



探索.NET新世界







### 誰說 AI 人員不能和維運團隊合作!?

### MLOps 深入淺出

Jennie Lin

## 你可能會問?

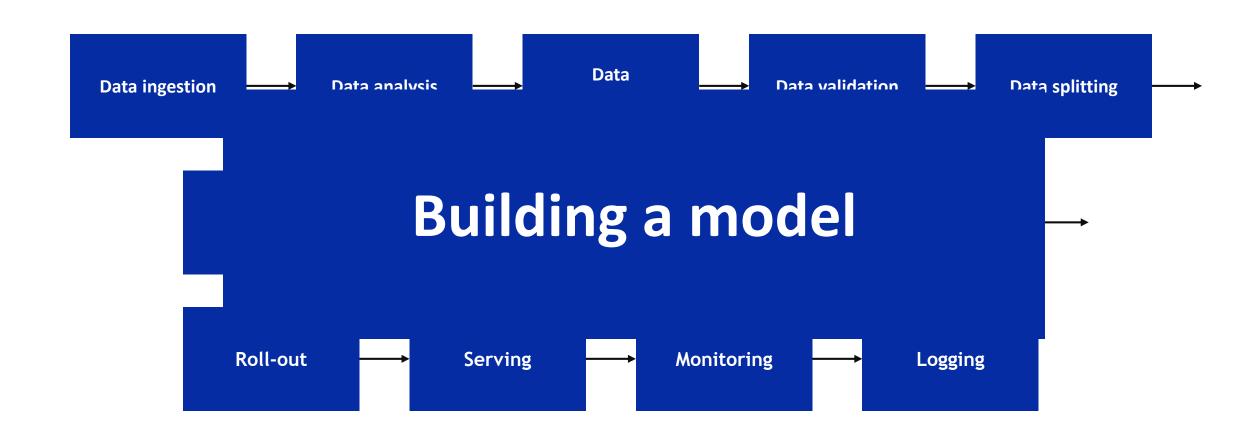
- 1. 為什麼有MLOps?
- 2. Azure 為 MLOps 投資什麼?
- 3. 我如何利用MLOps 功能?

# 為什麼有 MLOps?

## 典型數據科學的過程

**Building a model** 

## 典型數據科學的過程



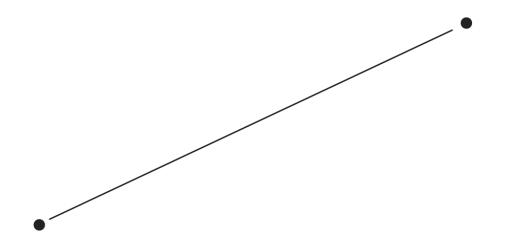
## 成功實施ML的障礙

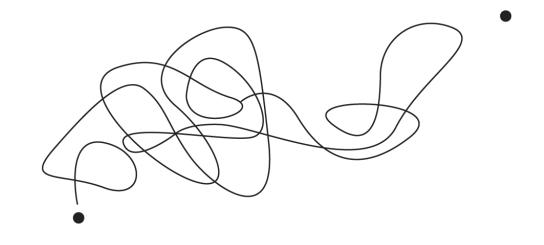
96%

5%

的公司AI計劃都在努力超越測試階段的公司成功地充分利用機器學習模型

### 成功實施ML的障礙

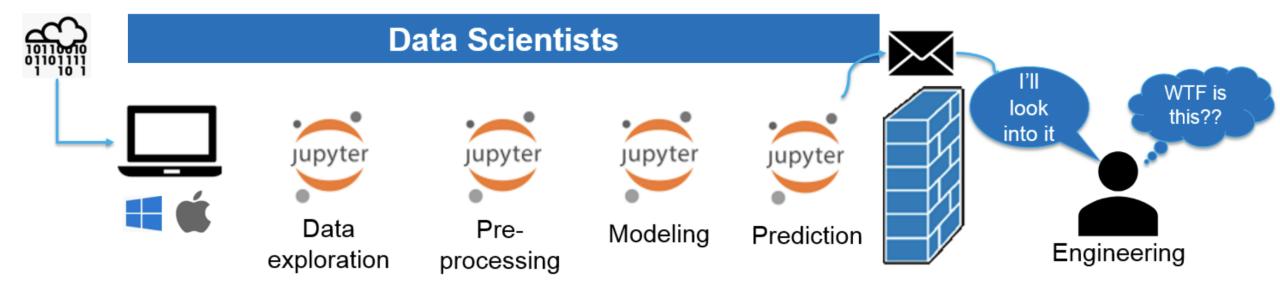




理想

現實

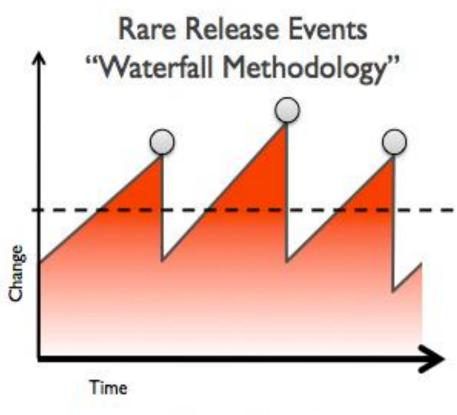
## 成功實施ML的障礙



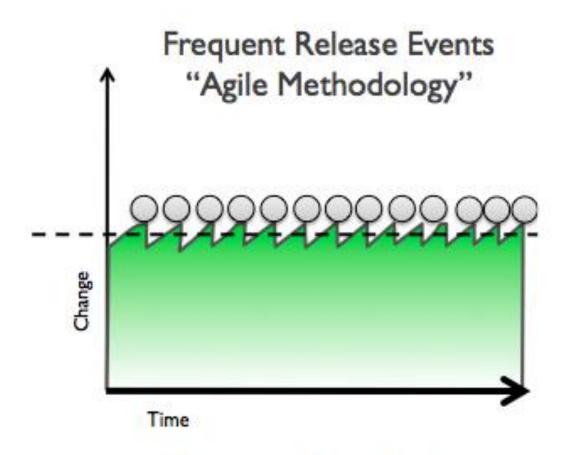


### 我們不希望......

### 我們希望.....



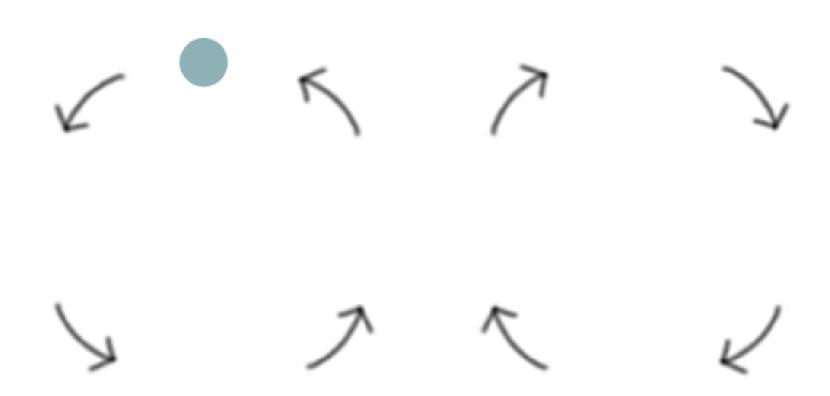
Effort Peaks High Risk



Smoother Effort Less Risk

### 持續交付不停歇的產生價值





## MLOps = ML + DEV + OPS

### **MLOps**

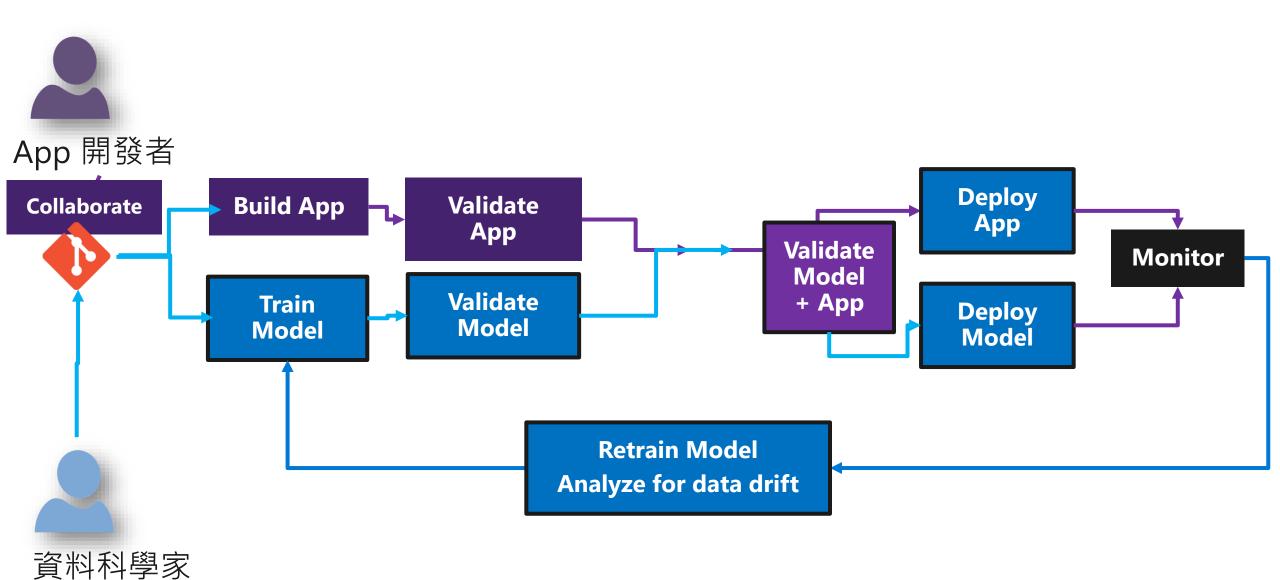
Develop 模型+ 測試 持續整合 持續部署



Operate 持續交付 資料品質回饋 系統與模型監控

Experiment 獲取資料 理解業務 模型初始設計

綠字: 機器學習 , 藍字: DevOps



## DevOps vs MLOps

### DevOps

### **MLOps**



© Code保存與使用



模型保存與使用



**Code** 測試



**学**模型驗證



應用程式部署

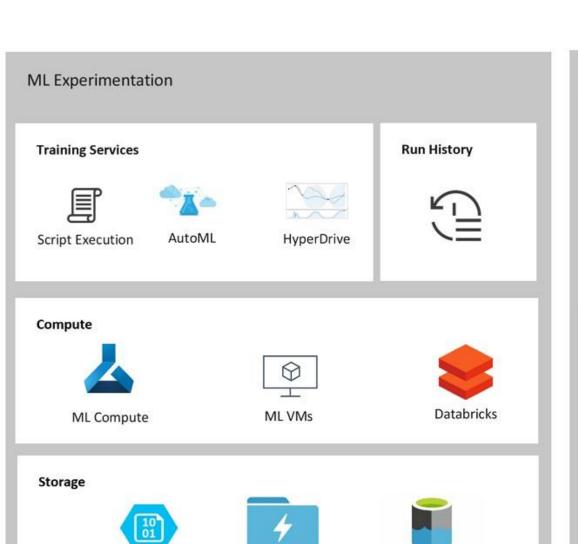


模型部署



模型再訓練

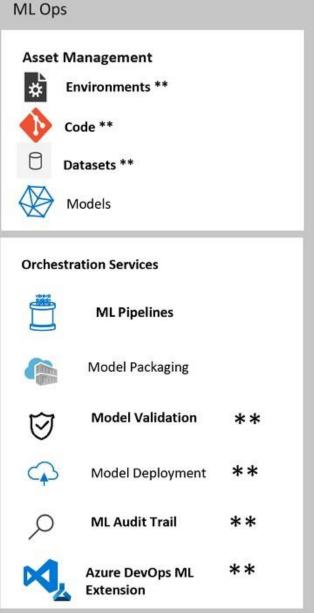
## MLOps的工具

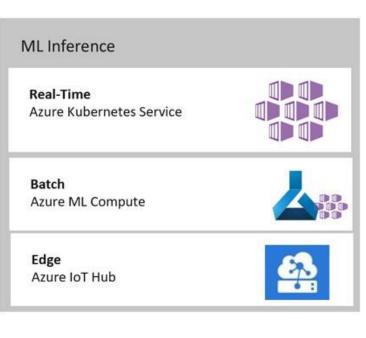


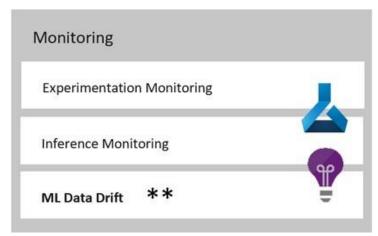
Files

Data Lake

**Blob Store** 

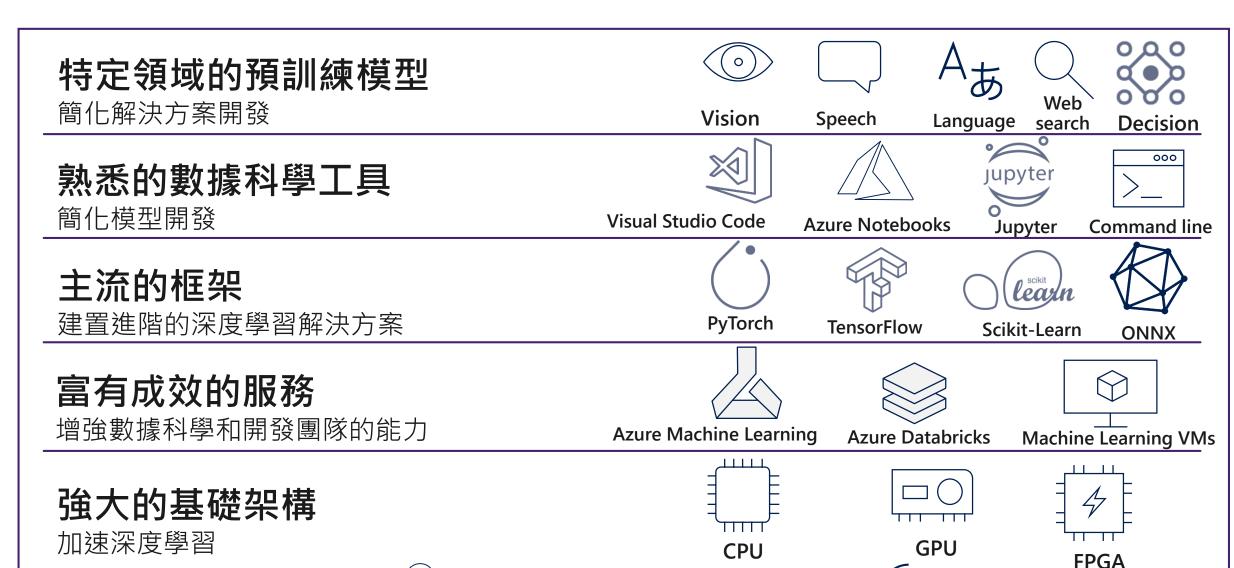






## Azure E É SML

### Machine Learning on Azure

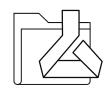


From the Intelligent Cloud to the Intelligent Edge



## Azure Machine Learning

### **Azure Machine Learning Service**



#### Workspace



實驗



模型



管線



影像



計算



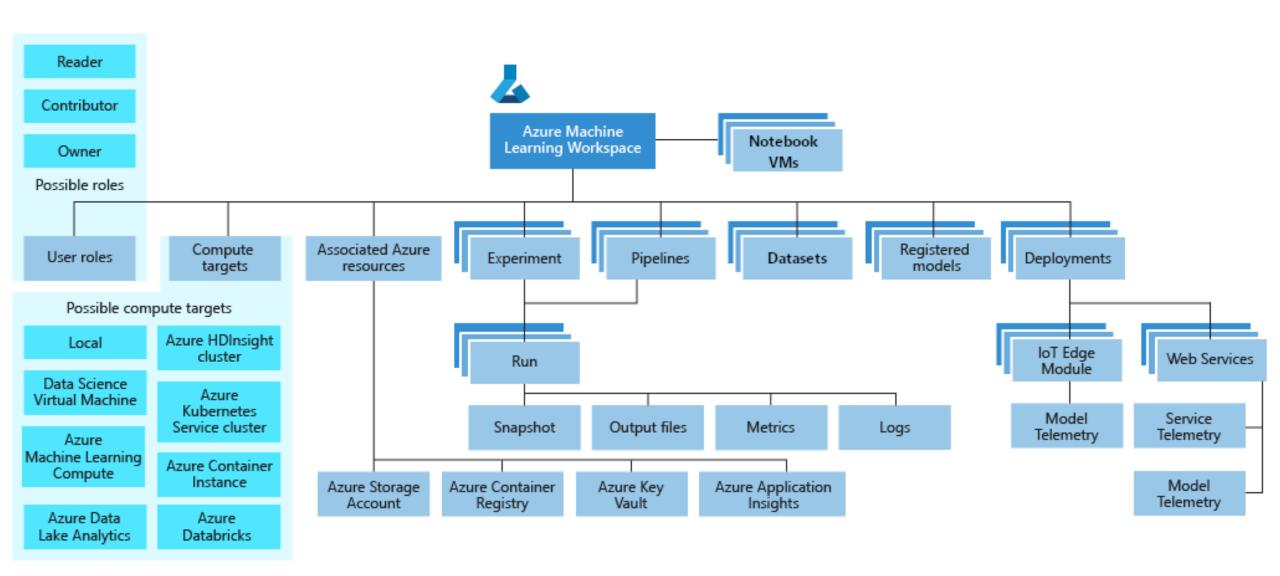
部署

- · 使用任何工具和語言
- 共享計算資源
- 註冊版本化模型
- 容器化部署
- 監控效果



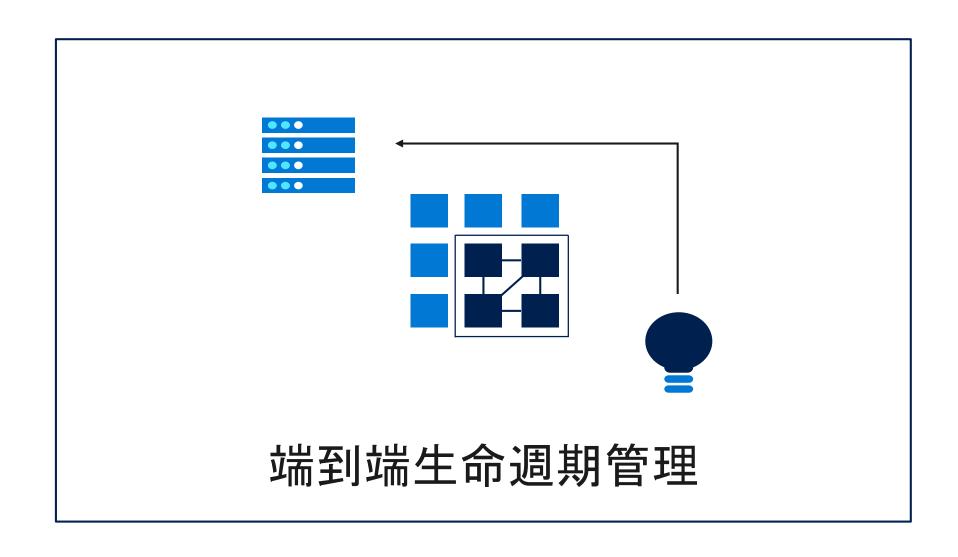
**Data Stores** 

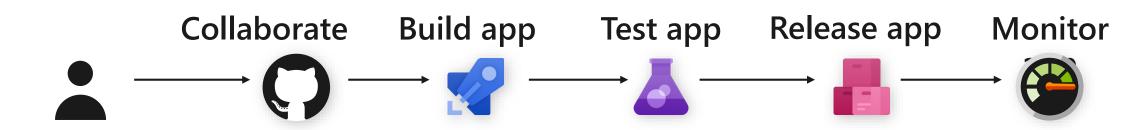
### **Azure Machine Learning workspace**



## 端到端(E2E) ML生命週期

### **Azure Machine Learning Service**



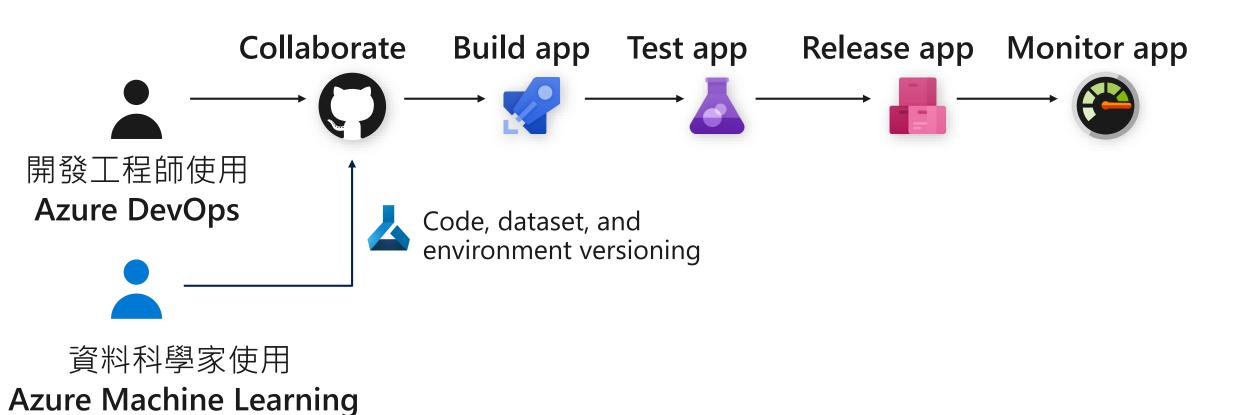


開發工程師 使用 Azure DevOps

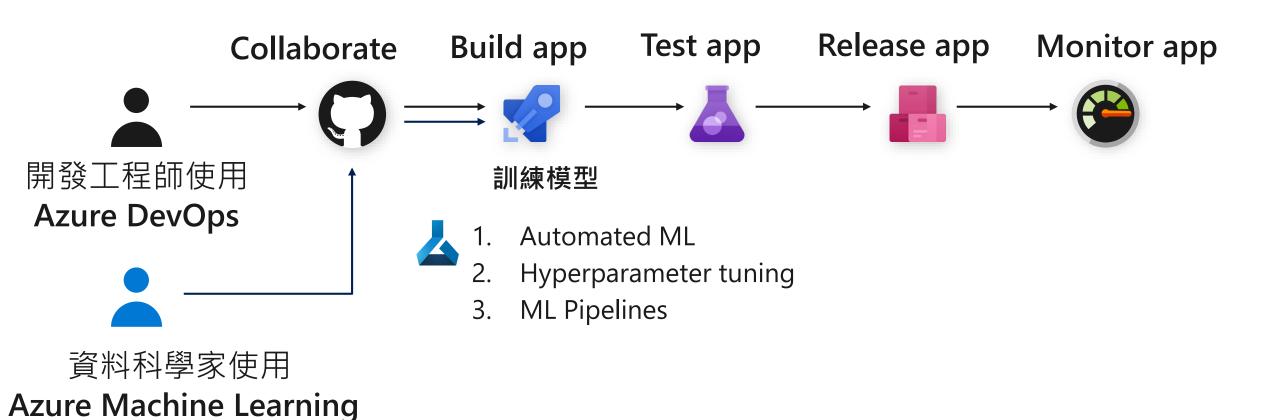


資料科學家使用

**Azure Machine Learning** 







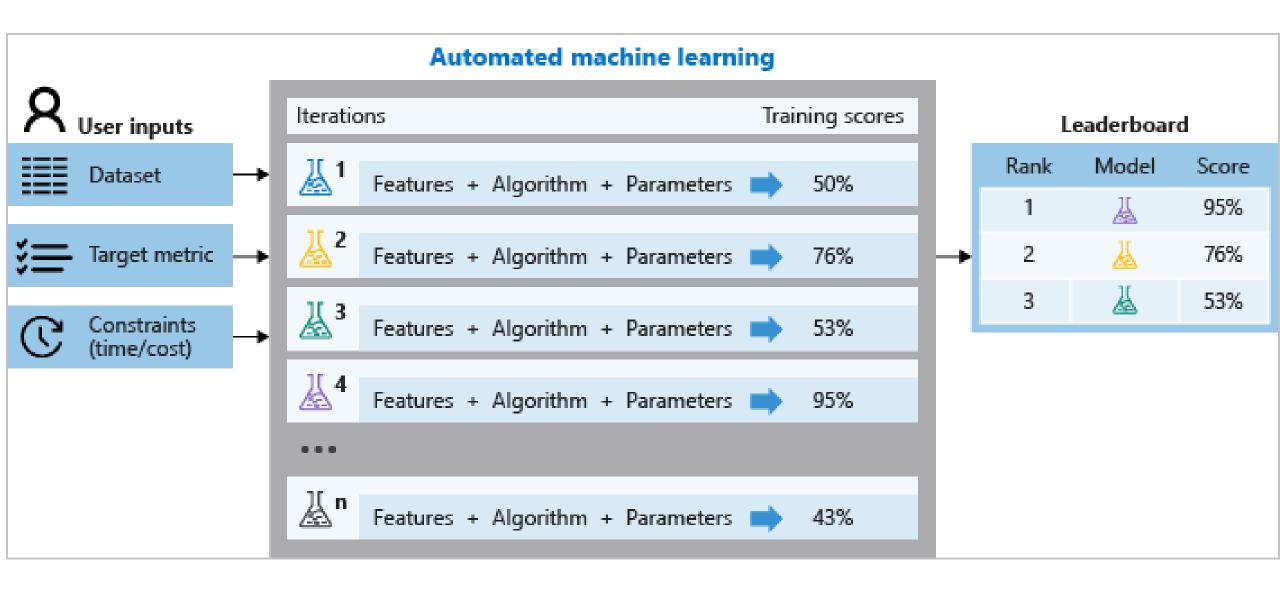


### 自動化 ML 的運作方式

#### **Feature Selection**

	_	_
	_	_

#### 自動化 ML 的運作方式



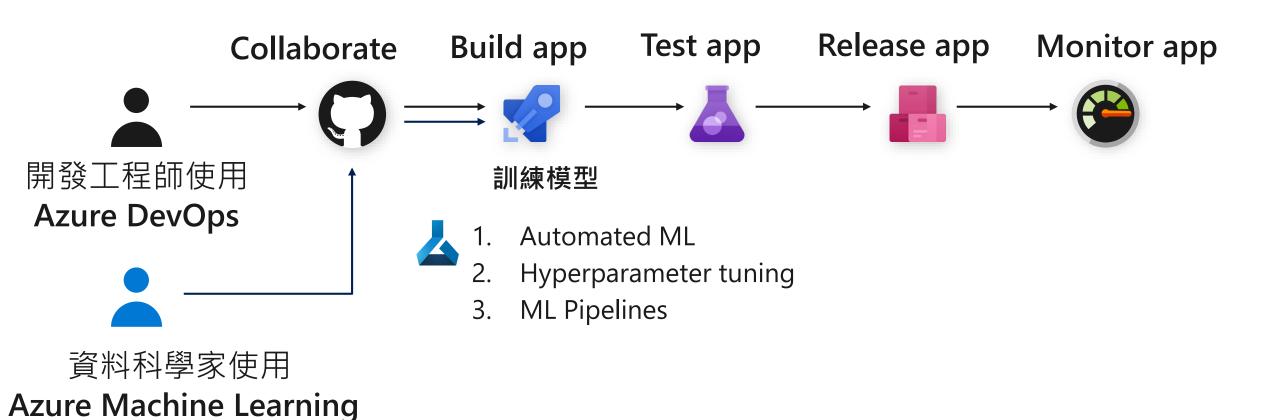
### 自己動手做AutoML-使用Python SDK

https://is.gd/PMUvgF

### 自動化 ML的分類計量

計量	說明	計算	額外的參數
AUC_Macro	AUC 是「接收者作業特性曲線」下方的面積。 Macro 是每個類別 AUC 的 算術平均值。	計算	average="macro"
AUC_Micro	AUC 是「接收者作業特性 曲線」下方的面積。 微的 計算方式是將每個類別的 真肯定和假陽性結合在一 起。	計算	average="micro"
AUC_Weighted	AUC 是「接收者作業特性曲線」下方的面積。 加權是每個類別的分數算術平均值,以每個類別中 true實例的數目加權。	計算	average="weighted"
精確度	精確度是完全符合 true 標 籤的預測標籤百分比。	計算	None

https://docs.microsoft.com/zh-tw/azure/machine-learning/service/how-to-understand-automated-ml





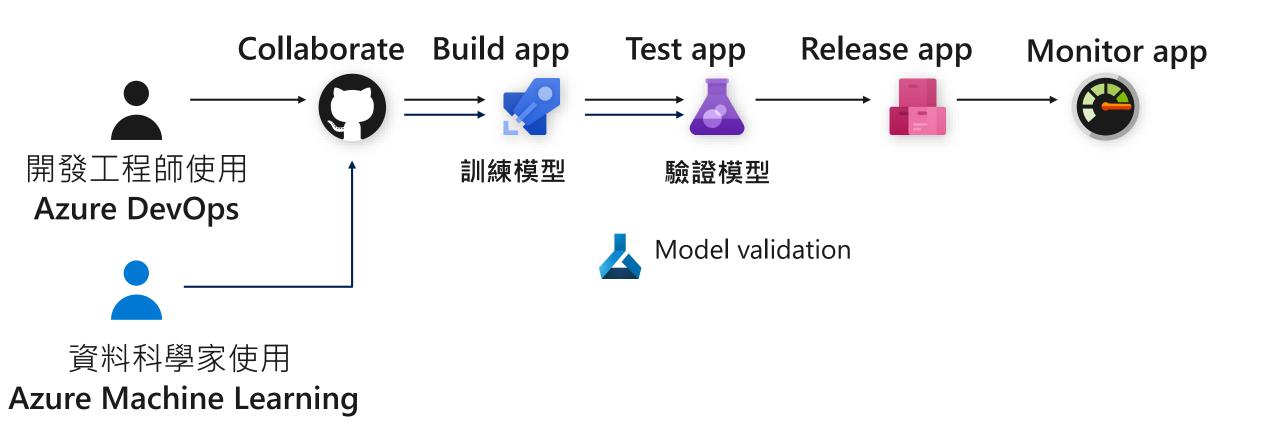
自己動手做 Hyperparameter tuning 使用Python SDK

https://is.gd/z7jhyA

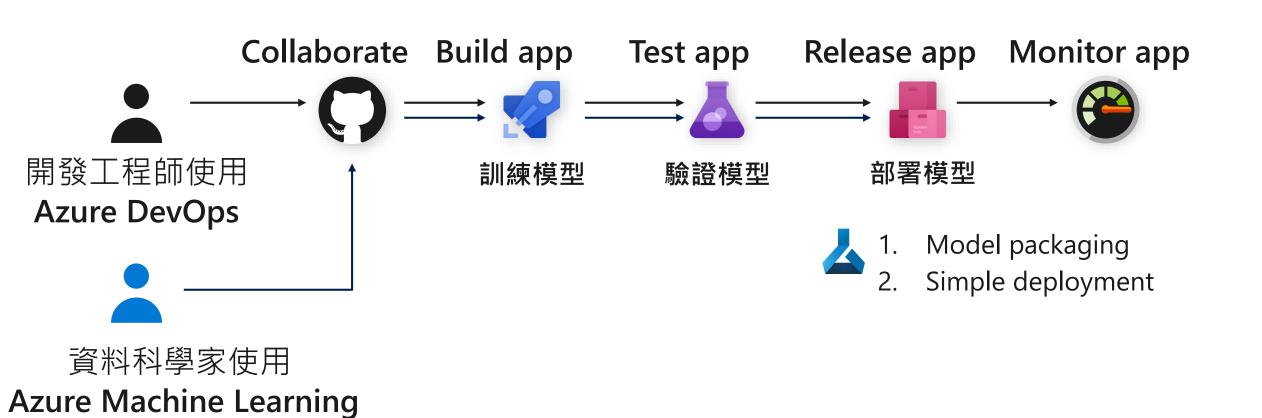
自己動手做 schedule-for-a-published-pipeline 使用Python SDK

https://is.gd/393S1F

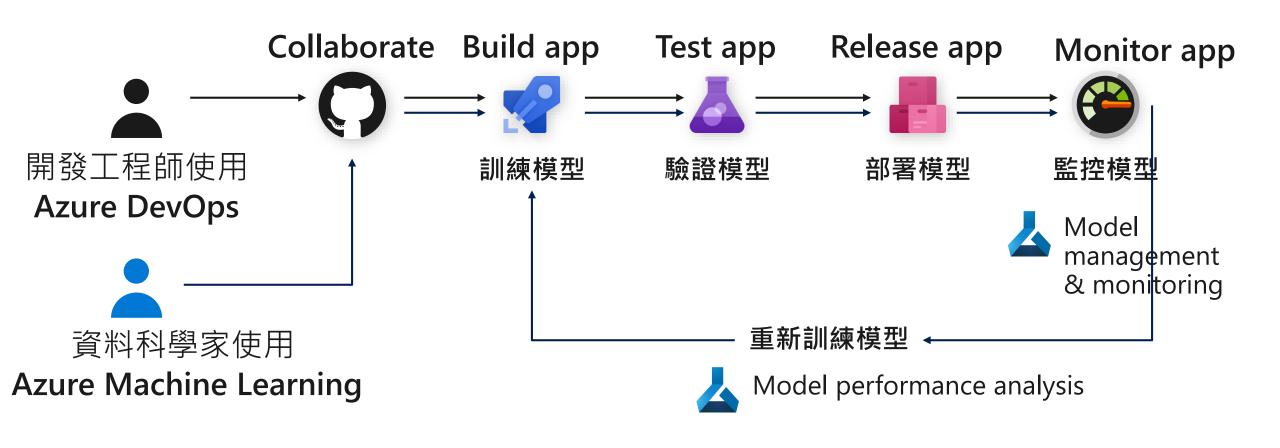
#### MLOps 工作流程



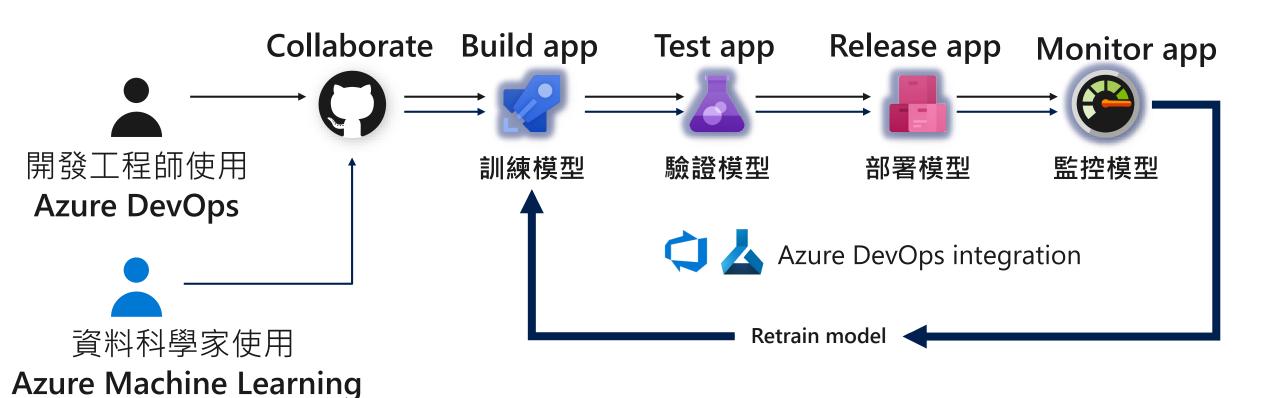
#### MLOps 工作流程

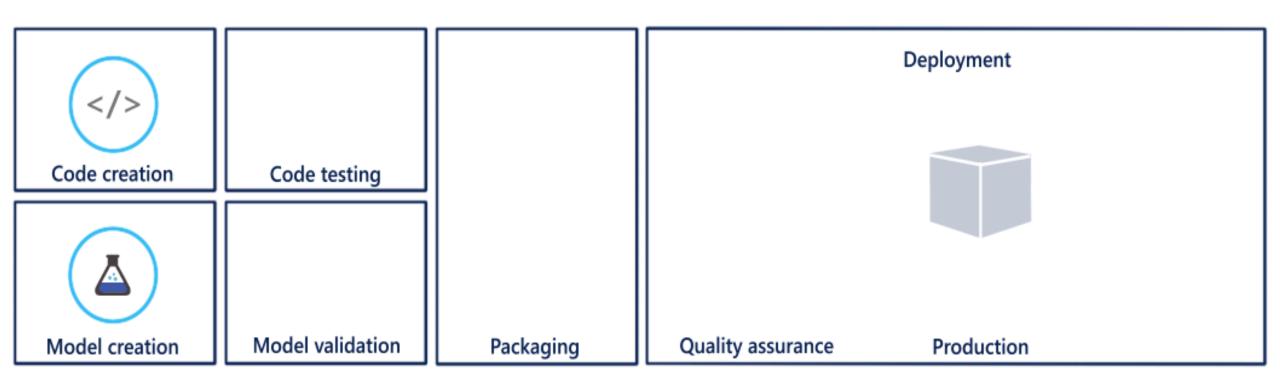


#### MLOps with Azure Machine Learning



#### MLOps with Azure Machine Learning





# Demo

#### Sample code

https://is.gd/8Bld2A

## Three Pipelines

#### Azure DevOps:

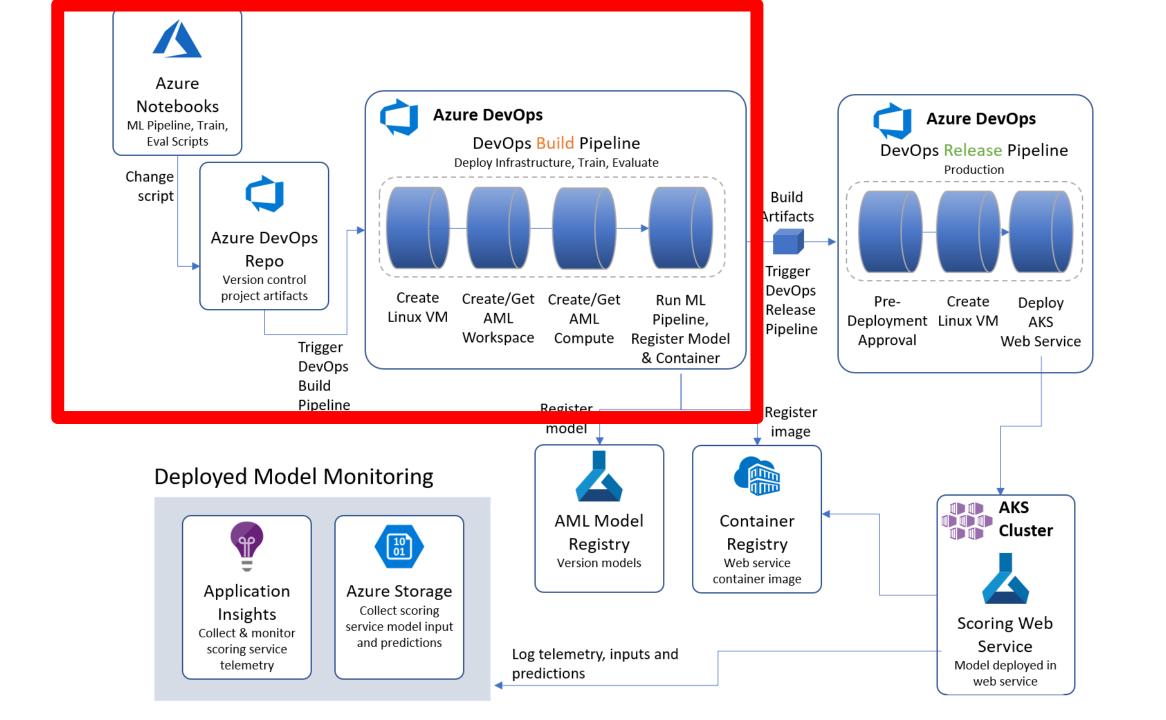
- Azure DevOps Build Pipeline
- Azure DevOps Release Pipeline

#### Azure Machine Learning Service :

Azure Machine Learning Service Pipeline

#### **Input Data**

	A	В	С	D
1	text	label		
2	good condition carbon fiber component manufactured in 201	0		
3	good condition carbon fiber component manufactured in 199	1		
4	manufactured in 2018 made of carbon fiber in good conditio	0		
5	manufactured in 2018 made of carbon fiber in poor condition	1		
6	manufactured in 1996 made of steel in good condition	0		
7	manufactured in 1971 made of steel in good condition	1		
8	carbon fiber component manufactured in 2011 in good condi	0		
9	carbon fiber component manufactured in 1986 in good condi	1		
10	good condition steel component manufactured in 2002	0		
11	poor condition steel component manufactured in 2002	1		
12	manufactured in 2019 made of carbon fiber in new condition	0		
13	manufactured in 2019 made of carbon fiber in fair condition	1		
14	manufactured in 2003 made of steel in new condition	0		
15	manufactured in 1978 made of steel in new condition	1		
16	new condition carbon fiber component manufactured in 1997	0		





#### Azure Notebooks

ML Pipeline, Train, Eval Scripts

Change script



Azure DevOps Repo

> Version control project artifacts

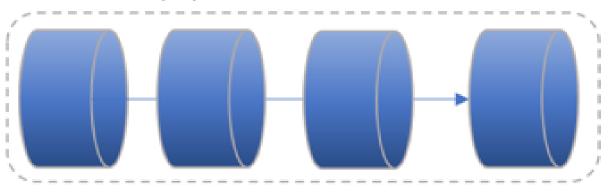
> > Trigger DevOps Build Pipeline



#### **Azure DevOps**

DevOps Build Pipeline

Deploy Infrastructure, Train, Evaluate



Create Linux VM AML Workspace

Create/Get Create/Get AML Compute

Run ML Pipeline, Register Model & Container

**Posictor** 

#### Azure Devops 建置管線 - yml

```
steps:
```

task: DownloadSecureFile@1

inputs:

name: configFile

secureFile: jennie config.json

task: UsePythonVersion@0 inputs:

versionSpec: 3.6

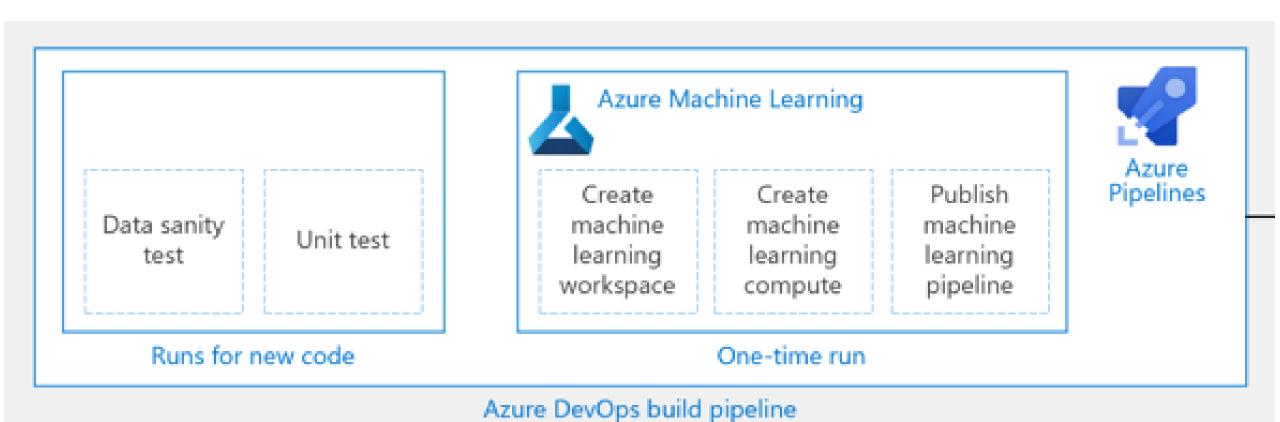
architecture: 'x64'

#### Job

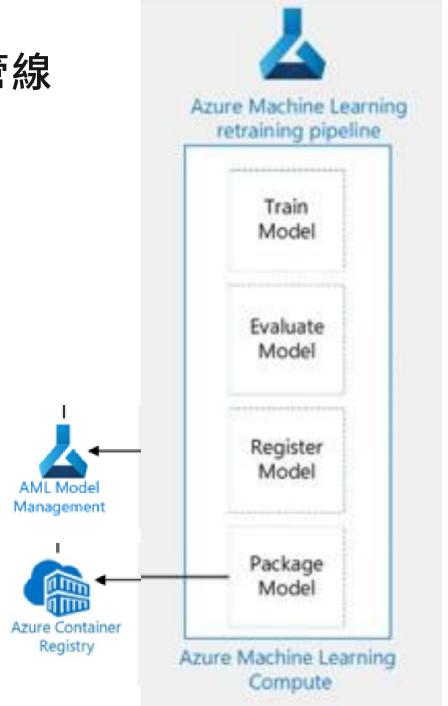
Pool: Azure Pipelines · Agent: Hosted Agent

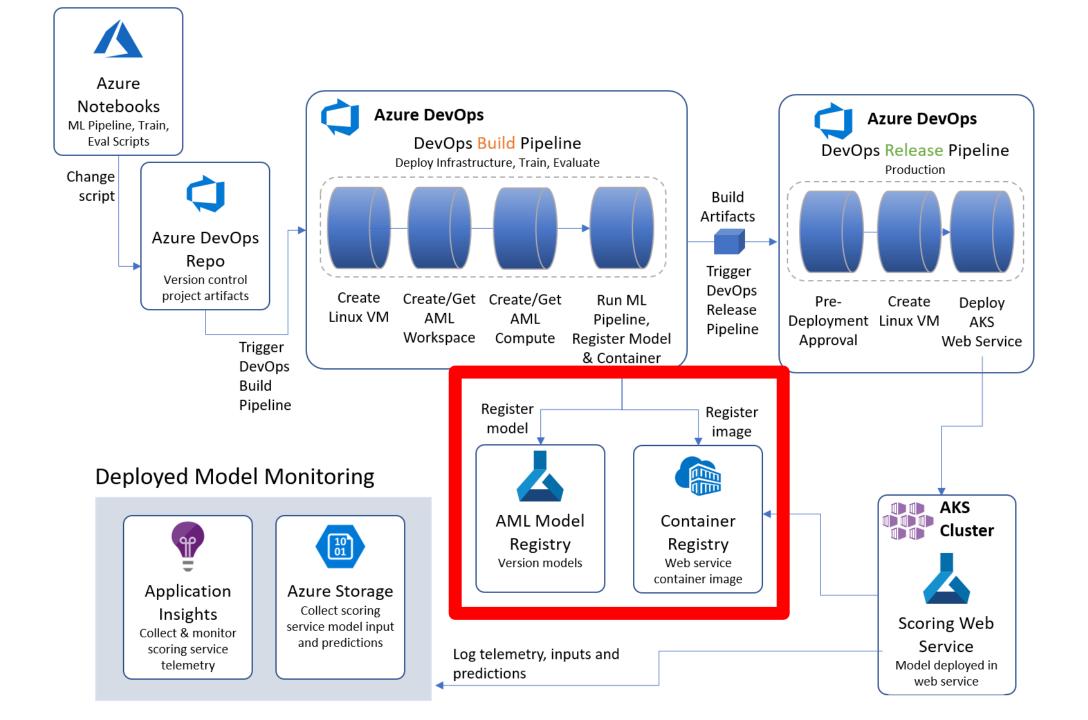
- Prepare job · succeeded
- ✓ Initialize job · succeeded
- ✔ Pre-job: DownloadSecureFile · succeeded
- Checkout · succeeded
- ✓ UsePythonVersion · succeeded
- ✓ CmdLine · succeeded
- CmdLine · succeeded
- Create Conda Environment · succeeded
- Install prerequisites · succeeded
- Disable existing pipelines · succeeded

#### Build 管線



#### **Azure Mmachine Learning 管線**





Register model

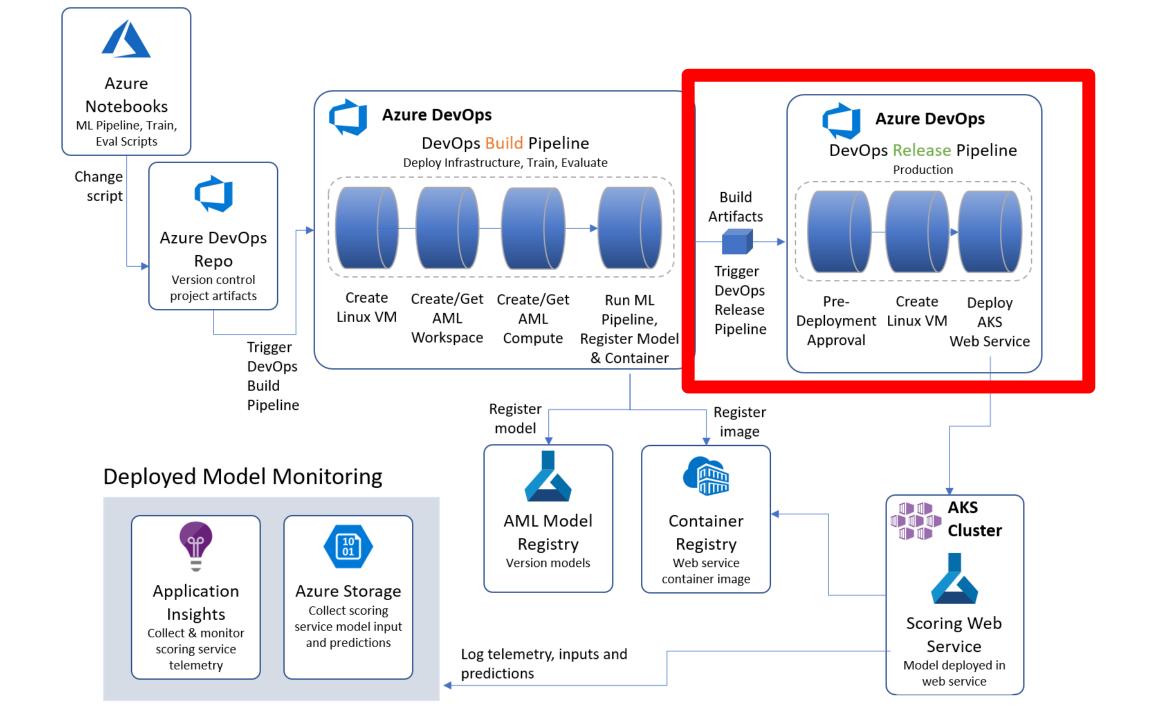
Register image



AML Model
Registry
Version models



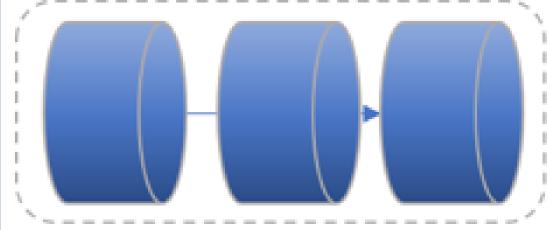
Container
Registry
Web service
container image





Build Artifacts



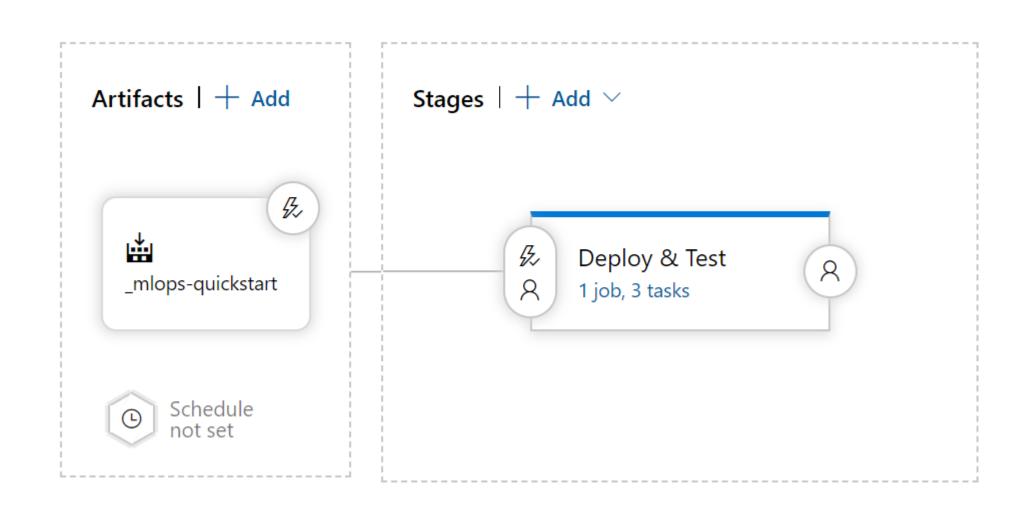


Azure DevOps

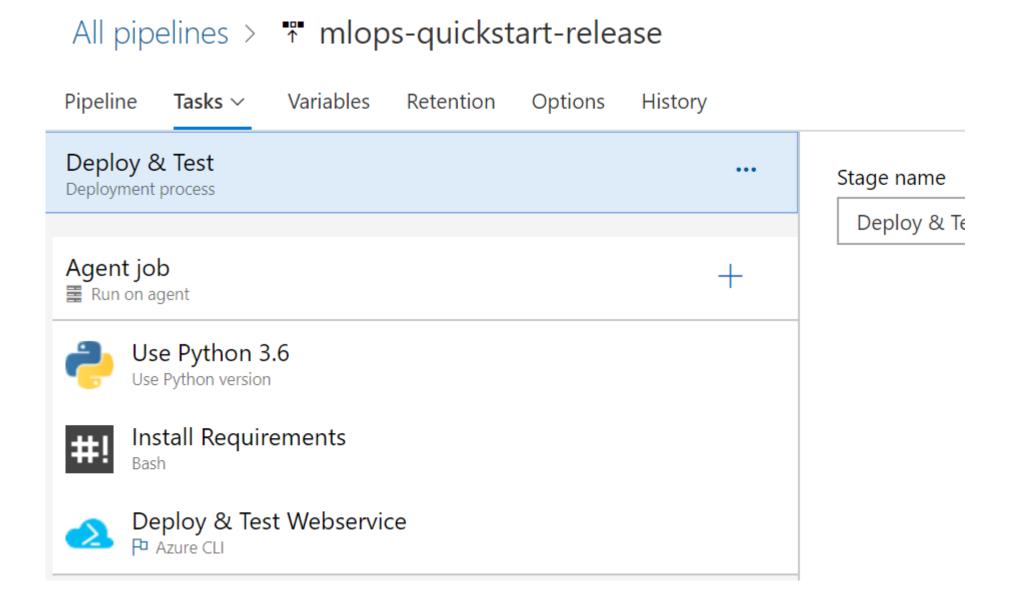
Pre- Create Deploy
Deployment Linux VM AKS
Approval Web Service

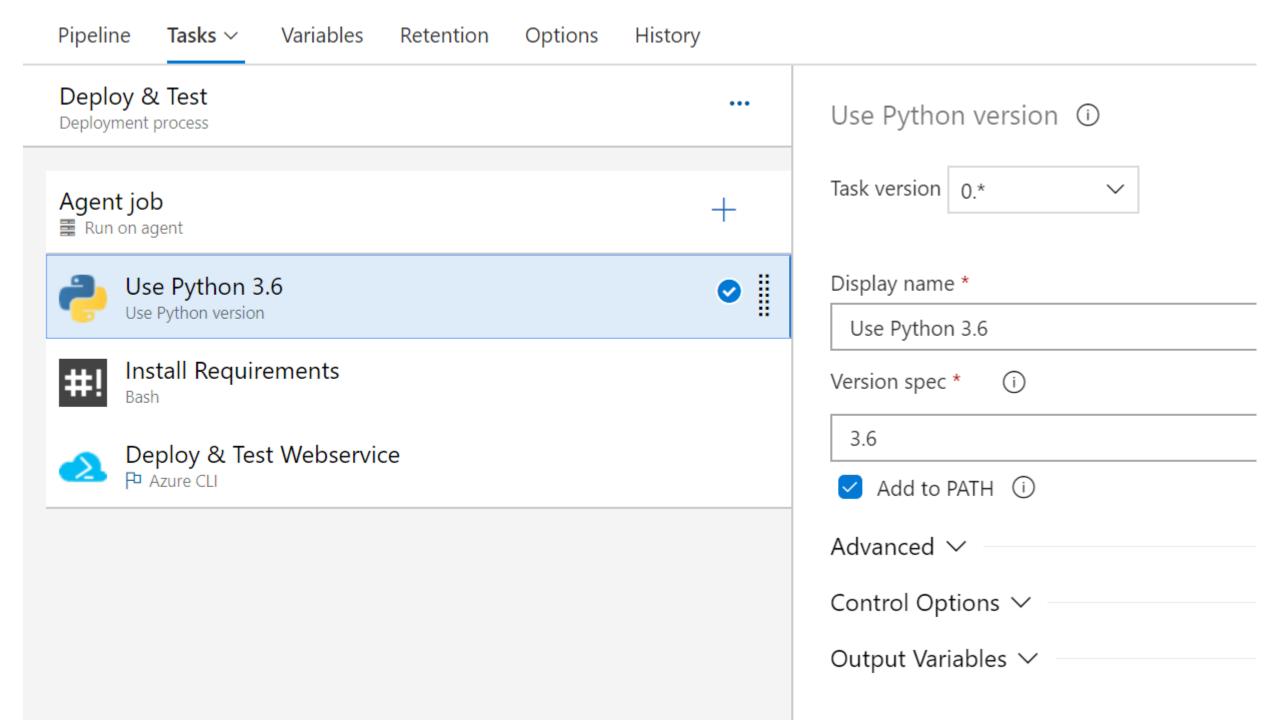
#### Release 管線

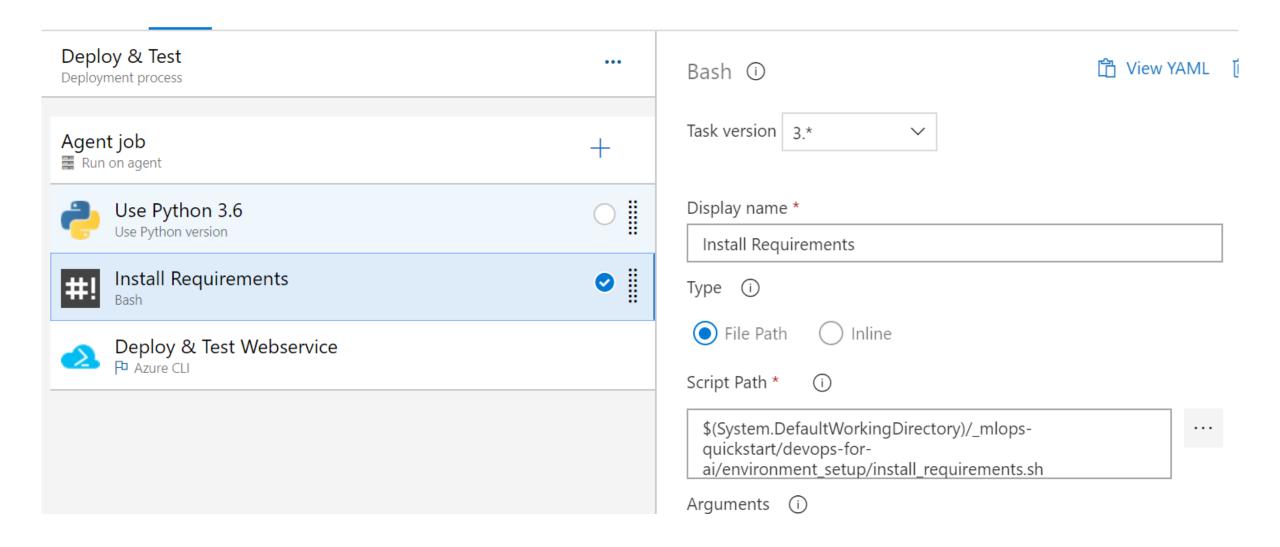
Pipeline Tasks ∨ Variables Retention Options History

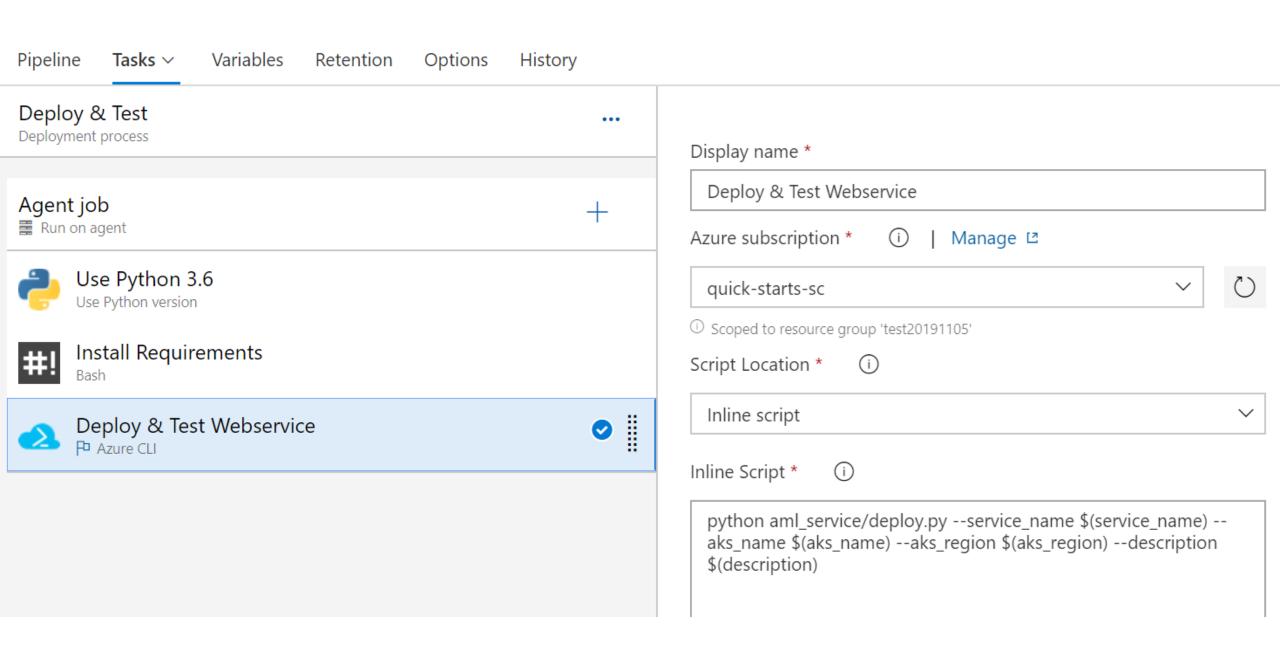


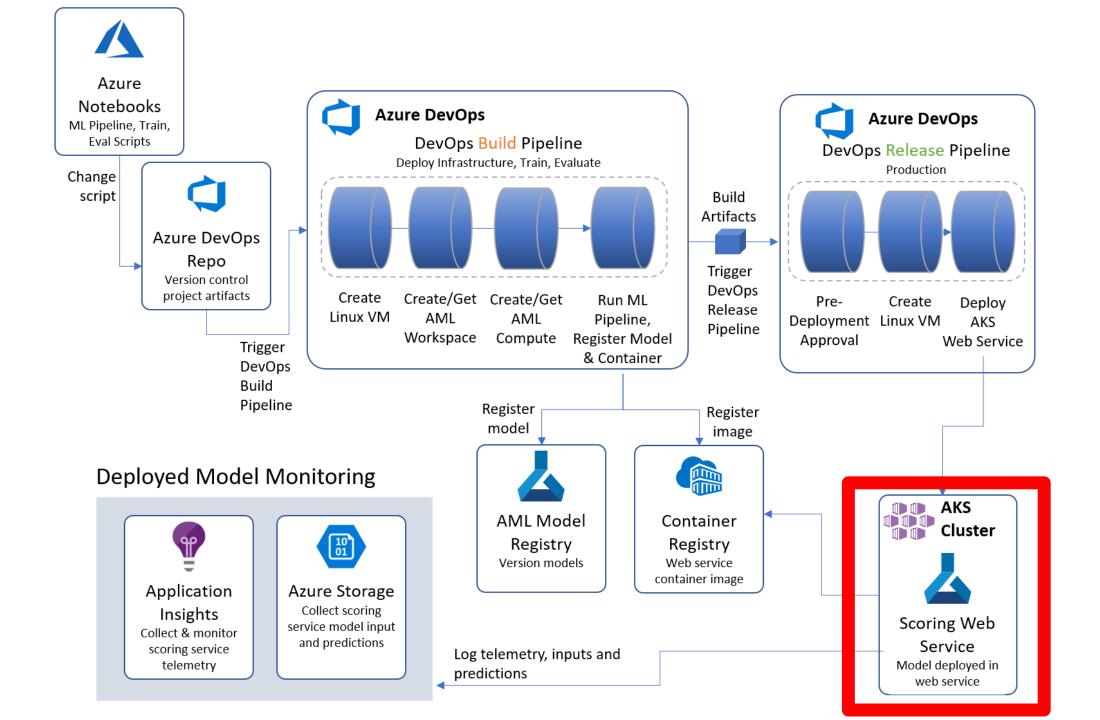
#### Release 管線 裡面的Job & Task



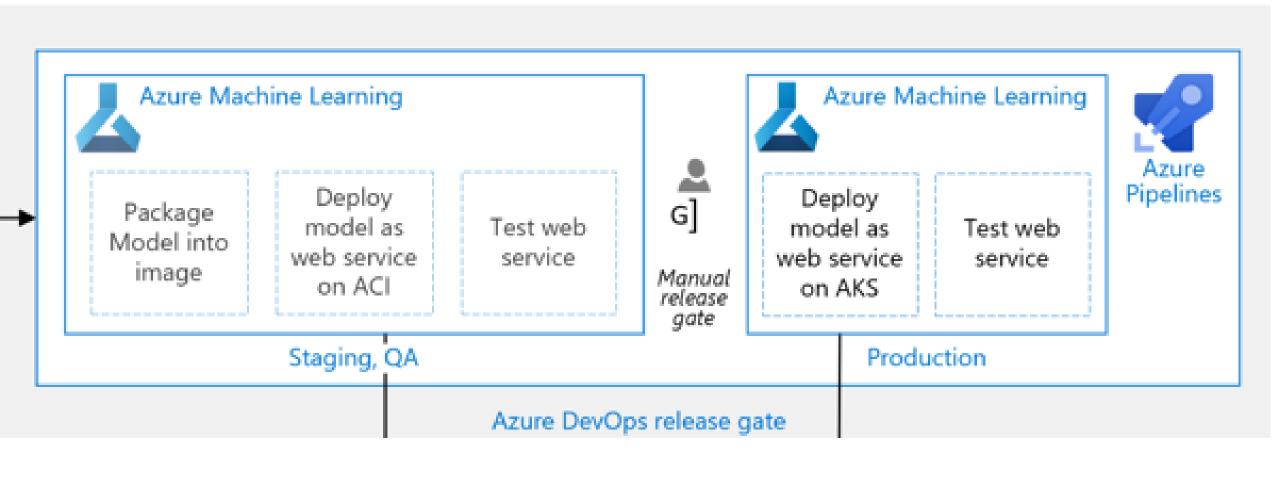






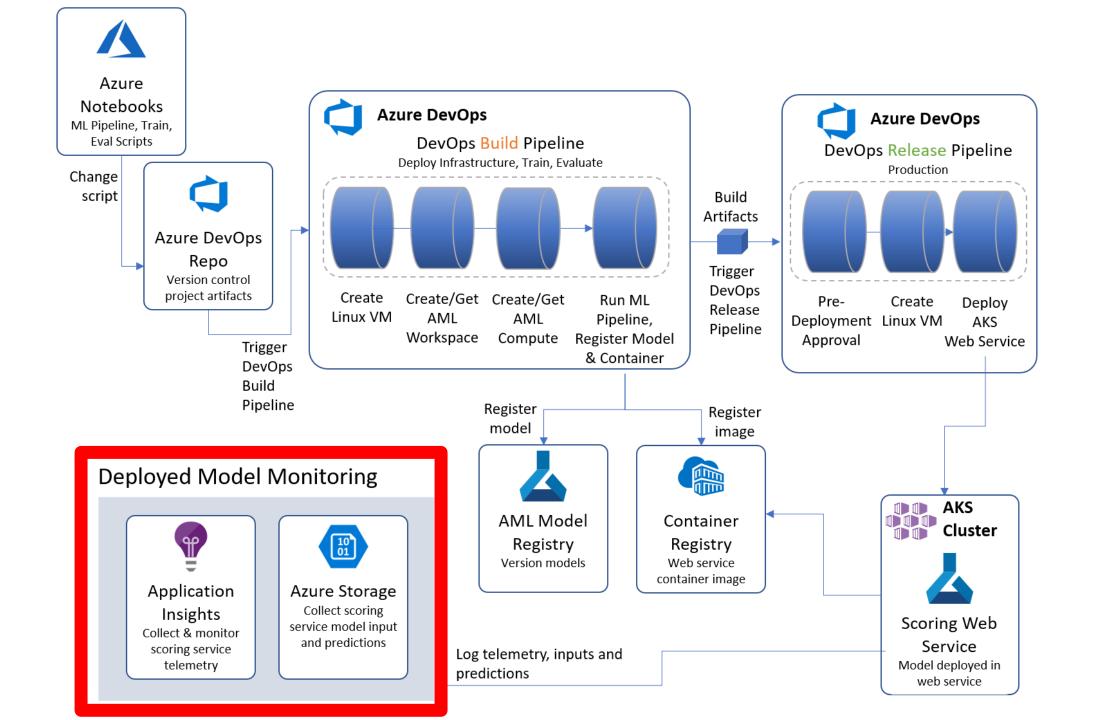






#### create docker images

#### **Create Webservice**



#### Deployed Model Monitoring



Application Insights

Collect & monitor scoring service telemetry



Azure Storage

Collect scoring service model input and predictions

Log telemetry, inputs and predictions

# 部模型

## 其他部署的選擇

Local deployment

Notebook VM web service (dev/test)

Azure Container Instances (dev/test)

Azure Kubernetes Service (dev/test and production)

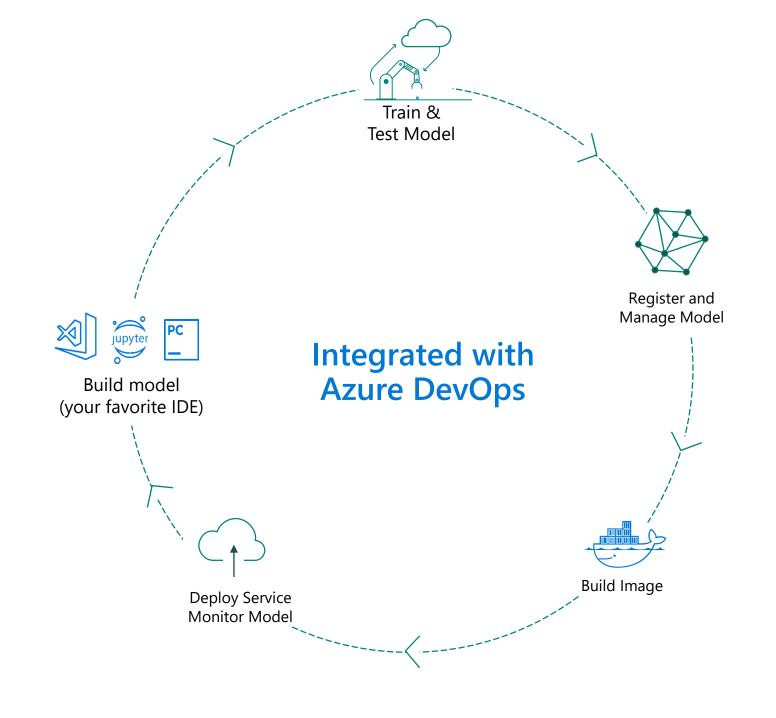
IoT Edge module (preview)

Azure App Service (preview)

# MLOps 的好處

- 1.減少將模型投入生產的時間和難度
- 2.減少團隊之間的摩擦並增強協作
- 3.改進模型跟踪,版本控制,監視和管理
- 4.為現代ML模型創建真正的周期性生命週期
- 5.標準化機器學習流程,以準備增加法規和政策

# Azure MLOps Helps You Bring ML to Production



#### Resources

Integrating the Data Science and App Development Cycles

Francesca Lazzeri, Microsoft

Medium: <a href="https://aka.ms/AA5ib6c">https://aka.ms/AA5ib6c</a>

MLOps: Manage, deploy, and monitor models with Azure Machine Learning Service

Microsoft Docs: <a href="https://aka.ms/AA5kjqo">https://aka.ms/AA5kjqo</a>

Train and deploy machine learning models with Azure Pipelines

Microsoft Docs: <a href="https://aka.ms/AA5kjqq">https://aka.ms/AA5kjqq</a>

Microsoft Al Platform <a href="https://www.microsoft.com/en-us/ai/ai-platform">https://www.microsoft.com/en-us/ai/ai-platform</a>

## 特別感謝



















以及各位參與活動的你們







