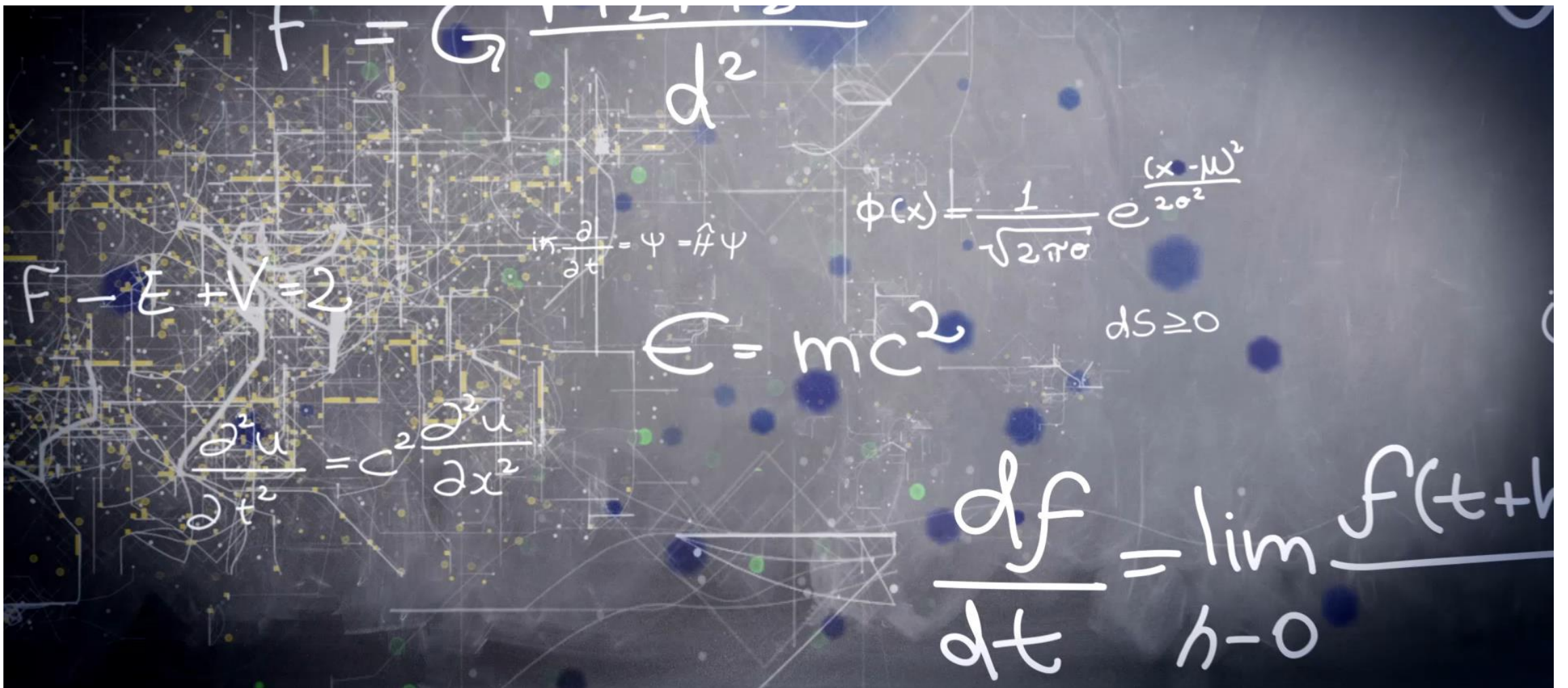


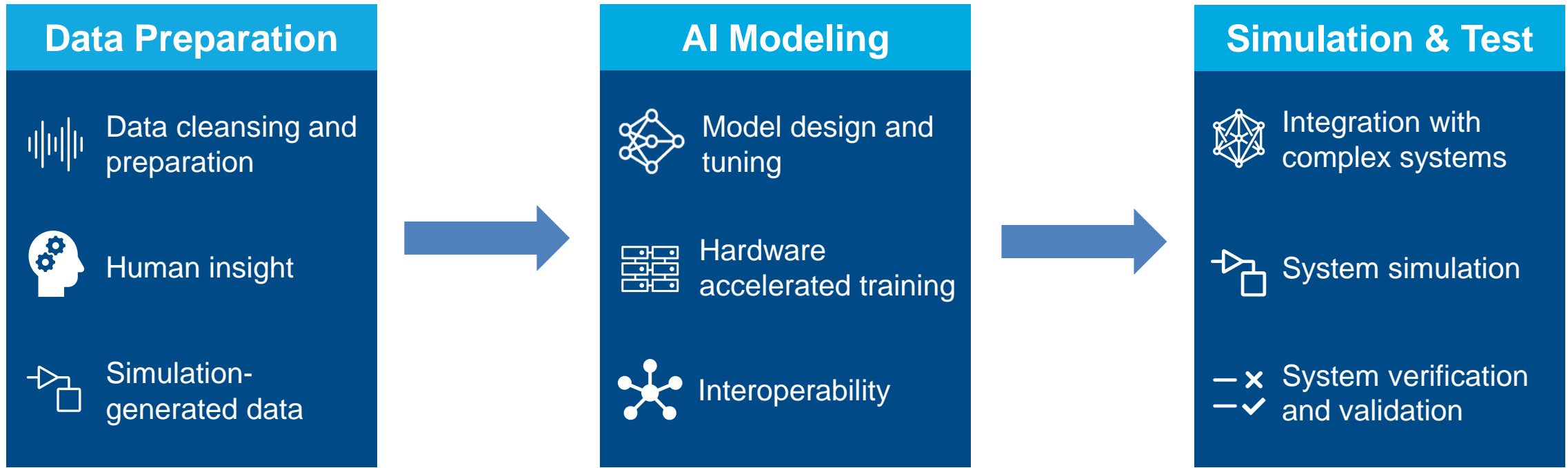
# 不是人工智慧專家也能上手 — AI低程式碼開發MATLAB APP

Fred Liu  
Application Engineer



## Low Code AI

# AI APP Workflow



**Labeler APP**

A collection of application icons for the Labeler APP, arranged in two rows:

- Lidar Labeler
- Image Labeler
- Video Labeler
- Medical Image Labeler
- Signal Labeler
- Audio Labeler

**AI Modeling APP**

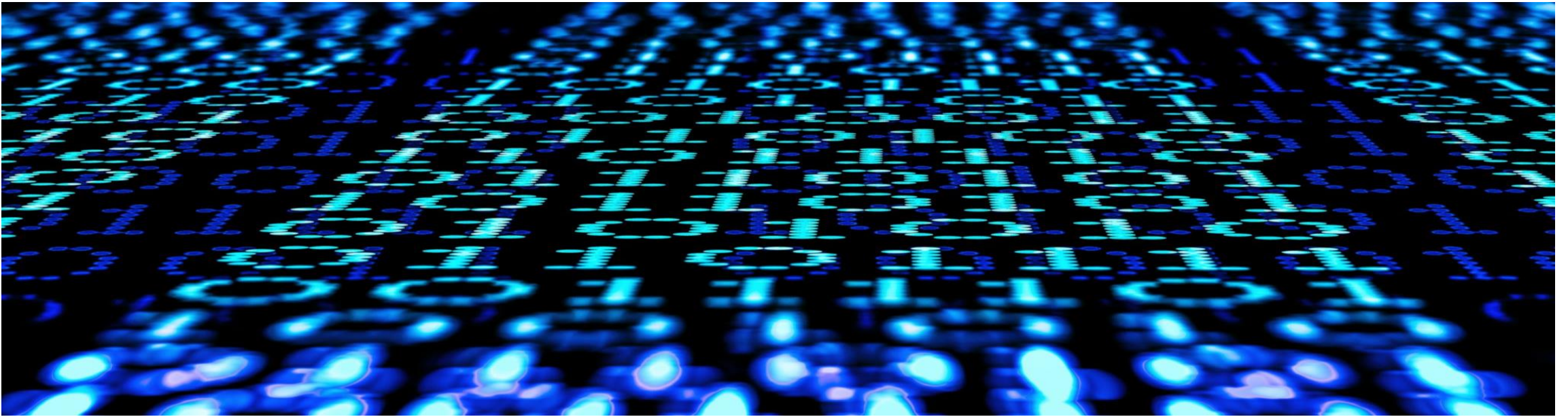
A collection of application icons for the AI Modeling APP, arranged in two rows:

- Classification Learner
- Deep Network Designer
- Regression Learner
- Reinforcement Learning Des...
- Neural Net Clustering
- Neural Net Fitting
- Neural Net Pattern Reco...
- Neural Net Time Series

**AI Simulation APP**

A collection of application icons for the AI Simulation APP, arranged in one row:

- Deep Network Quantizer
- Experiment Manager



## **Low Code AI – First : Data Labeling**

# 花最少的時間標記資料

- 各領域的標記工具都有涵蓋
- 並且支援各種輔助、半自種、全自動標記功能

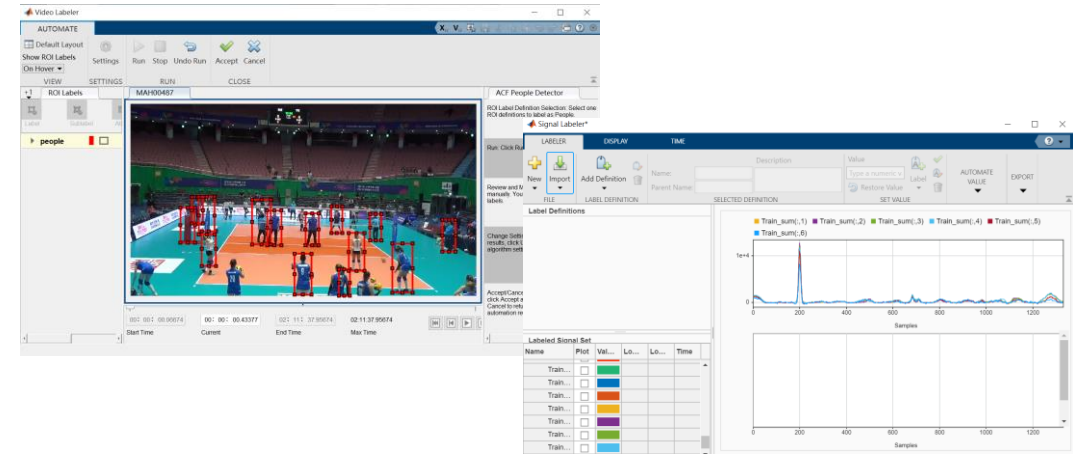
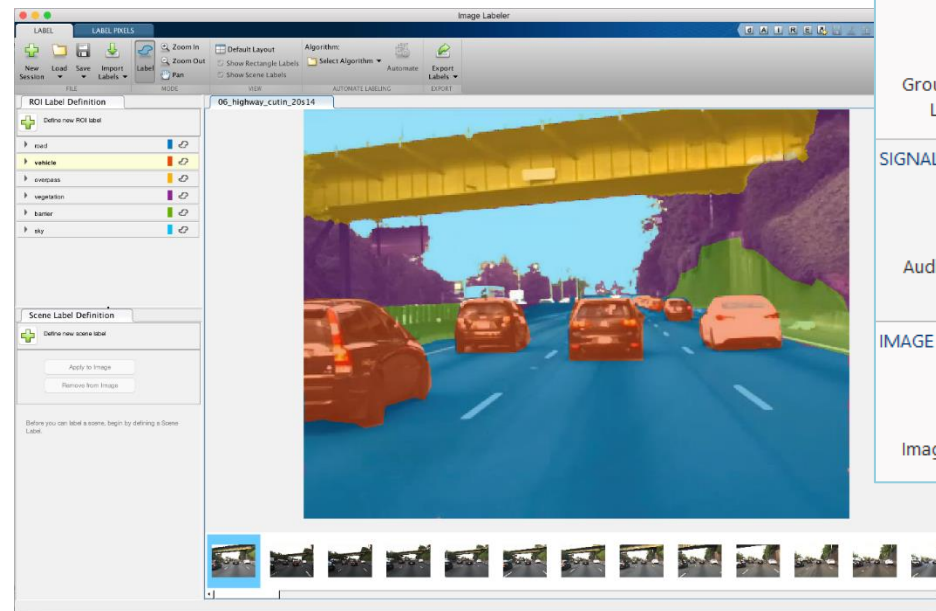



Image Labeler <i>Computer Vision Toolbox</i>	R2017b
Video Labeler <i>Computer Vision Toolbox</i>	R2018b
Audio Labeler <i>Audio Toolbox</i>	R2019a
Signal Labeler <i>Signal Processing Toolbox</i>	R2019a
Lidar Labeler <i>Lidar Toolbox</i>	R2020b
Image Labeler <i>Big Image support</i>	R2021a
Medical Image Labeler <i>Medical Image Toolbox</i>	R2022b





**AUTOMOTIVE**

 Ground Truth Labeler




---

**SIGNAL PROCESSING AND COMMUNICATIONS**

 Audio Labeler     Signal Labeler

---

**IMAGE PROCESSING AND COMPUTER VISION**

 Image Labeler     Lidar Labeler     Video Labeler

# Labeler APP for Image

- 標記類別：image, video, lidar, medical data
- Important for training networks for:
  - 分類Classifiers
  - 物件偵測Object Detectors
  - 分割Segmentation
- Features:
  - 創建標記定義與屬性
  - 半自動標記與全自動標記，並且可匯入客製化演算法
  - 大尺寸影像預切割匯入
  - 自動超像素分割(Image, Video)

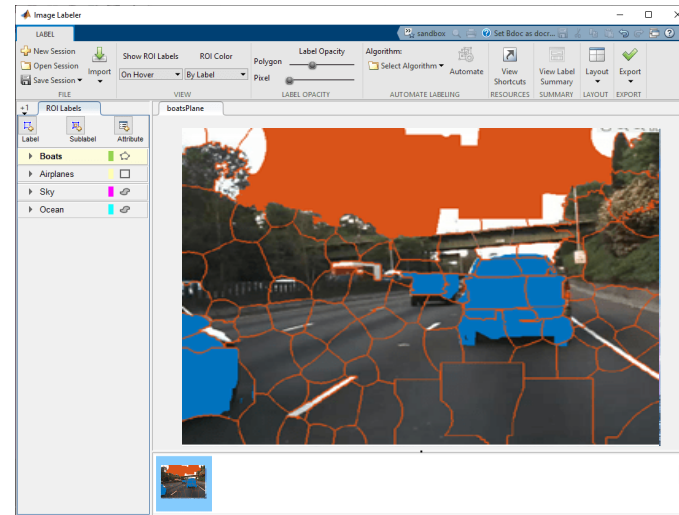
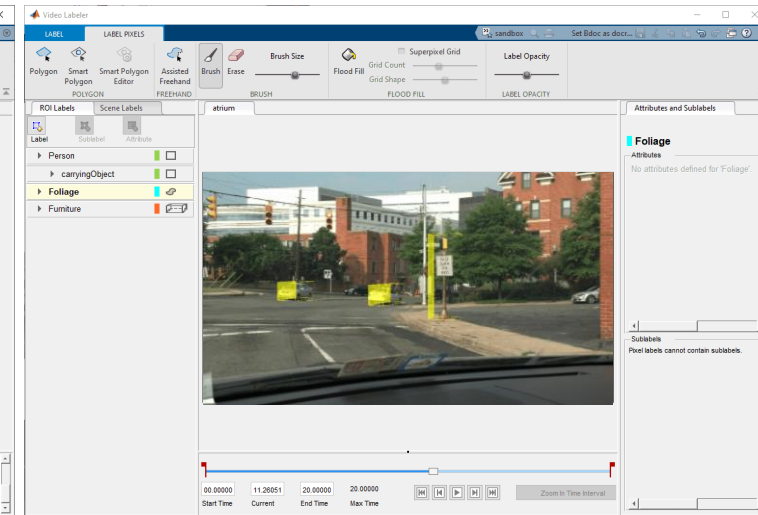
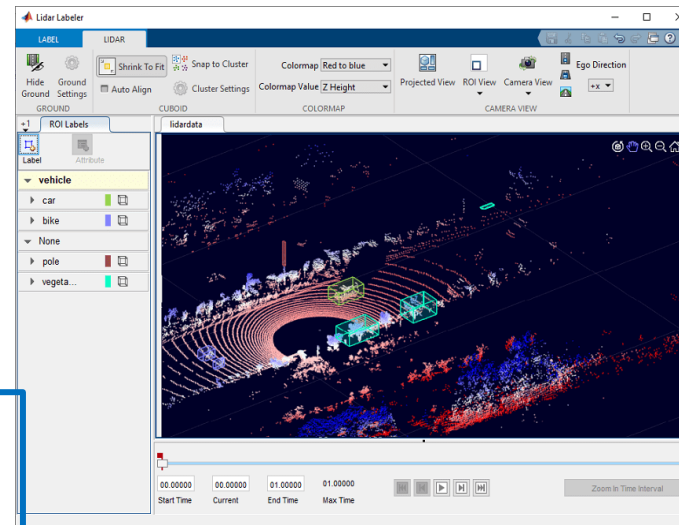


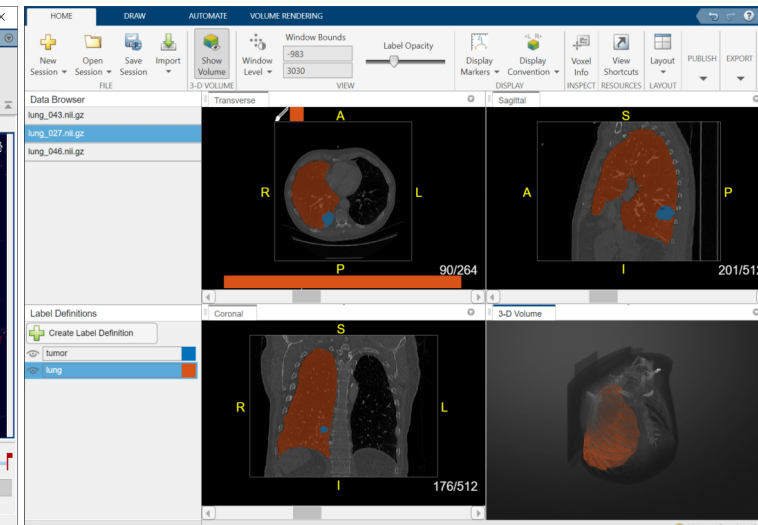
Image Labeler (Computer Vision Toolbox)



Video Labeler (Computer Vision Toolbox)



Lidar Labeler (Lidar Toolbox)



Medical Image Labeler (Medical Imaging Toolbox)

## New:

- Project 3D cuboid labels (Image, Video)
- Lidar labeler updates (Lidar section)
- Medical Image Labeler app (Medical section)

# Labeler APP for Signal

- 標記類別：Signal, Audio, MixData
- Important for training networks for:
  - 分類Classifiers
  - 回歸Regression
- Features:
  - 創建標記定義與屬性
  - 半自動標記與全自動標記，並且可匯入客製化演算法
  - 多個波段與訊號源音軌標記分析
  - 自動人聲分離與語音處理演算法
  - 多類別標記

The screenshot displays the Labeler APP interface. On the left, the 'Label Definitions' section shows a tree view with 'WhaleType', 'MoanRegions', 'TrillRegions', and 'TrillPeaks'. Below this is the 'Labeled Signal Set' table:

Name	Plot	Value	Location (Min)	Location (Max)
whale1	<input checked="" type="checkbox"/>	blue		
WhaleType		blue		
MoanRegions				
	<input checked="" type="checkbox"/>	true	6.13604115...	7.763
	<input type="checkbox"/>	true	16.37525	18.153984...
	<input type="checkbox"/>	true	11.4020000...	13.120148...
TrillRegions				
	<input type="checkbox"/>	true	1.4357724...	3.275
TrillPeaks				
	<input type="checkbox"/>	1	1.77425	
	<input type="checkbox"/>	2	2.44375	
	<input checked="" type="checkbox"/>	3	2.74225	
whale2	<input checked="" type="checkbox"/>	blue		
WhaleType		blue		
MoanRegions				
	<input checked="" type="checkbox"/>	true	2.44511966...	3.5605
	<input type="checkbox"/>	true	5.7136928...	8.113
	<input type="checkbox"/>	true	15.3215	16.712880...
TrillRegions				
	<input type="checkbox"/>	true	10.91475	13.152470...
TrillPeaks				
	<input type="checkbox"/>	1	11.50975	
	<input type="checkbox"/>	2	11.88	
	<input checked="" type="checkbox"/>	3	12.32975	

The main window shows a waveform plot with two channels, 'whale1' (blue) and 'whale2' (orange), over a time axis from 0 to 18 seconds. Annotations include shaded regions for 'MoanRegions' and 'TrillRegions', and triangles for 'TrillPeaks'. A legend at the bottom right identifies the colors for 'WhaleType' (blue) and 'MoanRegions' (orange).

On the right side, there is a sidebar with categories: 'AUTOMOTIVE' (Ground Truth Labeler), 'SIGNAL PROCESSING AND COMMUNICATIONS' (Audio Labeler, Signal Labeler), and 'IMAGE PROCESSING AND COMPUTER VISION' (Image Labeler, Lidar Labeler, Video Labeler).

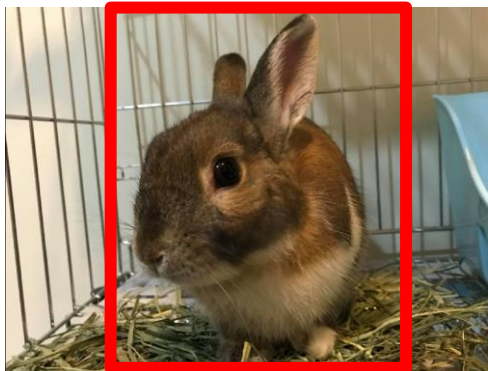
# 電腦視覺於深度學習

## Classification



Rabbit

## Classification + Localization



Rabbit

Single object

## Object Detection



Mini Lop & Hare

Multiple object

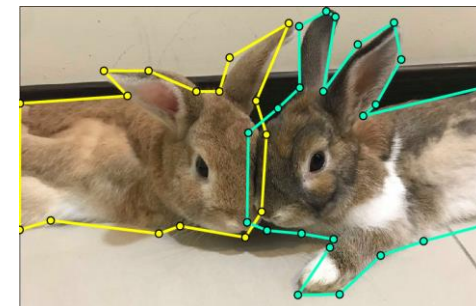
## Semantic Segmentation



Mini Lop & Hare

No object, just pixel

## Instance Segmentation



Mini Lop & Hare

Object & Pixel

Resnet 18/50/101  
VGG 16/19  
Darknet 19/53  
Inceptionv3  
xception

densenet201  
mobilenetv2  
nasnetmobile/large  
Effcientnetb0  
ConvMixer

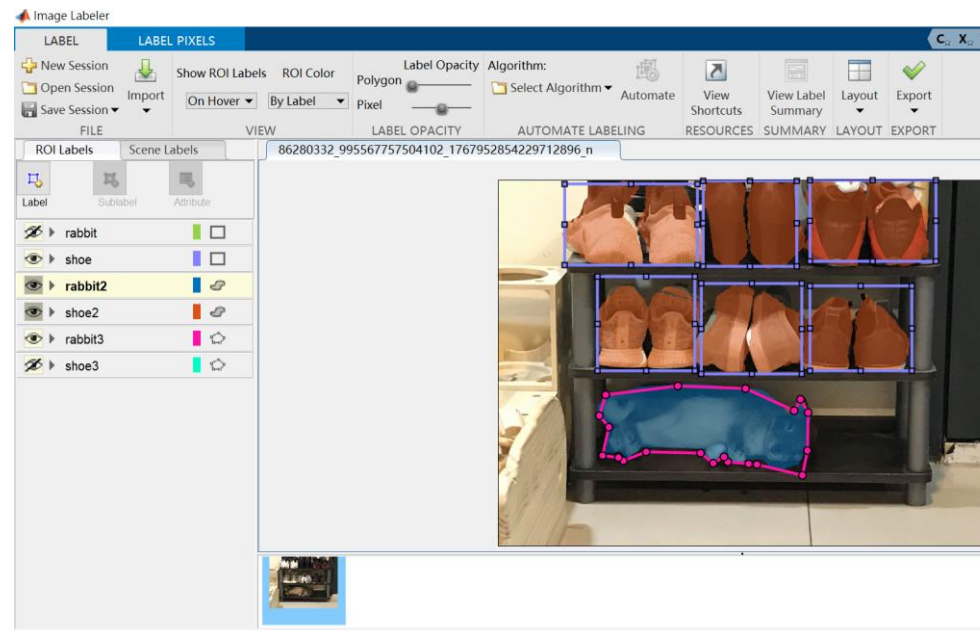
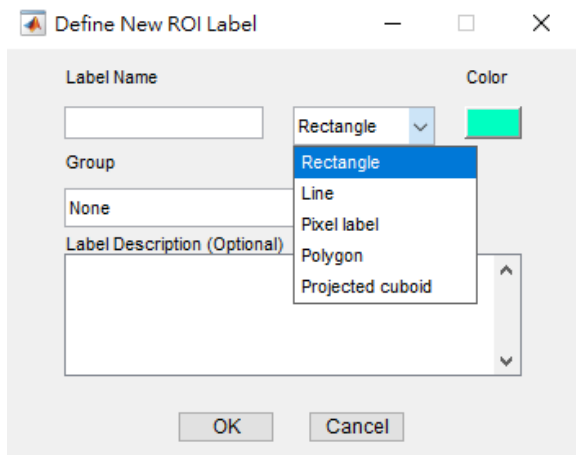
YOLOX  
YOLOv4,v3,v2  
EfficientDet - D0  
SSD  
Faster R-CNN

DeepLabv3+  
U-net  
3-D U-net  
AdaptSeg(GAN)

Mask R-CNN



# 影像中標記方式



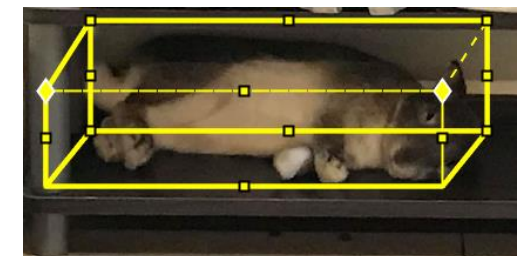
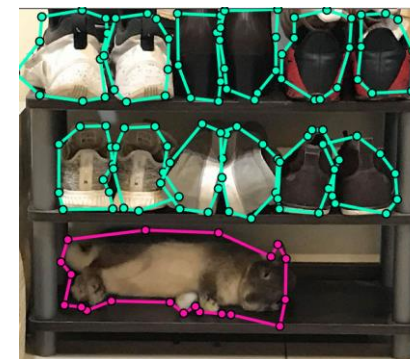
Lane line

Object Detection

Semantic Segmentation

Instance Segmentation

Point Cloud



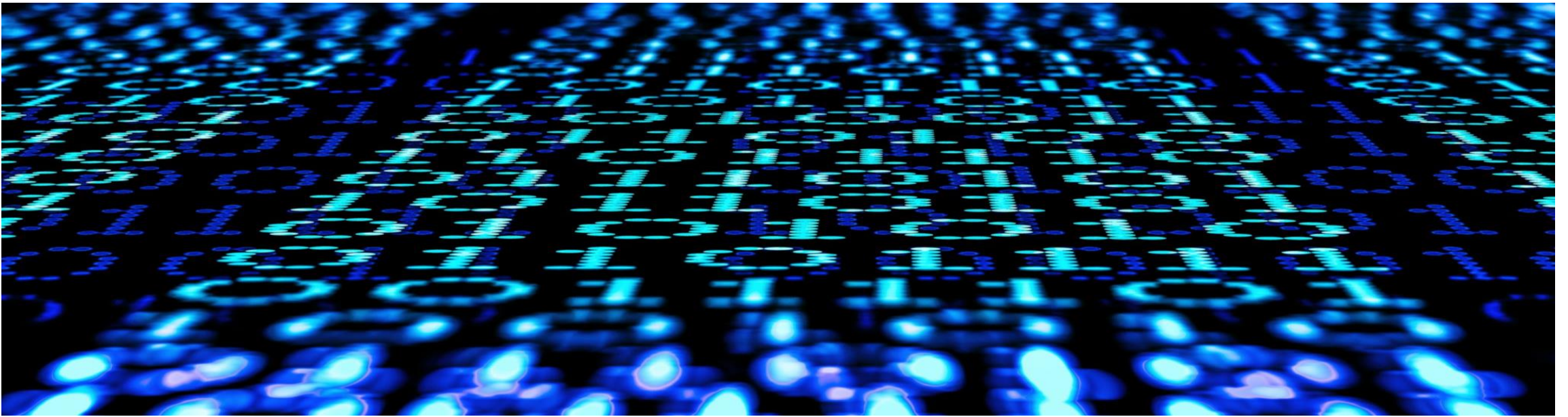
(Line)

(Rectangle)

(Pixel Label)

(Polygon)

(Projected cuboid)



## Low Code AI –

First : Data Labeling

**Second : Prepare Data**

# 龐大且眾多種類的AI資料庫

花最少的時間找到AI資料，  
最速開始進行模型訓練

- Images
- Video
- Signals
- Timeseris
- Text
- Autio
- Tabular Data

[Data Sets for Deep Learning](#) documentation page

[Data Sets for Machine Learning and Statistics](#) documentation page

The screenshot shows the MathWorks Help Center page for "Data Sets for Deep Learning". The page is titled "Data Sets for Deep Learning" and includes a navigation menu with "Documentation", "Examples", "Functions", and "Api". The main content area is titled "Image Data Sets" and lists several data sets with their descriptions and code snippets.

Data Set	Description
Zurich RAW to RGB	The Zurich RAW to RGB data set contains 48,043 spatially registered pairs of RAW and RGB training image patches of size 448-by-448 [15]. The data set contains two separate test sets. One test set consists of 1,204 spatially registered pairs of RAW and RGB image patches of size 448-by-448. The other test set consists of unregistered full-resolution RAW and RGB images. The data set is 22 GB. <pre>Create a directory to store the Zurich RAW to RGB data set.  imageDir = fullfile(tempdir, 'ZurichRAWtoRGB'); if ~exist(imageDir, 'dir')     mkdir(imageDir); end  To download the data set, request access using the Zurich RAW to RGB dataset form. Extract the data into the directory specified by the imageDir variable. If the extraction is successful, then imageDir contains three directories: full_resolution, test, and train.  For an example showing how to process this data for deep learning, see Develop Camera Processing Pipeline Using Deep Learning.</pre>
See-In-The-Dark (SID)	The See-In-The-Dark (SID) data set provides registered pairs of RAW images of the same scene [16]. In each pair, one image has a short exposure time and is underexposed, and the other image has a longer exposure time and is well-exposed. The size of the Sony camera data from the SID data set is 25 GB. <pre>Specify dataDir as the desired location of the data.  dataDir = fullfile(tempdir, "SID"); if ~exist(dataDir, "dir")     mkdir(dataDir); end</pre>
Digits	The digits data set consists of 10,000 synthetic grayscale images of handwritten digits. Each image is 28-by-28 pixels and has an associated label denoting which digit the image represents (0–9). Each image has been rotated by a certain angle. When loading the images as arrays, you can also load the rotation angle of the image. <pre>Load the digits data as in-memory numeric arrays using the digitTrain4DArrayData and digitTest4DArrayData functions.  [XTrain, YTrain, anglesTrain] = digitTrain4DArrayData; [XTest, YTest, anglesTest] = digitTest4DArrayData;  For examples showing how to process this data for deep learning, see Monitor Deep Learning Training Progress and Train Convolutional Neural Network for Regression.</pre>

# 花更少的時間整理資料

## 節省大量的時間整理大量的資料以及不適合儲存的資料集

tabularTextDatastore	R2014b
imageDatastore	R2015b
augmentedImageDatastore	R2018a
audioDatastore <i>Audio Toolbox</i>	R2018b
parquetDatastore	R2019a
<i>DenoisingImageDatastore</i> <i>Image Processing Toolbox</i>	R2019b
signalDatastore <i>Signal Processing Toolbox</i>	R2020a
blockedImageDatastore <i>Image Processing Toolbox</i>	R2021a

### Datastores for Deep Learning

R2020a

Datastores in MATLAB® are a convenient way of working with and representing collections of data that are too large to fit in memory at one time. Because deep learning often requires large amounts of data, datastores are an important part of the deep learning workflow in MATLAB.

#### Select Datastore

For many applications, the easiest approach is to start with a built-in datastore. For more information about the available built-in datastores, see [Select Datastore for File Format or Application](#) (MATLAB). However, only some types of built-in datastores can be used directly as input for network training, validation, and inference. These datastores are:

Datastore	Description	Additional Toolbox Required
<a href="#">ImageDatastore</a>	Datastore for image data	none
<a href="#">AugmentedImageDatastore</a>	Datastore for resizing and augmenting training images  Datastore is <a href="#">nondeterministic</a>	none
<a href="#">PixelLabelDatastore</a>	Datastore for pixel label data	Computer Vision Toolbox™
<a href="#">PixelLabelImageDatastore</a>	Datastore for training semantic segmentation networks  Datastore is <a href="#">nondeterministic</a>	Computer Vision Toolbox
<a href="#">boxLabelDatastore</a>	Datastore for bounding box label data	Computer Vision Toolbox
<a href="#">RandomPatchExtractionDatastore</a>	Datastore for extracting random patches from image-based data  Datastore is <a href="#">nondeterministic</a>	Image Processing Toolbox™
<a href="#">bigimageDatastore</a>	Datastore to manage blocks of single large images that do not fit in memory	Image Processing Toolbox
<a href="#">DenoisingImageDatastore</a>	Datastore to train an image denoising deep neural network  Datastore is <a href="#">nondeterministic</a>	Image Processing Toolbox

# 資料擴充：花更少的時間做資料前處理

支援各種資料前處理與資料擴充的演算法

可應用於：影像，訊號

支援各種尺寸縮放、旋轉、位移、切割、色溫更改等。

imageDataAugmenter  
Image Processing Toolbox

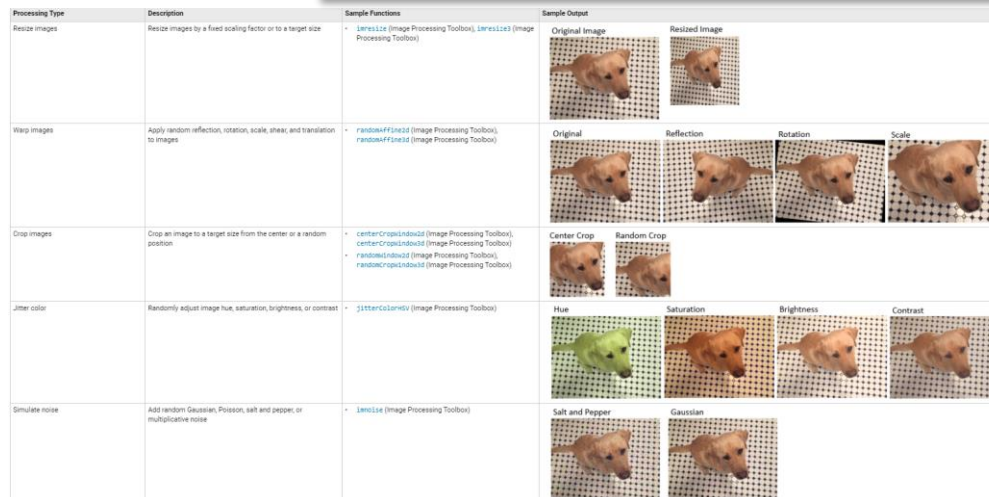
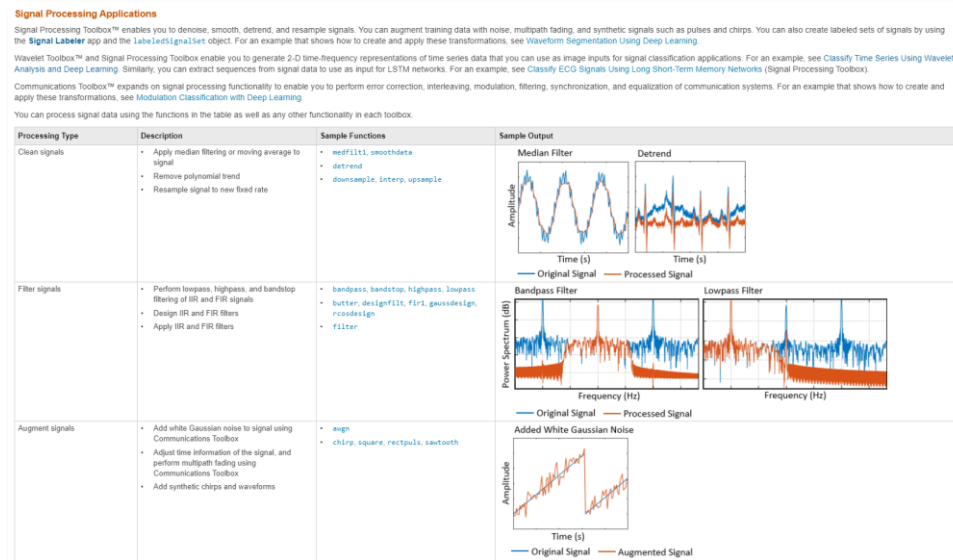
R2017b

waveletScattering  
Wavelet Toolbox

R2018b

audioFeatureExtractor  
Audio Toolbox

R2019b

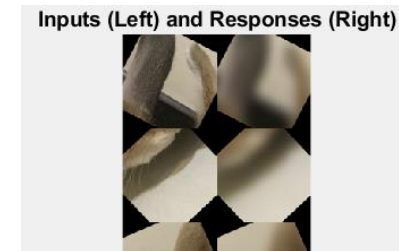


# 資料擴充：RandomPatchExtractionDatastore

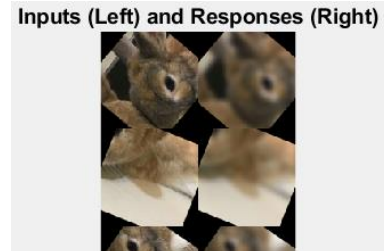
↓  
Show some demo



Patch size:150



Patch size:300



[imageDataAugmenter](#) with

**%% Input Data**

```
FillValue: 0  
RandXReflection: 1  
RandYReflection: 0  
RandRotation: [0 90]
```

```
imds1 = imageDatastore('rabbit');  
imds2 = transform(imds1,@(x)imgaussfilt(x,8));
```

**%% Image Augmenter**

```
RandScale: [1 1]  
RandXScale: [1 1]  
RandYScale: [1 1]  
RandXShear: [0 C]  
RandYShear: [0 C]
```

```
augmenter = imageDataAugmenter('RandRotation',[0 90],'RandXReflection',true);
```

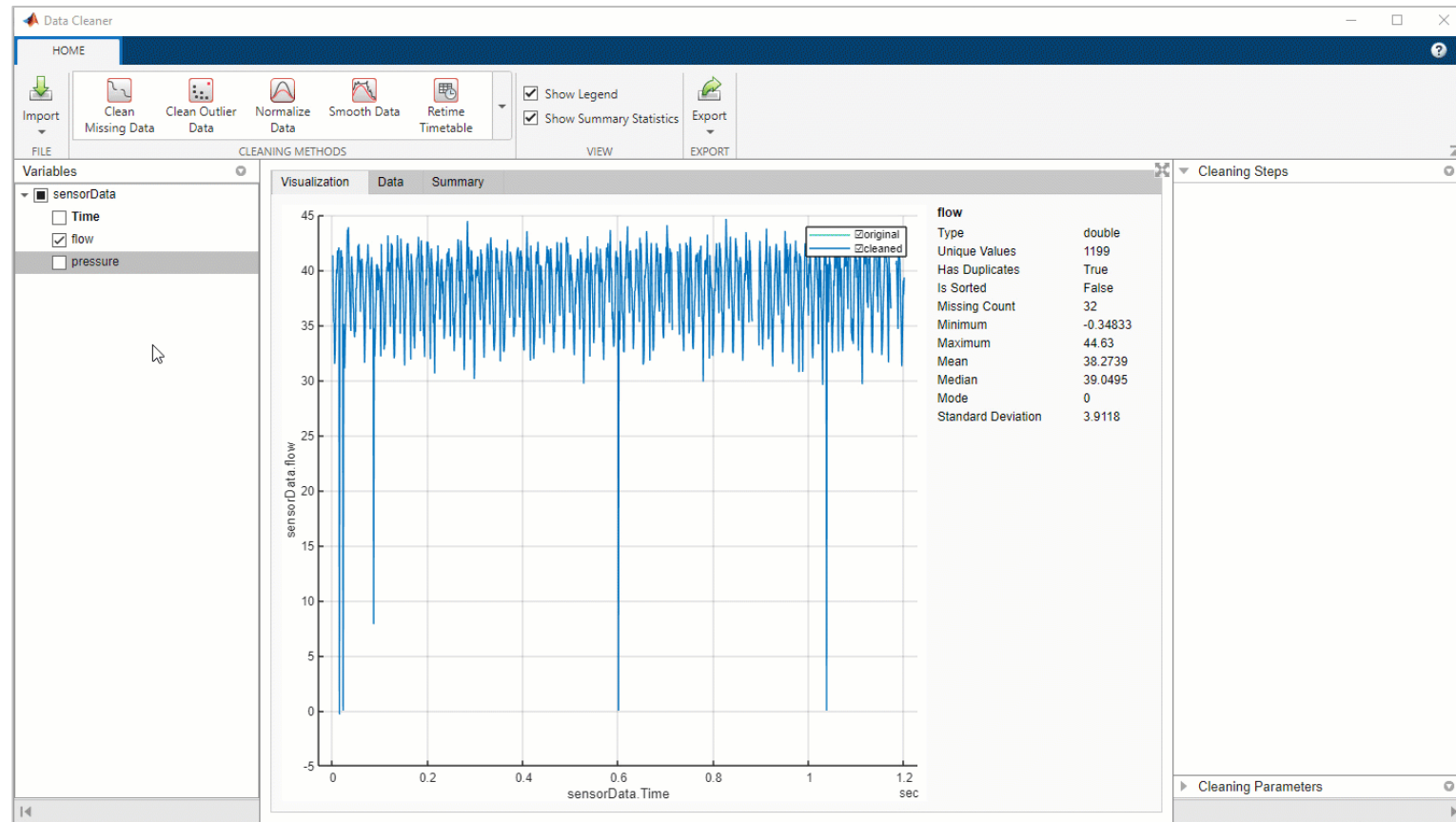
**%% RandPatchExtraction**

```
RandXTranslation: [0 C]  
RandYTranslation: [0 C]
```

```
patchds = randomPatchExtractionDatastore(imds1,imds2,[500 500], ...  
    'DataAugmentation',augmenter);
```

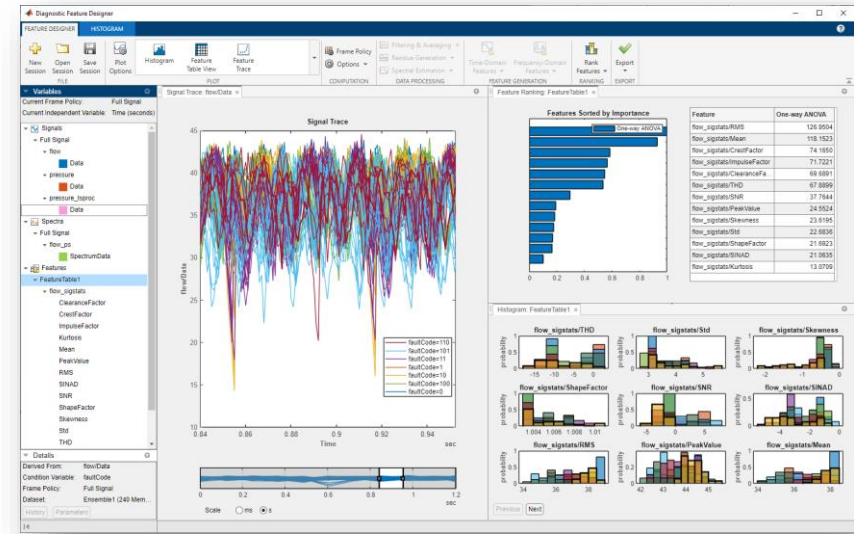
# Data Cleaner APP 預處理資料清洗

- Get insights on data impurities
- Interactively clean, verify and adjust
- Export to workspace or generate MATLAB code
- Works on tables or timetables
- **Supports:**
  - Missing data
  - Outlier data
  - Normalize and smoothing
  - Retiming
  - Stacking and unstacking



Data Cleaner

# Diagnostic Feature Designer APP 自動特徴提取工具



*Diagnostics Feature Designer*

Signal Analyzer

R2016a

Text Analytics Toolbox

R2017b

waveletScattering

R2018b

Diagnostic Feature Designer app

R2019a

signalTimeFeatureExtractor

R2021b

signalFrequencyFeatureExtractor

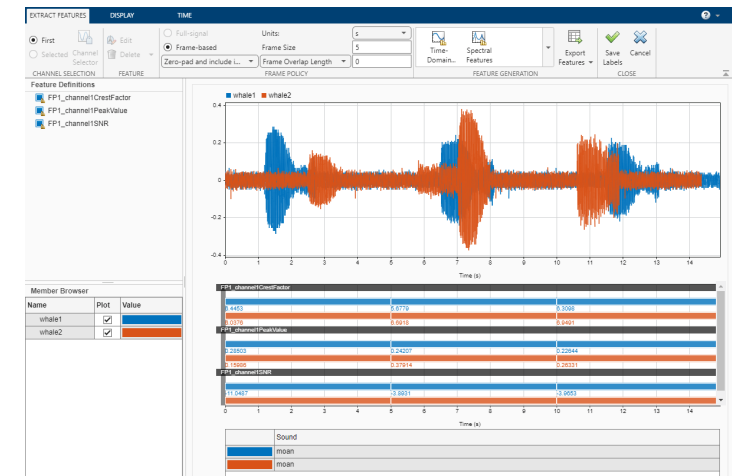
R2021b

Extract Features in Signal Labeler

R2022a

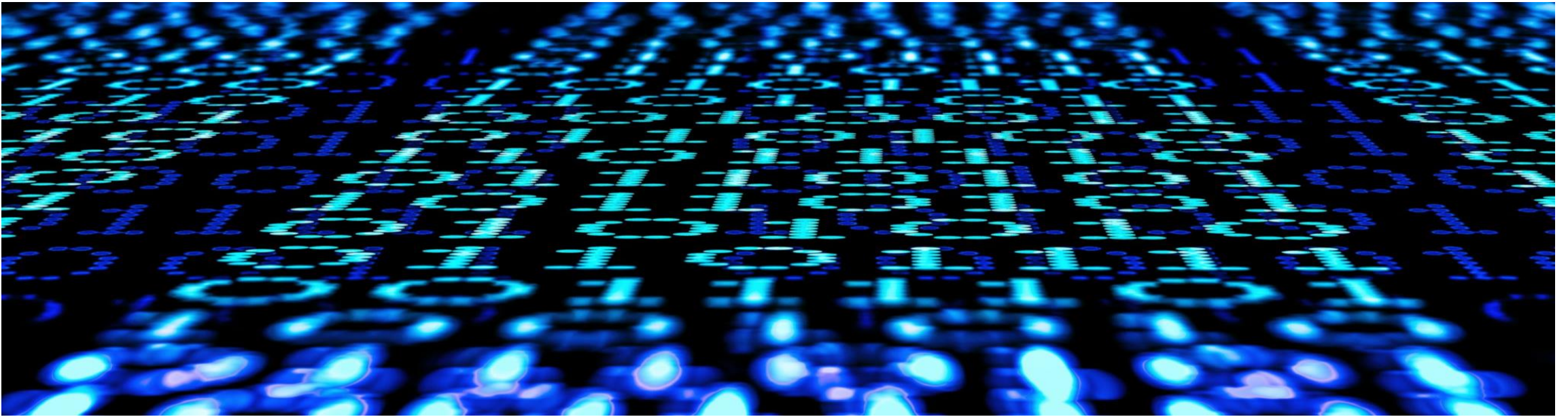
Identify important features and perform dimensionality reduction

PCA, T-SNE, NCA, Laplacian scores, MRMR, RICA, NNMF, Factor Analysis, and many more...



*Feature Extraction in Signal Labeler*





## Low Code AI –

First : Data Labeling

Second : Prepare Data

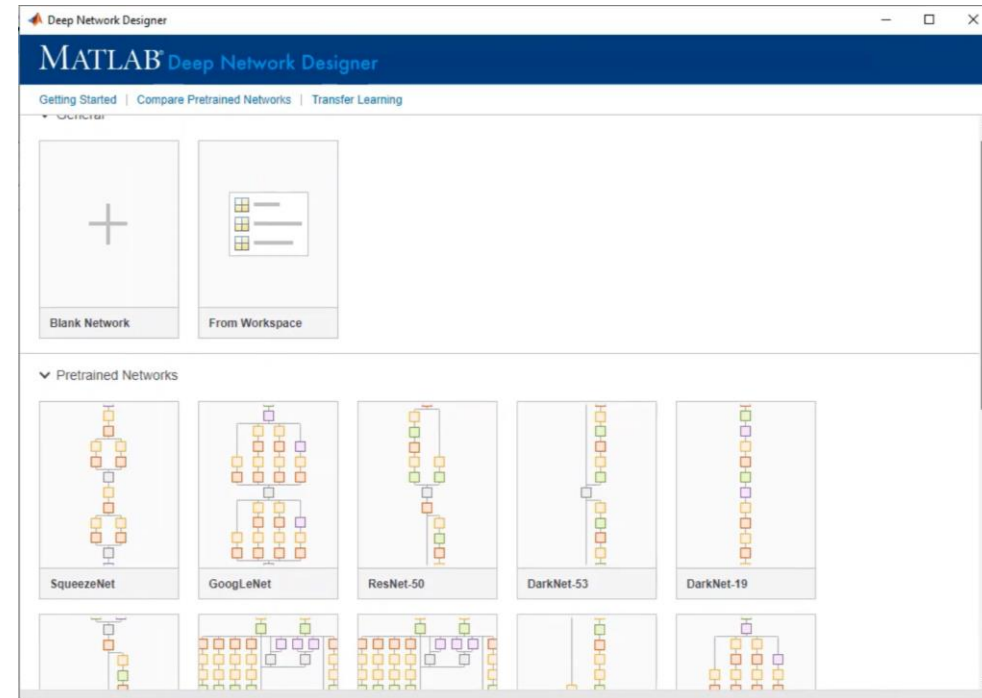
**Third : AI Modeling**

# No Code可視化，快速AI深度學習模型建立

## Build, visualize, edit & train network Deep Network Designer

- 自定義編輯網路，自動分析網路架構
- 自由拖拉模塊，與匯入自定義層
- 內建資料擴充與可視化資料
- 訓練網路，並且可視化訓練流程與參數

Initial release	R2018b
Automatically generate code	R2019a
Import Data & Train Networks	R2020a
Import pretrained networks	R2020a
Timeseries support	R2020b
Export to Simulink	R2021b
Create experiments for Experiment Manager	R2022a



Deep Network Designer app to build, visualize, and edit deep learning networks

# No Code可視化，快速AI機器學習模型建立

- 一鍵執行三十多種的模型訓練
- 匯入後可透過特徵提取排名特徵強度
- 模型的各種輸出可視化呈現

Optimizable models that train hyperparameters using Bayesian Optimization

R2019b

Added “shallow” neural nets

R2021a

Kernel linear models and optimized neural nets

R2021b

Feature ranking

R2022a

Train/Validation/Test split

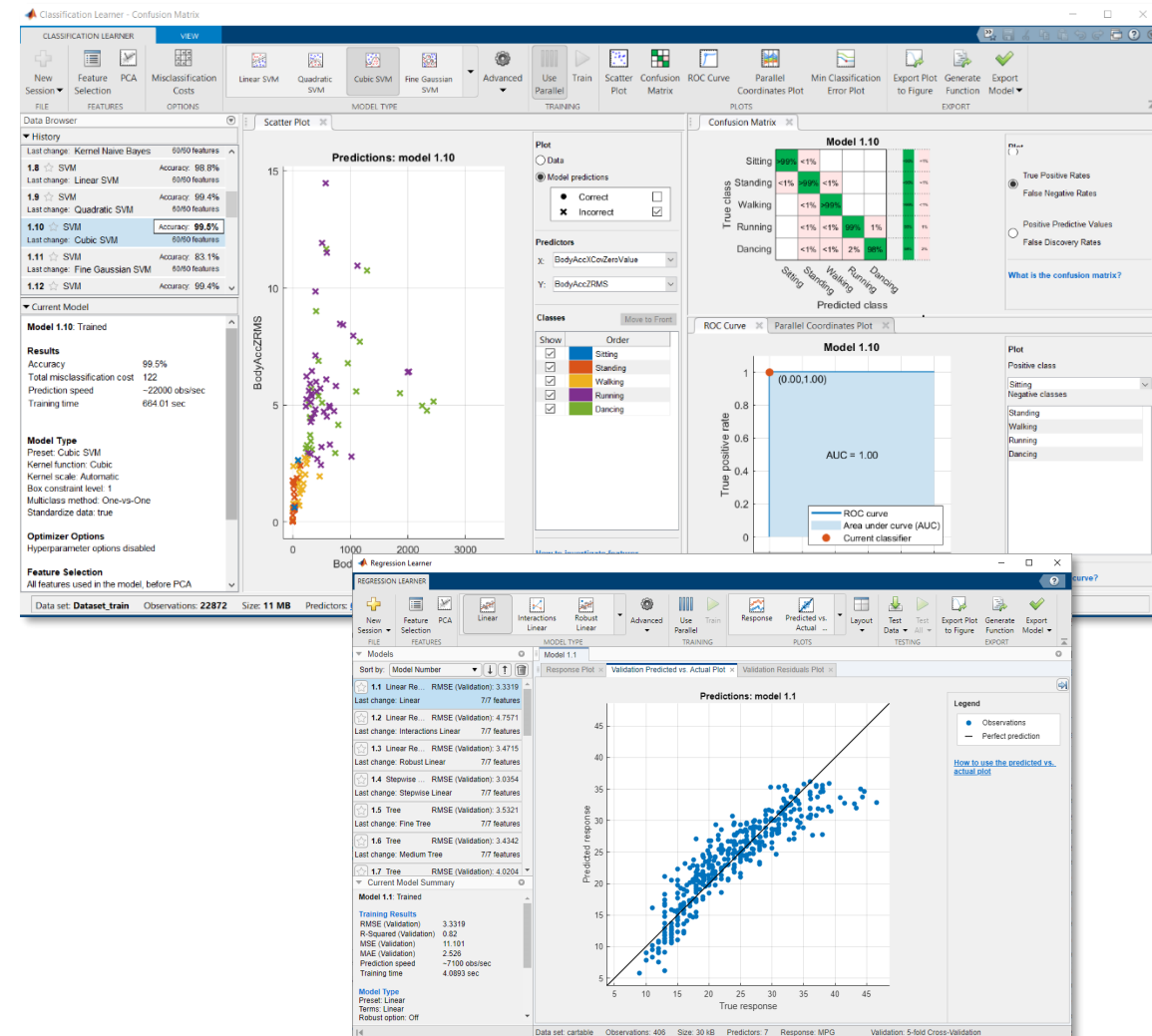
R2022a

Partial dependence plots

R2022b

Model comparison table

R2022b

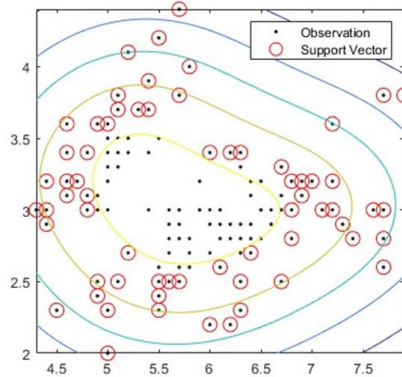


# 使用機器學習進行異常檢測

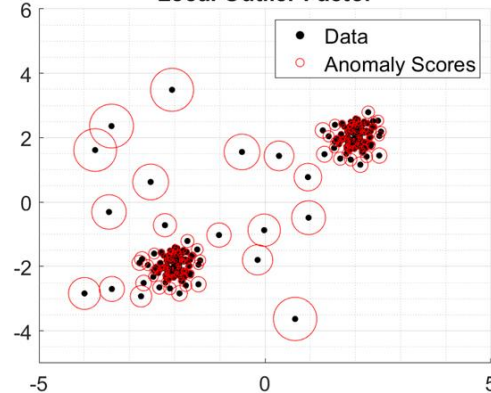
- 使用正常數據訓練模型，使用模型檢測離群點

Isolation forest models for anomaly detection	R2019b
Local outlier factor calculation	R2022b
Efficient one-class support vector machine (SVM) models using primal solver	R2022b

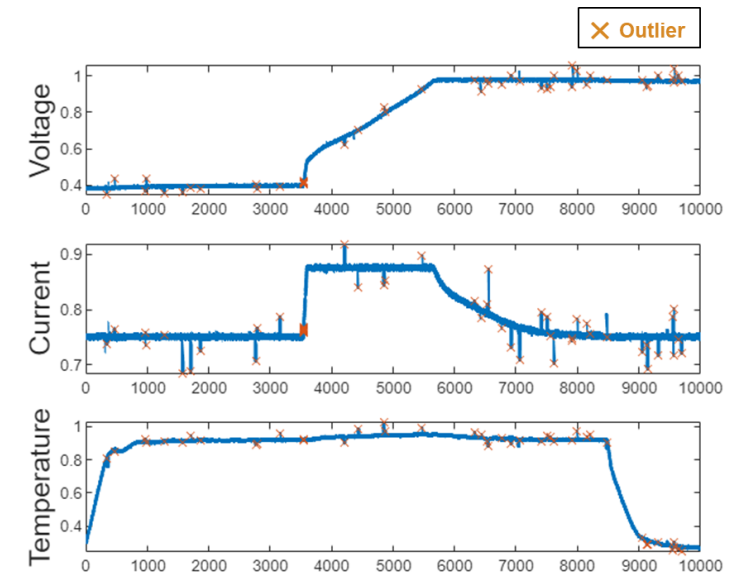
One-class Support Vector Machine (ocsvm)

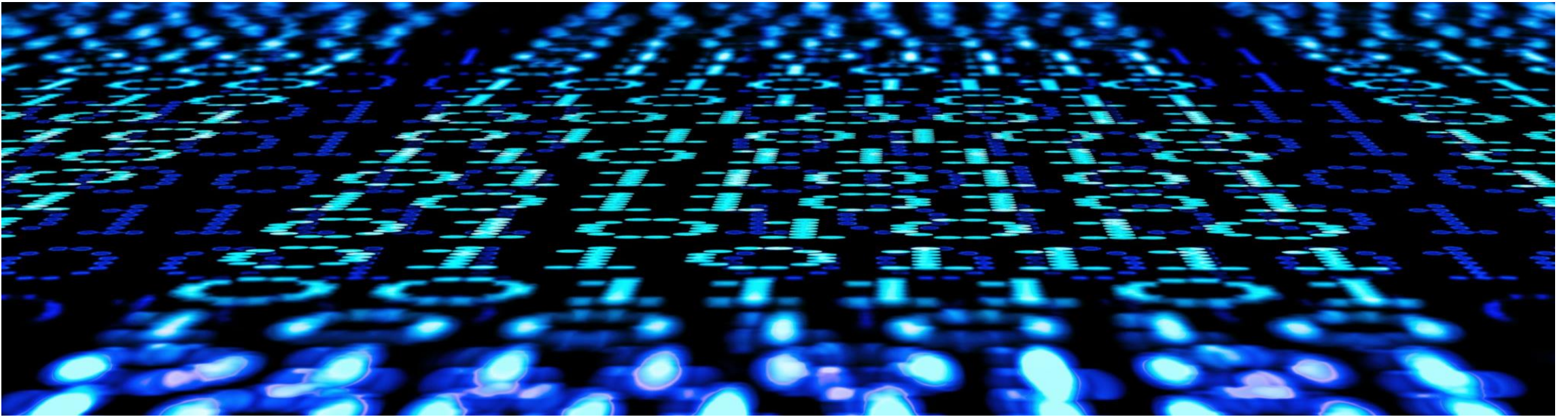


Local Outlier Factor



\*Faster than fitsvm() on large datasets due to primal solver.





## Low Code AI –

First : Data Labeling

Second : Prepare Data

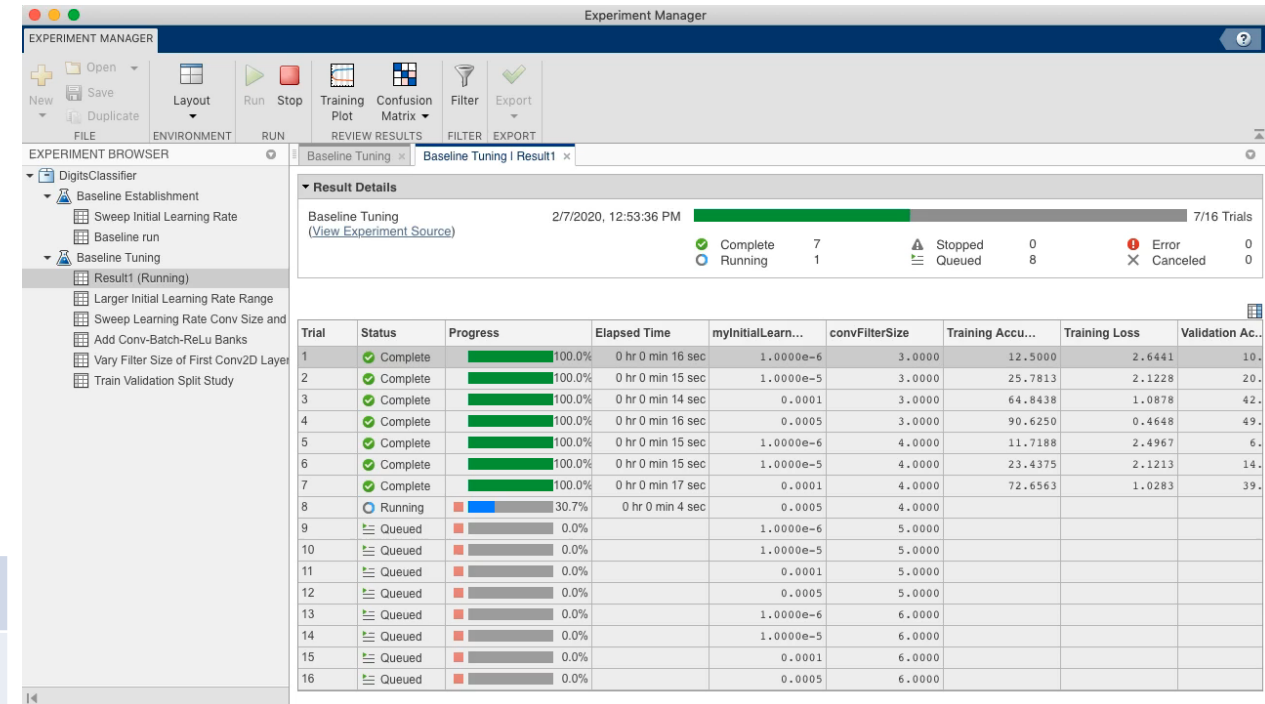
Third : AI Modeling

**Fourth : AI Simulation**

# 進行實驗找到最佳化模型參數

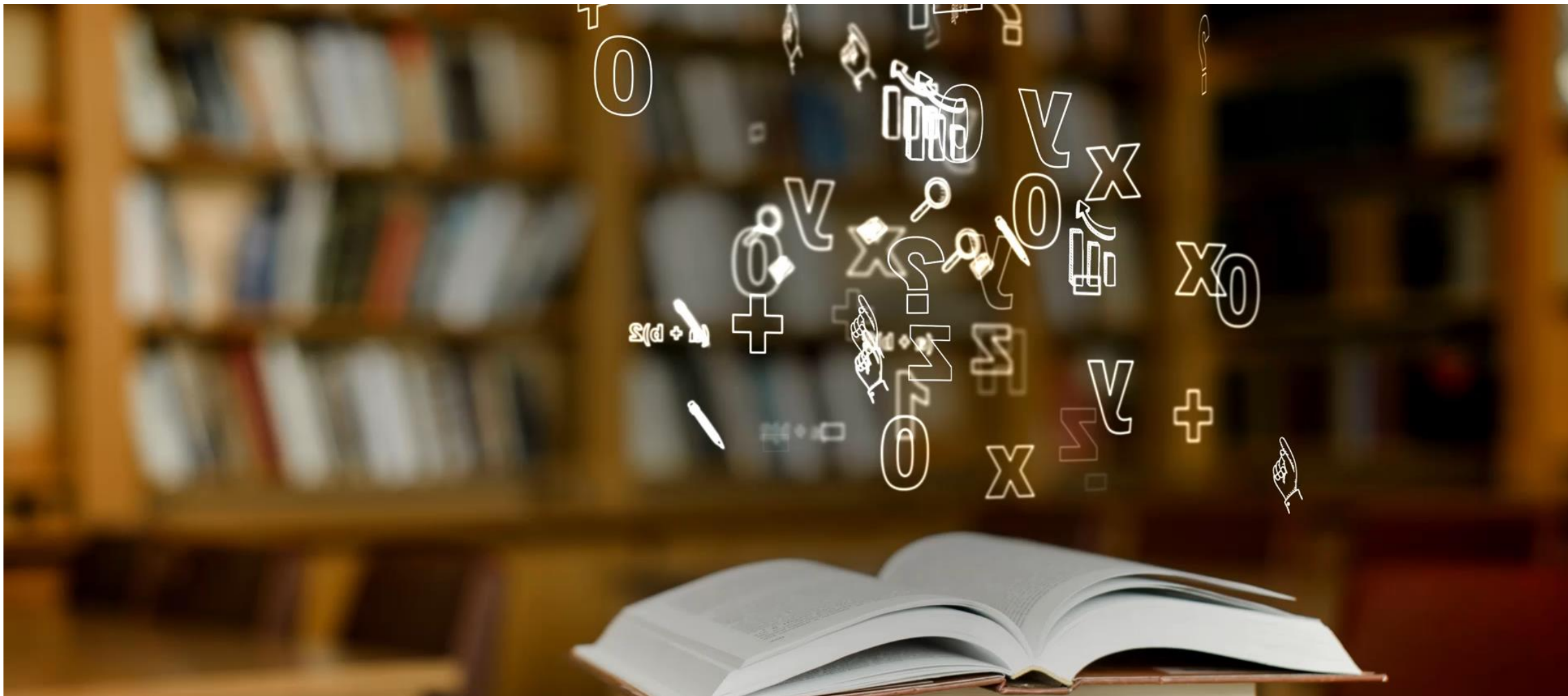
使用 Deep Learning Experiment APP :

- 掃描一系列超參數值
- 比較使用不同資料集的結果
- 測試不同的深度網絡架構



Experiment Manager app to manage multiple deep learning experiments, analyze and compare results and code

Initial release	R2020a
Train networks in parallel	R2020b
Bayesian optimization	R2020b
Custom Training Experiments	R2021a
MATLAB online support	R2021b
Offload experiments as batch jobs	R2022a



## 教學資源

## 各領域線上課程

自選上課時間，互動式練習實作，完成頒發證書



實際操作範例，系統在過程中自動提供協助



針對成果及時給予回饋
















完成頒發證書，證書可即時分享。








# 課程主題

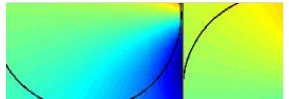
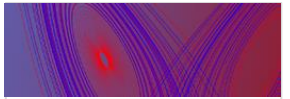
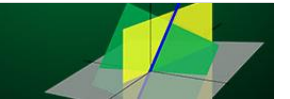

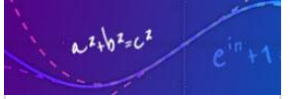
## Getting Started

 FREE	 FREE	 FREE	 FREE	 FREE	 FREE	 NEW FREE	 NEW
MATLAB Onramp	Deep Learning Onramp	Reinforcement Learning Onramp	Machine Learning Onramp	Image Processing Onramp	Signal Processing Onramp	Optimization Onramp	Wireless Communications Onramp
 FREE	 FREE	 FREE	 FREE	 NEW FREE			
Simulink Onramp	Control Design Onramp with Simulink	Stateflow Onramp	Simscape Onramp	Circuit Simulation Onramp			

## MATLAB

		
MATLAB Fundamentals	MATLAB for Data Processing and Visualization	MATLAB Programming Techniques
		 NEW
Deep Learning with MATLAB	Machine Learning with MATLAB	Image Processing with MATLAB

## Computational Mathematics

 NEW		
Signal Processing with MATLAB	Solving Nonlinear Equations with MATLAB	Solving Ordinary Differential Equations with MATLAB
		
Introduction to Linear Algebra with MATLAB	Introduction to Symbolic Math with MATLAB	

# Youtube 資源

## Fred玩MATLAB

Low Code AI ▶ 全部播放



2022a更新! 深度學習(Deep Network Designer) - MATLAB...

Fred玩MATLAB  
觀看次數: 563次 · 8 個月前



2022a更新! 機器學習(Classification Learner) - ...

Fred玩MATLAB  
觀看次數: 400次 · 8 個月前

影片 ▶ 全部播放



MATLAB深度學習之七(3)RabbitDetect語意分割篇...

觀看次數: 72次 · 1 個月前



MATLAB深度學習之七(3)RabbitDetect語意分割篇...

觀看次數: 66次 · 1 個月前



MATLAB深度學習之七(2)RabbitDetect語意分割篇...

觀看次數: 48次 · 1 個月前



MATLAB深度學習之七(1)RabbitDetect語意分割篇...

觀看次數: 74次 · 1 個月前



深度學習超參數搜索(Experiment Manager) - ...

觀看次數: 64次 · 1 個月前



醫學影像標記工具(Medical Image Labeler) - MATLAB三...

觀看次數: 88次 · 1 個月前

熱門影片 ▶ 全部播放



不用寫code, 快速在MATLAB中使用Transfer Learning...

觀看次數: 4560次 · 2 年前



使用五行程式碼, 快速在MATLAB中使用深度學習模型

觀看次數: 2725次 · 2 年前



深度學習(Deep Network Designer) - MATLAB三分鐘...

觀看次數: 2347次 · 1 年前



影像標記(Image Labeler) - MATLAB三分鐘不用寫code...

觀看次數: 1448次 · 2 年前



機器學習(Classification Learner) - MATLAB三分鐘不...

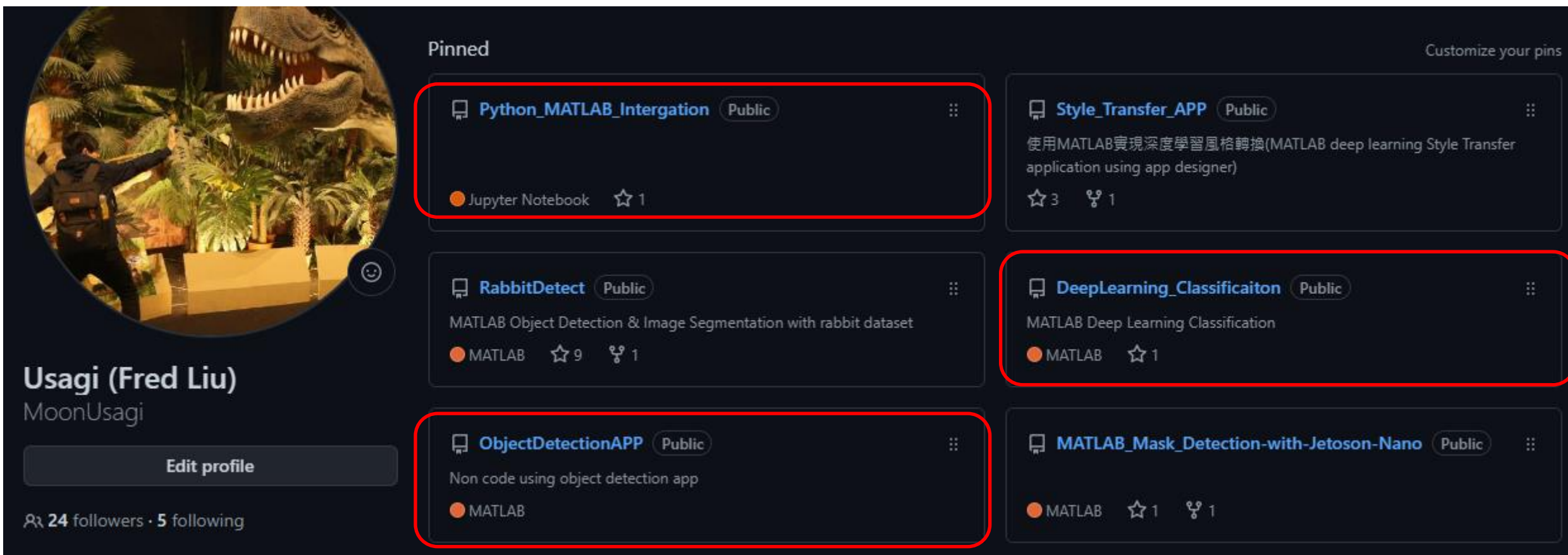
觀看次數: 1336次 · 1 年前



Use YOLOv4 to detect hockey video in MATLAB

觀看次數: 950次 · 2 年前

# GitHub 資源



The screenshot displays the GitHub profile of Usagi (Fred Liu). The profile includes a circular profile picture of a person in a dark jacket standing in front of a large dinosaur head sculpture in a museum-like setting. Below the picture is the name "Usagi (Fred Liu)" and the username "MoonUsagi". There is an "Edit profile" button and a notification that the user has 24 followers and is following 5 people.

The "Pinned" section shows six repositories, each with a red border highlighting its title and description:

- Python\_MATLAB\_Intergation** (Public): A Jupyter Notebook with 1 star.
- Style\_Transfer\_APP** (Public): A MATLAB application using app designer for style transfer, with 3 stars and 1 fork.
- RabbitDetect** (Public): MATLAB Object Detection & Image Segmentation with rabbit dataset, with 9 stars and 1 fork.
- DeepLearning\_Classificaiton** (Public): MATLAB Deep Learning Classification, with 1 star.
- ObjectDetectionAPP** (Public): Non code using object detection app, with 0 stars.
- MATLAB\_Mask\_Detection-with-Jetson-Nano** (Public): MATLAB application, with 1 star and 1 fork.

# GitHub 資源



## MATLAB Deep Learning

Deep learning resources, including pretrained neural network models.

<https://www.mathworks.com/solution...>

[Overview](#) [Repositories](#) 53 [Projects](#) [Packages](#) [People](#) 34

### Pinned

[MATLAB-Deep-Learning-Model-Hub](#) Public

Discover pretrained models for deep learning in MATLAB

MATLAB ☆ 172 🔗 36

[Image-Classification-in-MATLAB-Using-TensorFlow](#) Public

This example shows how to call a TensorFlow model from MATLAB using co-execution with Python.

MATLAB ☆ 21 🔗 8

[Image-Classification-in-MATLAB-Using-Converted-TensorFlow-Model](#) Public

This repository shows how to import a pretrained TensorFlow model in the SavedModel format, and use the imported network to classify an image.

MATLAB ☆ 1

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