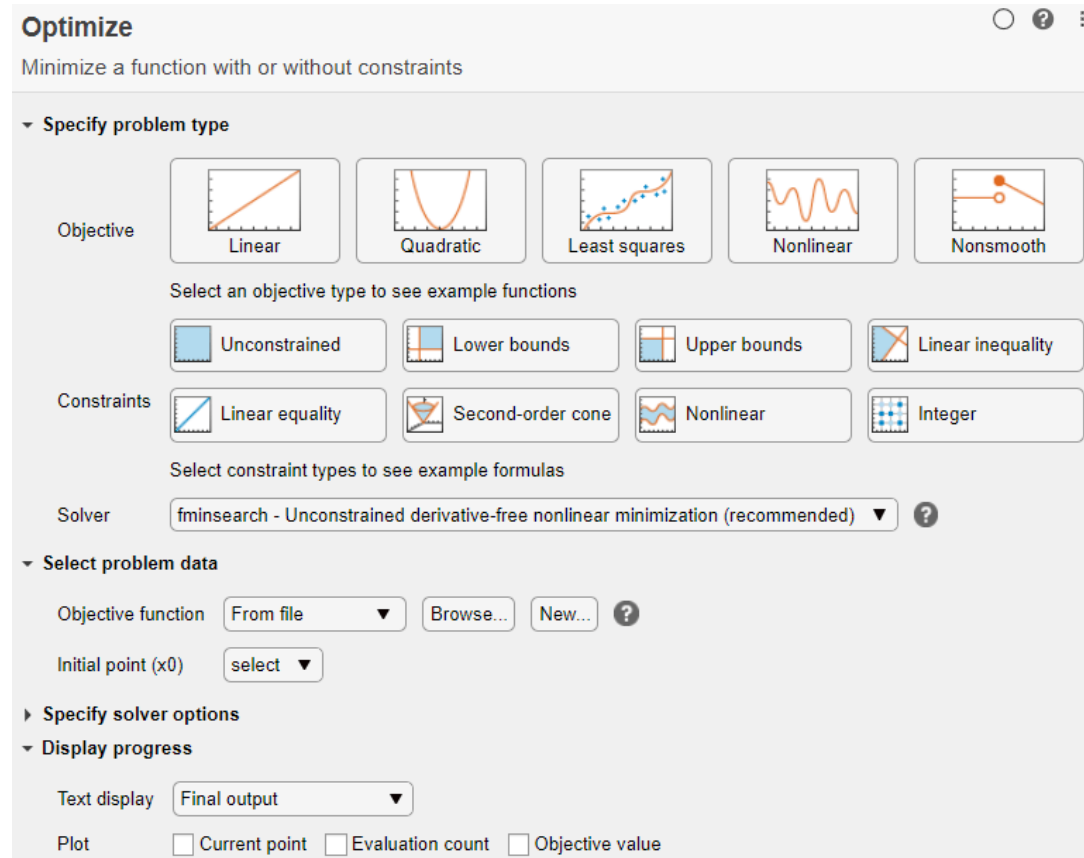
获取

探查与建模

分享

■ 数据分析

- 可视化、操作、预处理数据
- 数学、统计及优化



Optimize
Minimize a function with or without constraints

▼ Specify problem type

Objective: Linear, Quadratic, Least squares, Nonlinear, Nonsmooth

Select an objective type to see example functions

Constraints: Unconstrained, Lower bounds, Upper bounds, Linear inequality, Linear equality, Second-order cone, Nonlinear, Integer

Select constraint types to see example formulas

Solver: fminsearch - Unconstrained derivative-free nonlinear minimization (recommended)

▼ Select problem data

Objective function: From file, Browse..., New...

Initial point (x0): select

► Specify solver options

▼ Display progress

Text display: Final output

Plot: Current point Evaluation count Objective value

在数据分析、工程以及 AI 领域有超过100个低代码工具

获取

探查与建模

分享

■ 数据分析

- 可视化、操作、预处理数据
- 数学、统计及优化

■ 工程

- 控制系统设计与分析
- 信号处理与优化
- 图像处理与计算机视觉



在数据分析、工程以及 AI 领域有超过100个低代码工具

获取

探查与建模

分享

■ 数据分析

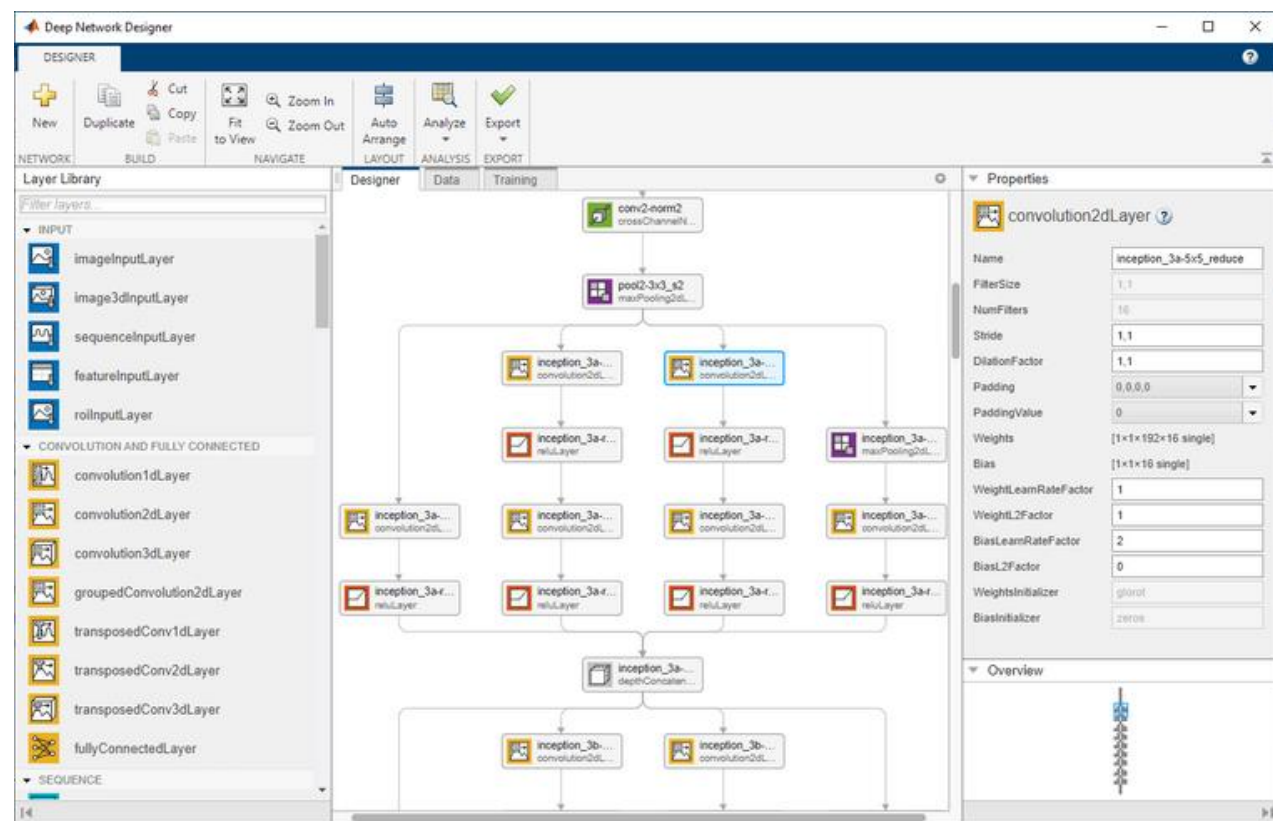
- 可视化、操作、预处理数据
- 数学、统计及优化

■ 工程

- 控制系统设计与分析
- 信号处理与优化
- 图像处理与计算机视觉

■ 人工智能

- 真实值分析
- 网络设计、训练及验证
- 网络量化并部署



代码文档同时写——您的脚本就是您的报告

获取

探索发现

分享

- 将代码分段
- 在代码旁直接显示输出
- 添加丰富的文本格式、方程式、图像
- 添加交互控件
- 启动绘图动画
- 直接保存为 PDF, HTML, Word, LaTeX

The screenshot displays the MATLAB Live Editor window titled "Live Editor - C:\MATLAB\Live Editor\ExploringExoplanets.mlx". The interface includes a menu bar with options like "LIVE EDITOR", "INSERT", and "VIEW". A toolbar contains various icons for file operations, editing, and execution. The main workspace is divided into sections: "CODE" and "RUN". The "CODE" section shows a script with the following lines:

```

1
2
3
4 xlim([0 1000])
5 ylabel('Number of Planets')
6 xlabel('Light Years from Earth')

```

The "RUN" section displays the output of the script, which includes a histogram showing the distribution of planets. The x-axis is labeled "Light Years from Earth" and ranges from 0 to 1000. The y-axis is labeled "Number of Planets" and ranges from 0 to 150. The histogram shows a peak in the number of planets between 100 and 200 light years from Earth. A context menu is open over the plot area, offering options like "Save", "Save As...", "Export to PDF...", "Export to Word...", "Export to HTML...", and "Export to LaTeX...". The menu also includes a "Save" option with the keyboard shortcut "Ctrl+S".

MATLAB 和您一起成长

- 从简单代码开始
- 创建脚本
- 可复用函数
- 编写稳健代码

```
classdef movingBlip < blip
    %MOVINGBLIP Summary of this class goes
    % Detailed explanation goes here

    % Copyright The MathWorks, Inc. 2008,

    properties
        deltaAoA
    end

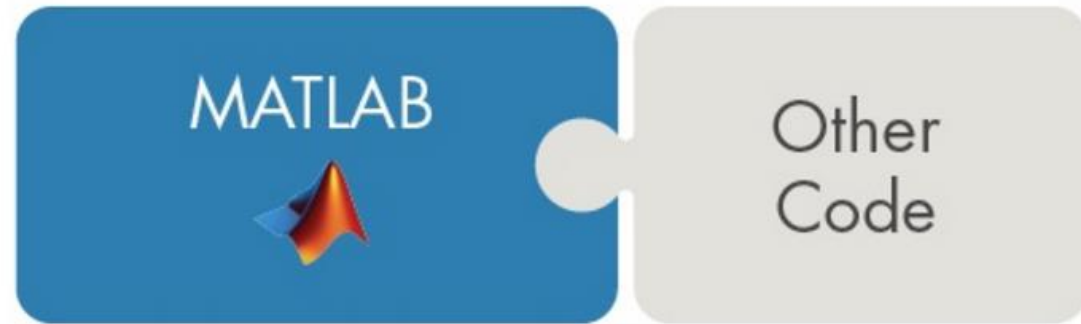
    methods
        function obj = movingBlip(deltaAoA
            % assign the superclass portio
            obj = obj@blip(varargin{:}) ;

            if nargin >= 1
                % assign the movingBlip's
                obj.deltaAoA = deltaAoA ;
            end
        end
    end
end
```


从独立编程到团队编程

- 项目
- 源代码管理
- 测试与持续集成
- 外部接口

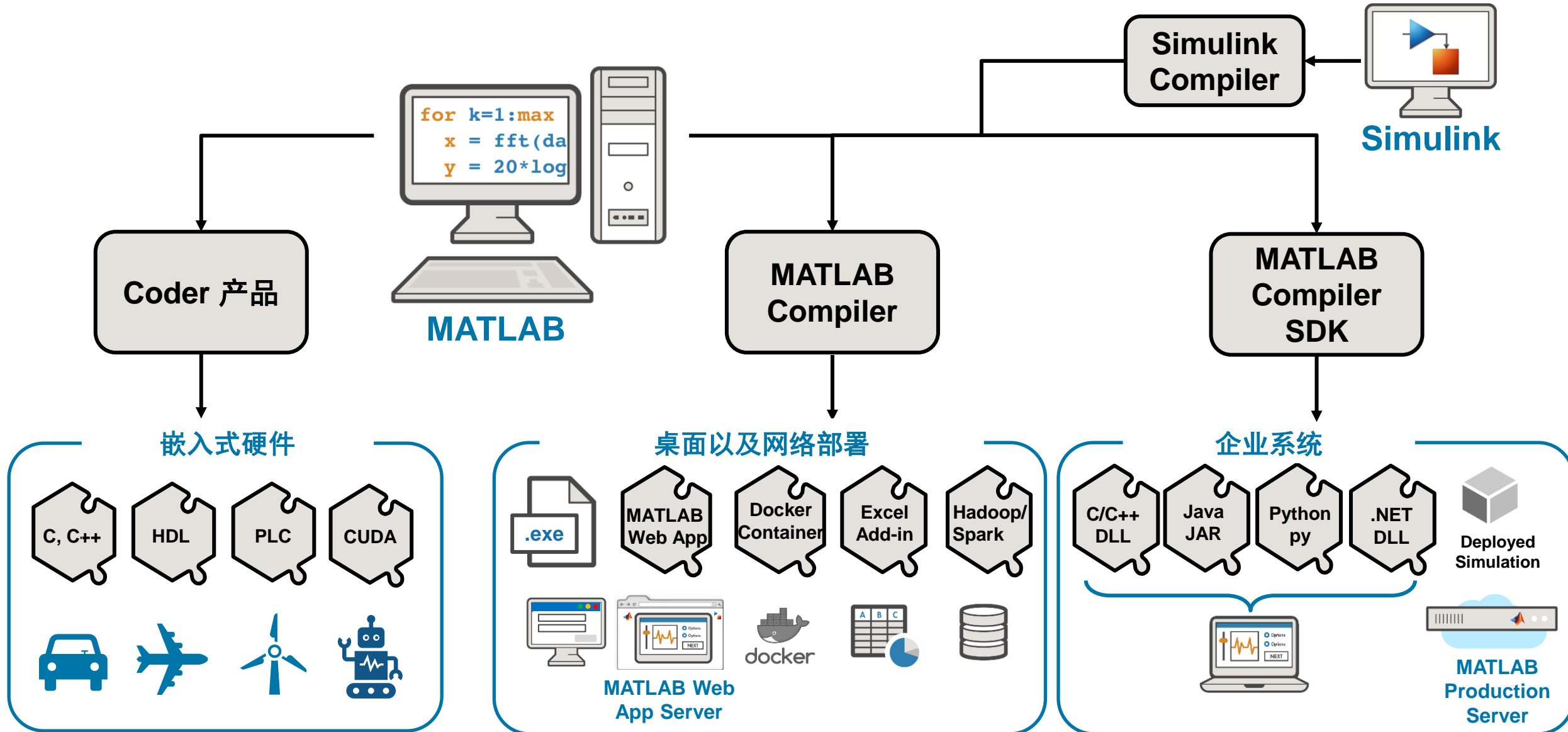
从MATLAB 中调用其他语言编写的库



从其他语言中调用MATLAB



为非 MATLAB 用户部署您的应用



今日日程

- 低代码数据分析
- 示例：模拟飞行传感器数据
- 学习资源

帮助文档

帮助中心

搜索帮助文档

目录

查看方式：
类别 | 产品列表

使用 MATLAB

MATLAB

使用 Simulink

Simulink

物理建模

基于事件建模

实时仿真和测试

工作流

并行计算

报告和数据库访问

系统工程

代码生成

应用程序部署

验证、确认和测试

文档 示例 函数 模块 App

如果文档已翻译，将显示翻译好的文档。如果文档尚未翻译，将显示英文文档。

文档

R2023b

使用 MATLAB

MATLAB

应用

AI、数据科学和统计

资源

发行说明

安装帮助

硬件支持

社区

File Exchange

使用 Simulink

Simulink

数学和优化

信号处理

图像处理 and 计算机视觉

控制系统

物理建模

基于事件建模

发行说明

The screenshot displays the MathWorks Help Center interface. At the top, there is a navigation bar with the 'Help Center' title and a search bar labeled 'Search Help'. Below this, a secondary navigation bar lists categories: 'Documentation', 'Examples', 'Functions', 'Blocks', and 'Apps'. The main content area is titled 'Release Notes' for version 'R2023b'. It features a section for 'Explore Release Notes' with a 'Select a Product' dropdown menu. To the right, under 'Online Resources', there are links for 'Installation and Licensing Changes', 'System Requirements', 'Bug Reports', and 'Bug Fixes'. A section titled 'New Products and Major Updates' contains four product cards: 'Aerospace Toolbox' (analyze and visualize aerospace vehicle motion), 'DO Qualification Kit' (qualify Simulink and Polyspace verification tools for DO-178, DO-278, and DO-254), 'Datafeed Toolbox' (access financial data from data service providers), and 'Instrument Control Toolbox' (control test and measurement instruments and communicate with computer peripherals). The browser's address bar at the bottom shows the file path: file:///C:/ProgramData/MATLAB/SupportPackages/R2023b/help/relnotes/index.html?s_tid=hc_resources.

帮助

Documentation

Help Center

Search Help

CONTENTS

« Documentation Home

Documentation Examples Functions Blocks Apps

Release Notes

R2023b

Explore Release Notes

Select a Product

Online Resources

- Installation and Licensing Changes
- System Requirements
- Bug Reports
- Bug Fixes

New Products and Major Updates

Aerospace Toolbox

Analyze and visualize aerospace vehicle motion using reference standards and models

DO Qualification Kit

Qualify Simulink® and Polyspace® verification tools for DO-178, DO-278, and DO-254

Datafeed Toolbox

Access financial data from data service providers

Instrument Control Toolbox

Control test and measurement instruments and communicate with computer peripherals

file:///C:/ProgramData/MATLAB/SupportPackages/R2023b/help/relnotes/index.html?s_tid=hc_resources

自定义进度在线课程

高质量，自定义进度在线课程
 交互式学习环境，提供真实产品使用体验
 自动评价并反馈
 提供进度报告和完成证书
 随时随地学习

Deep Learning Onramp (0% complete)

2.1 Course Example - Identify Objects in Some Images

Task 2

You can use the `imshow` function to display an image stored in a MATLAB variable

```
imshow(I)
```

TASK
Display the imported image in the variable `img1`.

Hint | See Solution | Reset | Submit | Next task

Test Results: Correct!
✓ Is `img1` displayed correctly?

View image files

Instructions are in the task pane to the left. Complete and submit each task one at a time.

Task 1
Import an image

```
1  img1 = imread('file01.jpg')
```

Task 2
View image

```
4  imshow(img1)
```

Task 3
Import and view more images

```
7  
8  
9
```

Workspace:







```
img1 = 227x227x3 uint8 array
img1(:,:,1) =
  90  90  89  87  85  84  83  ...
  91  91  90  88  87  85  84  ...
  93  92  91  90  89  88  87  ...
  95  94  94  93  92  91  91  ...
  97  97  96  96  95  95  95  ...
  99  99  99  99  98  98  98  ...
 100 100 101 101 101 101 101  ...
 101 101 102 102 102 102 102  ...
 103 102 115 105 106 113 108  ...
 112 100 105 108 109 110 112  ...
 120 132 120 120 112 102 96  ...
 128  90 118 119 117 109 51  ...
 119 100 128 117 124 120 75  ...
 134 145  67  77  82  62  71  ...
 101  00  10  41  65  60  57  ...
```

COMMAND WINDOW

自定义进度在线课程





初级课程（对所有人免费）


Get Started with MATLAB

-  MATLAB Onramp
-  Deep Learning Onramp
-  Machine Learning Onramp
-  Image Processing Onramp
-  Signal Processing Onramp
-  Statistics Onramp

-  App Building Onramp
-  Optimization Onramp
-  Computer Vision Onramp
-  Reinforcement Learning Onramp
-  Object Oriented Programming Onramp
-  Wireless Communications Onramp

Get Started with Simulink

-  Simulink Onramp
-  Simscape Onramp
-  Stateflow Onramp
-  Circuit Simulation Onramp

-  Power Electronics Simulation Onramp
-  Control Design Onramp with Simulink

进阶课程（全校版许可证）

MATLAB and Simulink

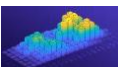







-  MATLAB Fundamentals
-  Simulink Fundamentals
-  MATLAB Programming Techniques
-  MATLAB for Data Processing and Visualization





Image and Signal Processing

-  Image Processing with MATLAB
-  Signal Processing with MATLAB

Data Science and AI

-  Deep Learning with MATLAB
-  Machine Learning with MATLAB

Computational Mathematics

-  Solving Nonlinear Equations with MATLAB
-  Solving Ordinary Differential Equations with MATLAB
-  Introduction to Symbolic Math with MATLAB
-  Introduction to Linear Algebra with MATLAB

自定义进度课程的形式和学习环境

- 随时随地学习：可以从网络浏览器进入，或者从产品中进入
- 通过实践学习：在 MATLAB 和 Simulink 中完成任务，并且收到及时反馈
- 跟踪学习进度，并且分享完成证书

The screenshot displays the MATLAB Fundamentals course interface. The top navigation bar shows "MY COURSES" and "MATLAB Fundamentals (2% complete)". The current task is "4.3 Creating Evenly-Spaced Vectors: (4/8) Use Colon Operator and Linspace". The interface is divided into three task sections: Task 1, Task 2, and Task 3. Task 1 shows the instruction "Create a variable named x that contains the row vector shown below." with a visual representation of the vector [3 5 7 9 11]. Task 2 shows the instruction "at a time." and the code `x = linspace(5,15,13)`. Task 3 shows the instruction "x = 3:2:11". The "Test Results" section indicates "Correct!" with two checkmarks: "Is x defined correctly?" and "Does script not contain square brackets?". The interface also includes a "Submit" button and a "Next task" button.

相关讲座视频链接：

- <https://ww2.mathworks.cn/videos/low-code-data-analysis-with-matlab-1676562237481.html>



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mathworks.cn 以及其他在线平台：



扫描下方二维码，填写反馈表，获取本场讲座课件

**大连海事大学MATLAB 活动：使用
MATLAB进行低代码数据分析**



