

# MATLAB EXPO

## 框架互操作：MATLAB与TensorFlow/PyTorch

袁航, MathWorks



关于深度学习，您是否也有以下疑问，例如：

*数据科学家使用 TensorFlow & PyTorch*  
*工程师使用 MATLAB*

**整个团队如何更高效地协作？**

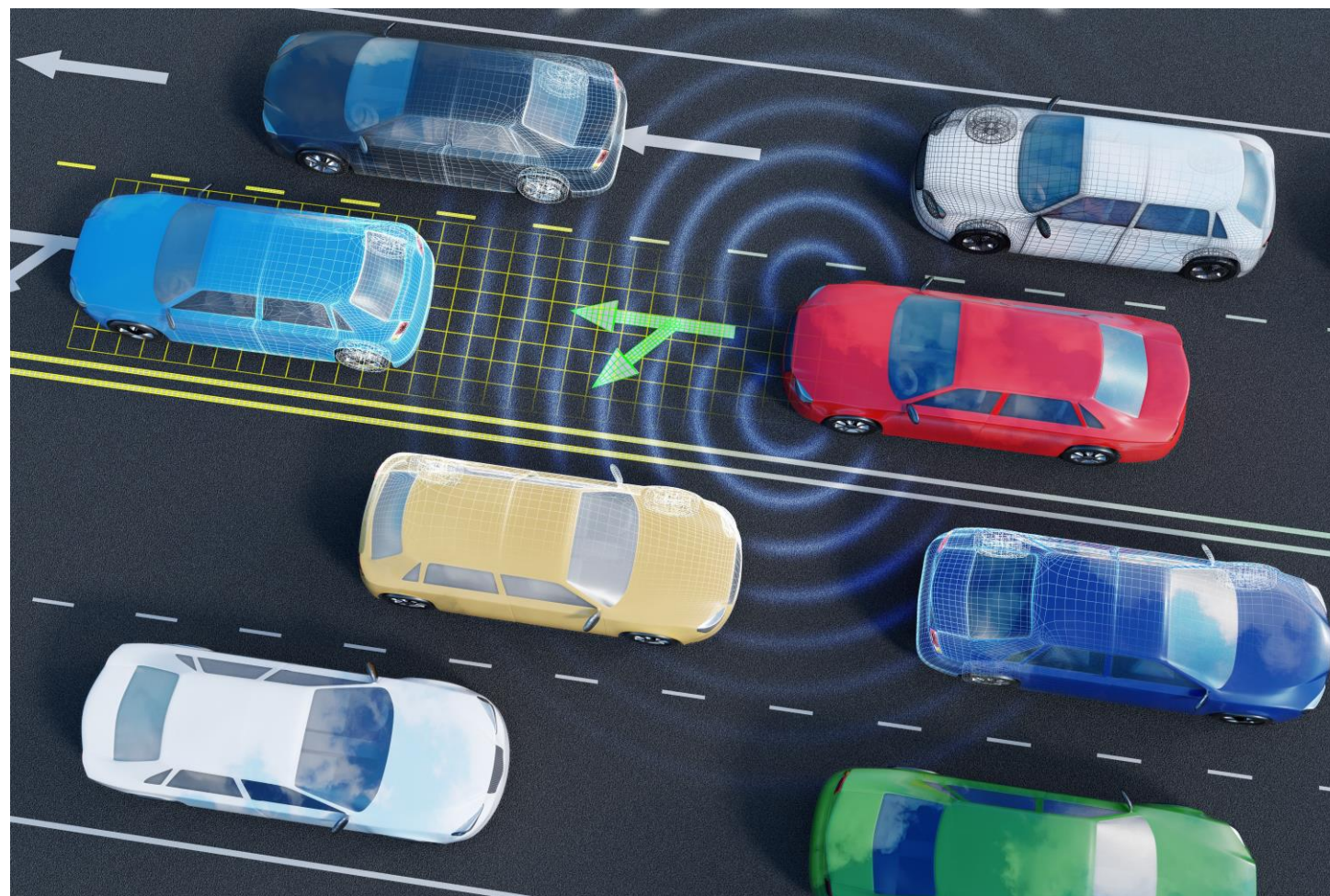
*最新的研究和模型通常基于 TensorFlow 和 PyTorch*

**MATLAB 是否能够支持这些最新的模型？**

*将模型部署到嵌入式系统中往往十分耗时*

**MATLAB能否帮助我们更快实现AI模型的嵌入式部署？**

# 基于 AI 的工程项目



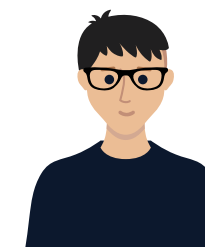
# 团队构成



项目管理

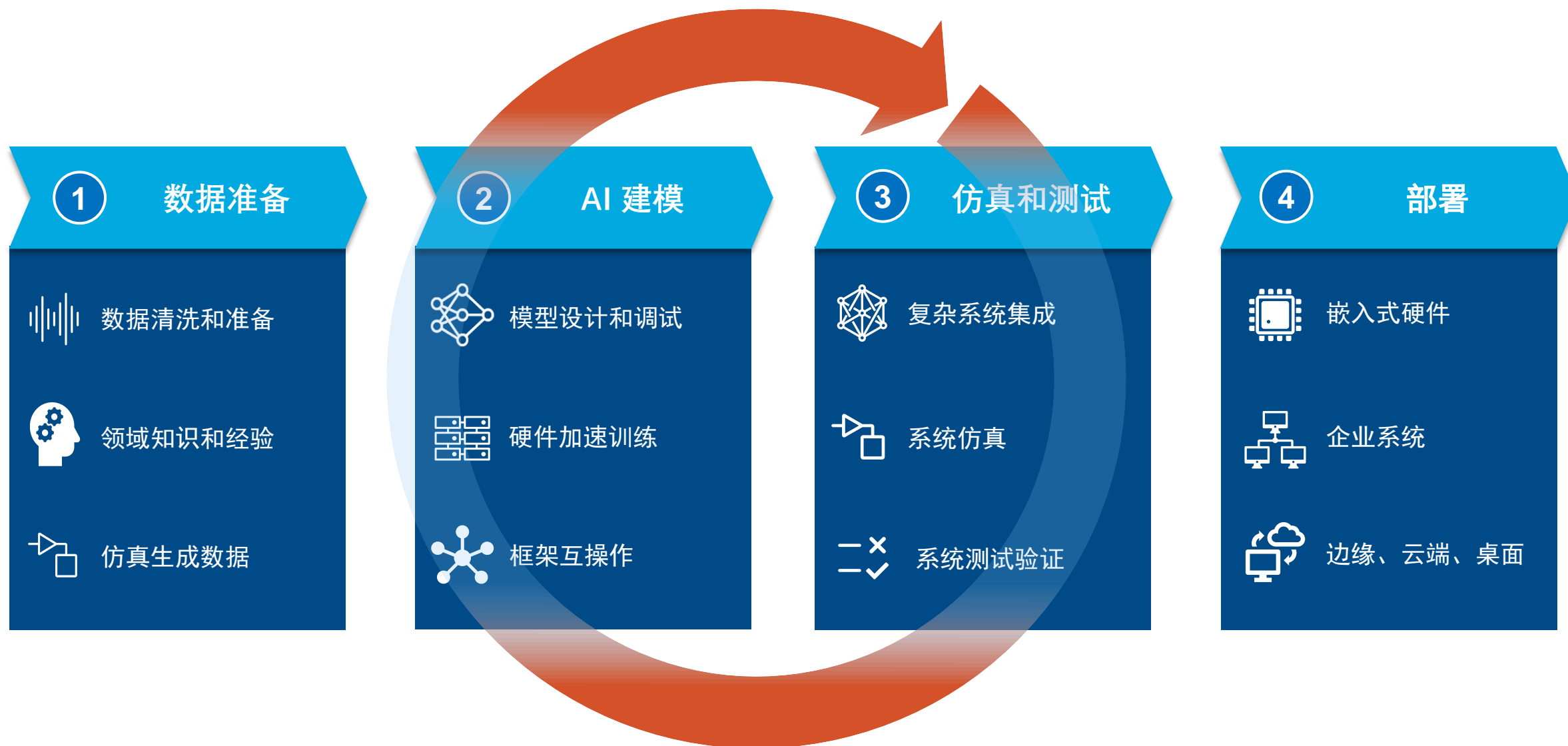


技术工程师



数据科学家

# 利用 AI 系统设计流程优化模型

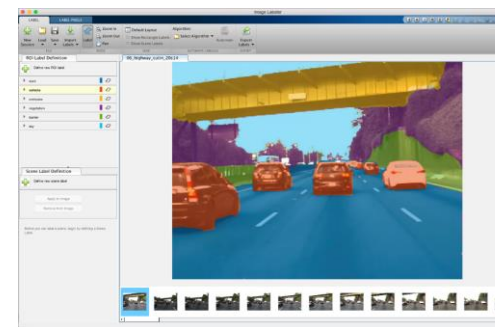




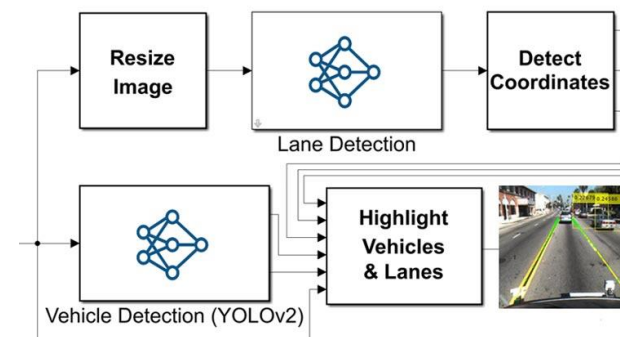
**首先，让我们一同分析一下项目需求**

# 数据准备 – 需求分析

- 利用领域知识



- 确保足够的数量
  - 使用系统仿真合成数据



1

## 数据准备

数据清洗和准备

领域知识和经验

仿真生成数据

# AI 建模 – 需求分析

2

AI 建模



模型设计和调试



硬件加速训练



框架互操作

- 为每一个应用场景选取最佳模型
- 不局限于某一工具

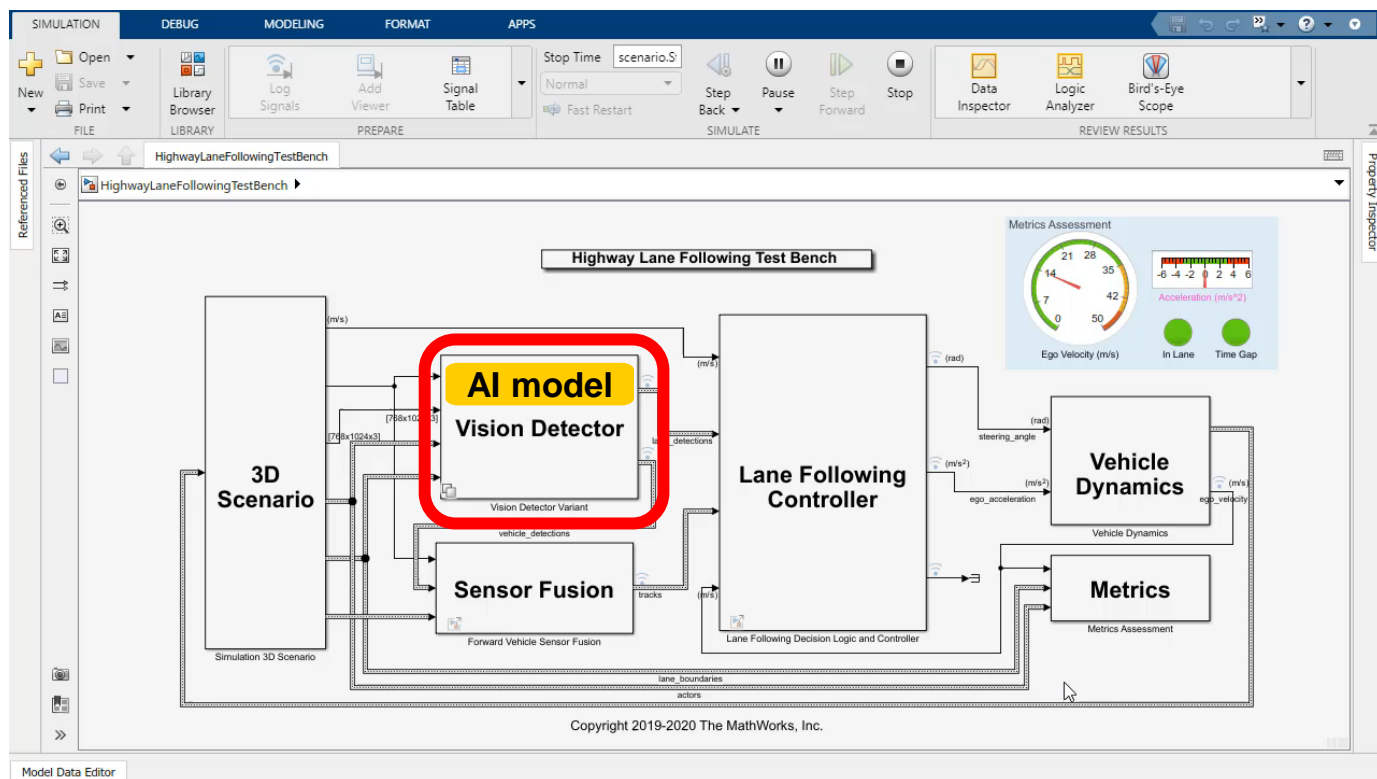


# 仿真和测试 – 需求分析

## 3 仿真和测试



- 必须在完整的系统中测试模型
  - 与系统级仿真集成



# 部署 – 需求分析

4

部署



嵌入式硬件



企业系统



边缘、云端、桌面

- 目标：尽可能选取能耗低、成本低的嵌入式硬件

CPU



GPU



FPGA



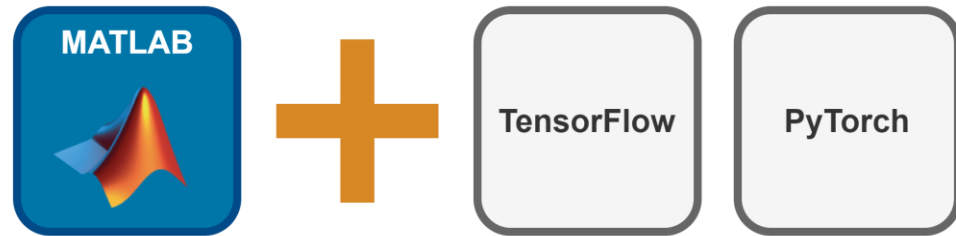
最后一点...

## 寻求最合适的团队合作方式



# 应该使用什么工具？

是否能够结合使用 MATLAB 和开源框架？



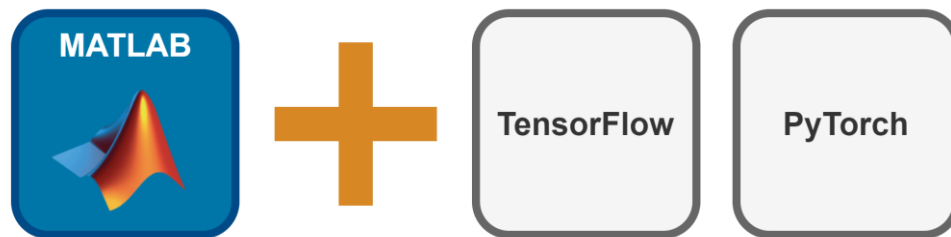


# MATLAB 提供 3 种方式实现与 TensorFlow 和 PyTorch 的框架互操作

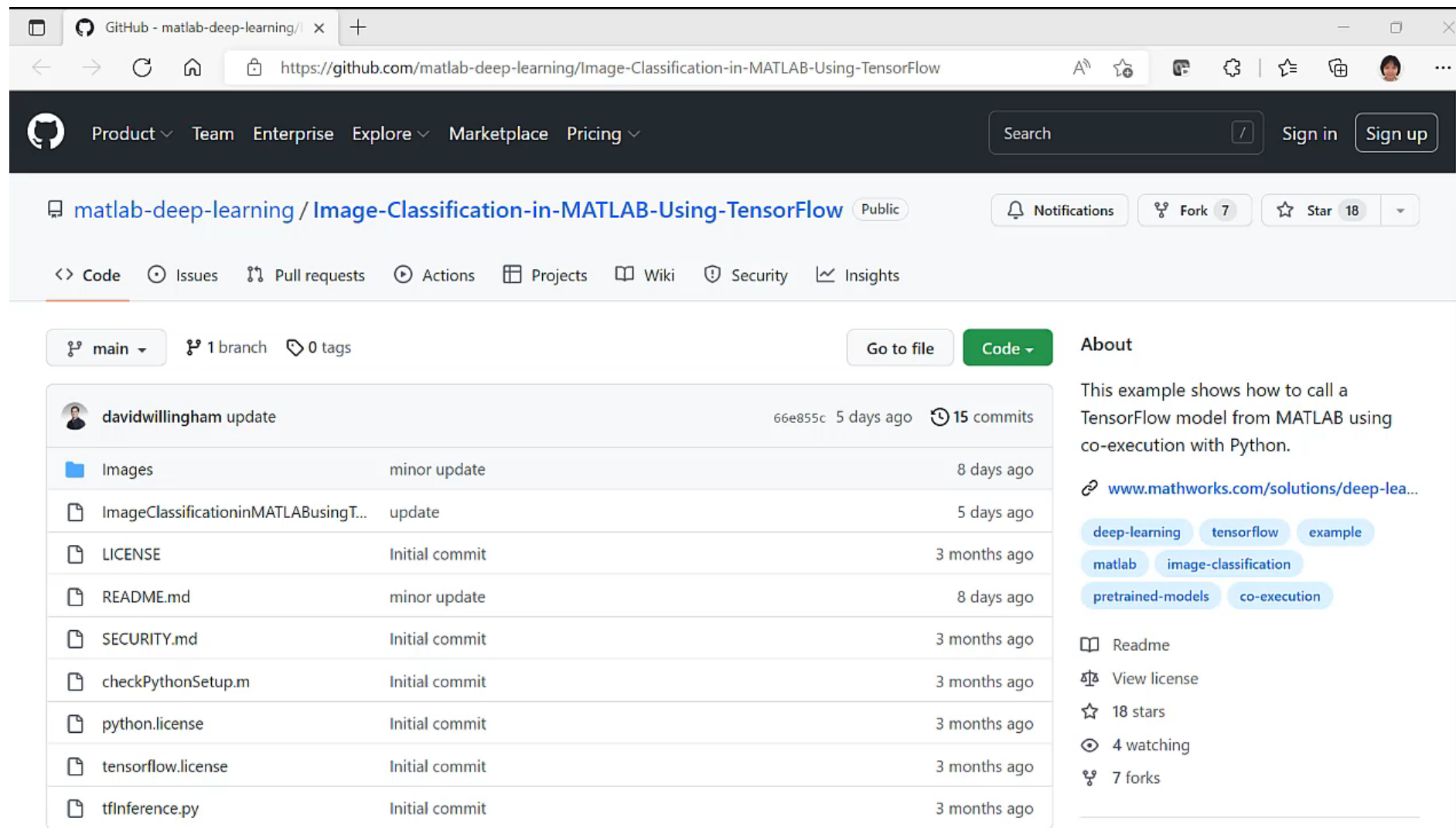
#	Option
1	Co-execution with TensorFlow or PyTorch
2	Model converters for TensorFlow & ONNX
3	MATLAB Deep Learning Model Hub

# 1. MATLAB 直接与 TensorFlow / PyTorch 互相调用

- 需要安装 MATLAB, TensorFlow / PyTorch
- 需要进行数据类型转换/重组
- 性能受到框架间的数据传输影响
- 可在MATLAB中测试任何基于TensorFlow/PyTorch模型



# 示例1：在 MATLAB 中直接调用 TensorFlow 库



The screenshot shows a GitHub repository page for 'matlab-deep-learning/Image-Classification-in-MATLAB-Using-TensorFlow'. The repository is public and has 7 forks and 18 stars. The main branch is 'main'. The repository contains the following files and folders:

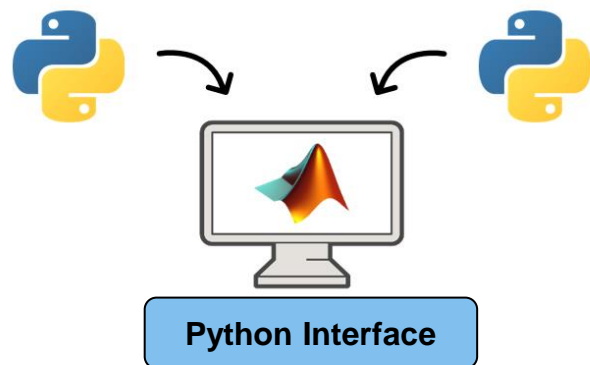
File/Folder	Commit	Time
Images	minor update	8 days ago
ImageClassificationinMATLABusingT...	update	5 days ago
LICENSE	Initial commit	3 months ago
README.md	minor update	8 days ago
SECURITY.md	Initial commit	3 months ago
checkPythonSetup.m	Initial commit	3 months ago
python.license	Initial commit	3 months ago
tensorflow.license	Initial commit	3 months ago
tfInference.py	Initial commit	3 months ago

The repository description states: "This example shows how to call a TensorFlow model from MATLAB using co-execution with Python." A link to the MathWorks solution page is provided: [www.mathworks.com/solutions/deep-lea...](http://www.mathworks.com/solutions/deep-lea...). The repository also includes tags for 'deep-learning', 'tensorflow', 'example', 'matlab', 'image-classification', 'pretrained-models', and 'co-execution'.

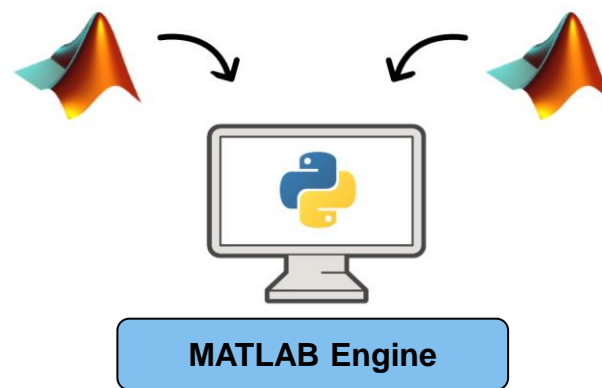
## 互相调用支持：

- 在MATLAB中调用Python，以获取任何AI框架和网络模型
- 在Python中调用MATLAB，以重用特定的领域处理技术

在MATLAB中调用Python

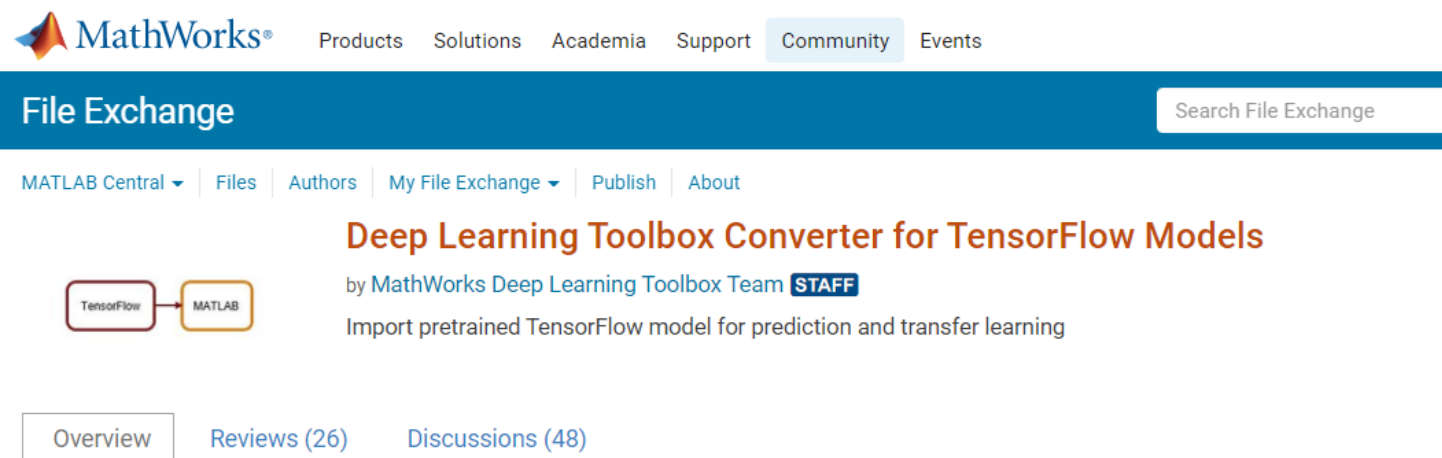


在Python 中调用MATLAB



## 2. 使用TensorFlow & ONNX Converter 导入模型

- 仅需要安装 MATLAB
- 直接导入 TensorFlow模型
- 使用ONNX导入 PyTorch 模型
- 每次版本更新增加新功能



The screenshot shows the MathWorks File Exchange interface. At the top, there is a navigation bar with the MathWorks logo and links for Products, Solutions, Academia, Support, Community, and Events. Below this is a blue header for "File Exchange" with a search bar. The main content area features a breadcrumb trail: MATLAB Central > Files > Authors > My File Exchange > Publish > About. The featured item is titled "Deep Learning Toolbox Converter for TensorFlow Models" by the MathWorks Deep Learning Toolbox Team (STAFF). It includes a diagram showing a TensorFlow box connected to a MATLAB box. The description states: "Import pretrained TensorFlow model for prediction and transfer learning". At the bottom, there are tabs for "Overview", "Reviews (26)", and "Discussions (48)".

The importer for the TensorFlow models would enable you to import a pretrained TensorFlow models and weights. You can then use this model for prediction or transfer learning. Alternatively, you can import layer architecture as a Layer array or a LayerGraph object. You can then train this model.

## 示例2：将 TensorFlow 模型导入 MATLAB

The screenshot shows a web browser displaying a MATLAB blog post. The browser's address bar shows the URL: `blogs.mathworks.com/deep-learning/2022/03/18/importing-models-from-tensorflow-pytorch-and-onnx/?doing_wp_cron=1648606960.5222079753875732421875`. The page header includes the MathWorks logo and navigation links for Products, Solutions, Academia, Support, Community, and Events. The main content area features a 'Deep Learning' category header and a post titled 'Importing Models from TensorFlow, PyTorch, and ONNX' by Johanna Pingel, dated March 18, 2022. The post has 1032 views, 3 likes, and 0 comments. The text of the post begins with 'How do you import a model created in TensorFlow™ or PyTorch™ and convert it into MATLAB Code?'. Below the text is a diagram showing three boxes labeled 'TensorFlow', 'PyTorch', and 'ONNX' with arrows pointing towards a central 'MATLAB' box. The TensorFlow box is on the left, the PyTorch box is at the top, and the ONNX box is on the right. The MATLAB box is in the center and contains the MATLAB logo. Below the diagram, the text reads: 'First, keep in mind there are different options for working with deep learning models in MATLAB.'

Live Editor - C:\Users\sparaske\OneDrive - MathWorks\Documents\R2022b\MATLABExpo\ImportTFModel\ImportTensorFlowModel.mlx

Importing Models from TensorFlow: x +

blogs.mathworks.com/deep-learning/2022/03/18/importing-models-from-tensorflow-pytorch-and-onnx/?doing\_wp\_cron=1648606960.5222079753875732421875

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Deep Learning Understanding and using deep learning networks

< Detection of ships on satellite...

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- 18 Mar Importing Models from TensorFlow, PyTorch, and ONNX
- 16 Feb Detection of ships on satellite images using YOLO v2 model
- 3 Feb Getting Started with AI Through Datathons and Competitions
- 3 Jan Deep Learning for Computer Vision using Python and MATLAB
- 16 Dec Deep Learning in Simulink. Simulating AI within large complex systems

MATLAB for Deep Learning

- A. Overview
- B. Features
- C. Examples
- D. Models

Importing Models from TensorFlow, PyTorch, and ONNX

Posted by Johanna Pingel, March 18, 2022 1032 views (last 30 days) | 3 Likes | 0 comment

The following post is from Sivylla Paraskevopoulou, Senior Technical Writer and David Willingham, Product Manager for Deep Learning Toolbox.

How do you import a model created in TensorFlow™ or PyTorch™ and convert it into MATLAB Code?

PyTorch

TensorFlow

MATLAB

ONNX

First, keep in mind there are different options for working with deep learning models in MATLAB.

# 3. MATLAB 深度学习模型库

## Deep Learning Model Hub

- 仅需要安装 MATLAB
- 超过 50 个预训练模型
- 与常见 TensorFlow 和 PyTorch 模型库相似

The screenshot shows the GitHub repository for the MATLAB Deep Learning Model Hub. The repository is public and has 13 watchers, 23 forks, and is starred. The main content area displays the README for the repository, which is titled "MATLAB Deep Learning Model Hub". The README describes the hub as a place to discover pretrained models for deep learning in MATLAB. It lists several models under the "Computer Vision" category, including Image Classification, Object Detection, Semantic Segmentation, Instance Segmentation, and Image Translation. The repository also shows a commit history table with columns for the commit message, author, date, and number of commits.

Commit Message	Author	Date	Commits
Script for launching the Deep Learning Model hub in a browser.	davidwillingham	1748d2c 24 days ago	12
initial commit		3 months ago	
Initial Commit		3 months ago	
Live script added, MATLABDeepLearningModelHub.mlx, so users have q...		2 months ago	
Live script added, MATLABDeepLearningModelHub.mlx, so users have q...		2 months ago	
Initial Commit		3 months ago	
Script for launching the Deep Learning Model hub in a browser.		24 days ago	

**README.md**

### MATLAB Deep Learning Model Hub

Discover pretrained models for deep learning in MATLAB.

#### Models

##### Computer Vision

- [Image Classification](#)
- [Object Detection](#)
- [Semantic Segmentation](#)
- [Instance Segmentation](#)
- [Image Translation](#)

**Releases** 1

- [R2021b](#) (Latest) on Dec 16, 2021

**Packages**

No packages published  
[Publish your first package](#)

**Languages**

- MATLAB 100.0%

# 示例3：使用 MATLAB Deep Learning Model Hub 获取预训练模型

The screenshot shows the GitHub repository page for `matlab-deep-learning / MATLAB-Deep-Learning-Model-Hub`. The repository is public and has 130 stars and 23 forks. The main content area displays a list of files and folders, including `Images`, `LICENSE`, `MATLABDeepLearningModelHub.mlx`, `README.md`, `SECURITY.md`, and `viewDeepLearningModelHubGitHu...`. The `README.md` file is selected, showing the title `MATLAB Deep Learning Model Hub` and the description `Discover pretrained models for deep learning in MATLAB.`

Repository details:

- Repository: `matlab-deep-learning / MATLAB-Deep-Learning-Model-Hub` (Public)
- Stars: 130
- Forks: 23
- Branches: 1 branch
- Tags: 3 tags

Files and folders:

File/Folder	Commit Message	Time Ago
Images	initial commit	3 months ago
LICENSE	Initial Commit	3 months ago
MATLABDeepLearningModelHub.mlx	updating YOLOv4 and CRAFT to link the new locations available in D...	2 days ago
README.md	Minor update to README.md	22 hours ago
SECURITY.md	Initial Commit	3 months ago
viewDeepLearningModelHubGitHu...	Script for launching the Deep Learning Model hub in a browser.	last month

Repository statistics:

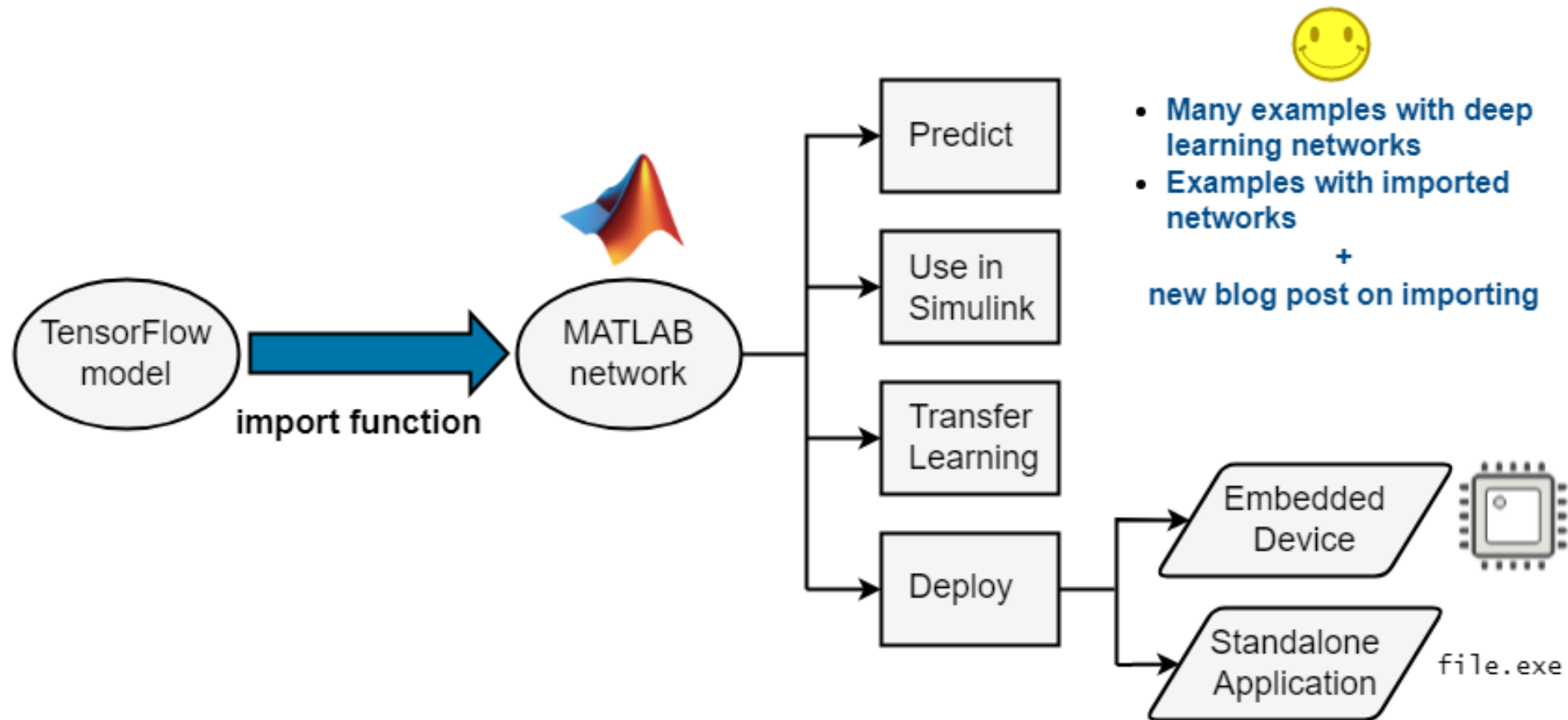
- Readme
- View license
- 130 stars
- 13 watching
- 23 forks

Releases:

- 2 releases
- R2022a (Latest) - yesterday
- + 1 release

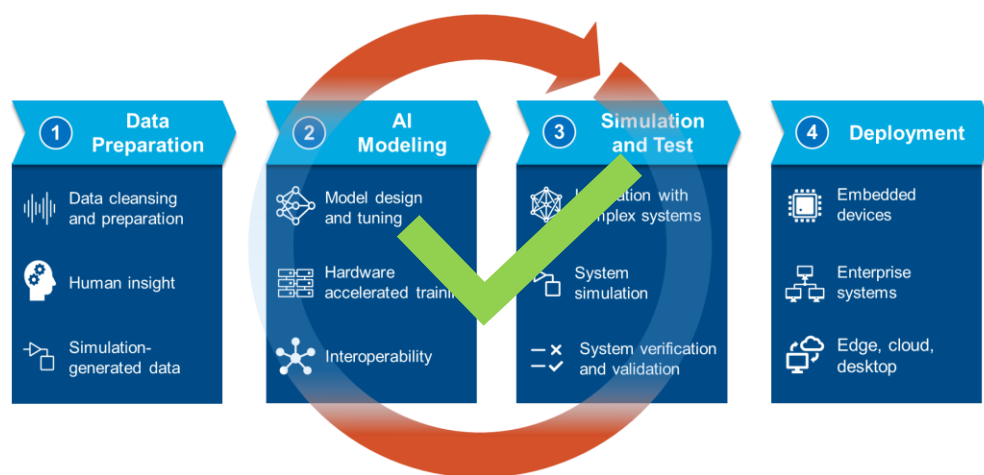


# 基于 MATLAB 神经网络模型的深度学习 workflow



# 关键问题和解决方案

#	挑战	方法
1	寻找并测试最佳模型	<ul style="list-style-type: none"> <li>互相调用 Co-execution</li> </ul>
2	部署到嵌入式目标硬件	<ul style="list-style-type: none"> <li>查看 MATLAB Deep Learning Model Hub 是否提供相关模型</li> <li>使用模型转换工具将模型导入MATLAB</li> </ul>



# 总结

**参考链接:**

[Co-execution between MATLAB and TensorFlow](#)

[Importing Models from TensorFlow, PyTorch, and ONNX](#)

[MATLAB Deep Learning Model Hub](#)

# MATLAB EXPO

谢谢!

