

.NET Conf China  
2022

# .NET 全场景开发的时代来了

卢建晖

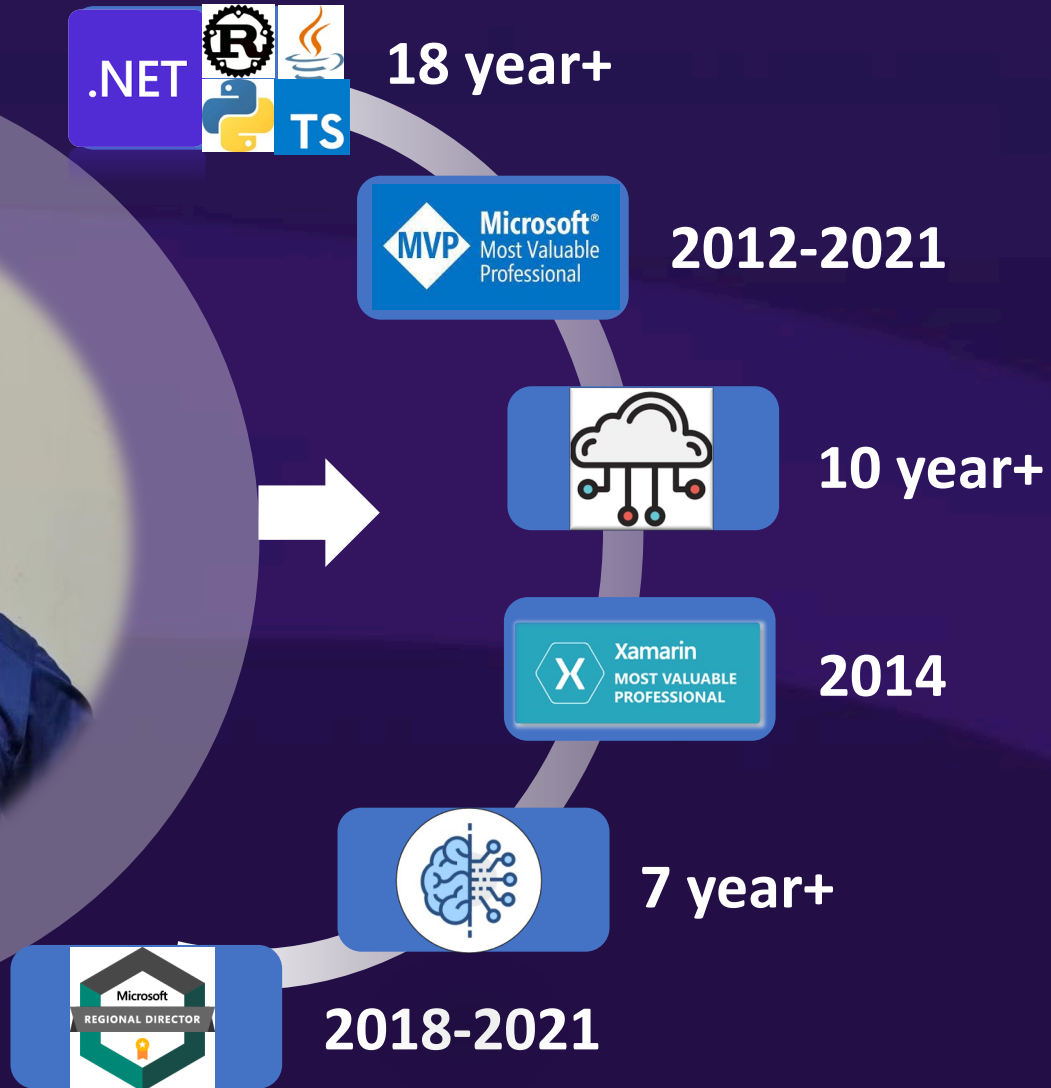
Microsoft Regional Cloud Advocate



# Hi



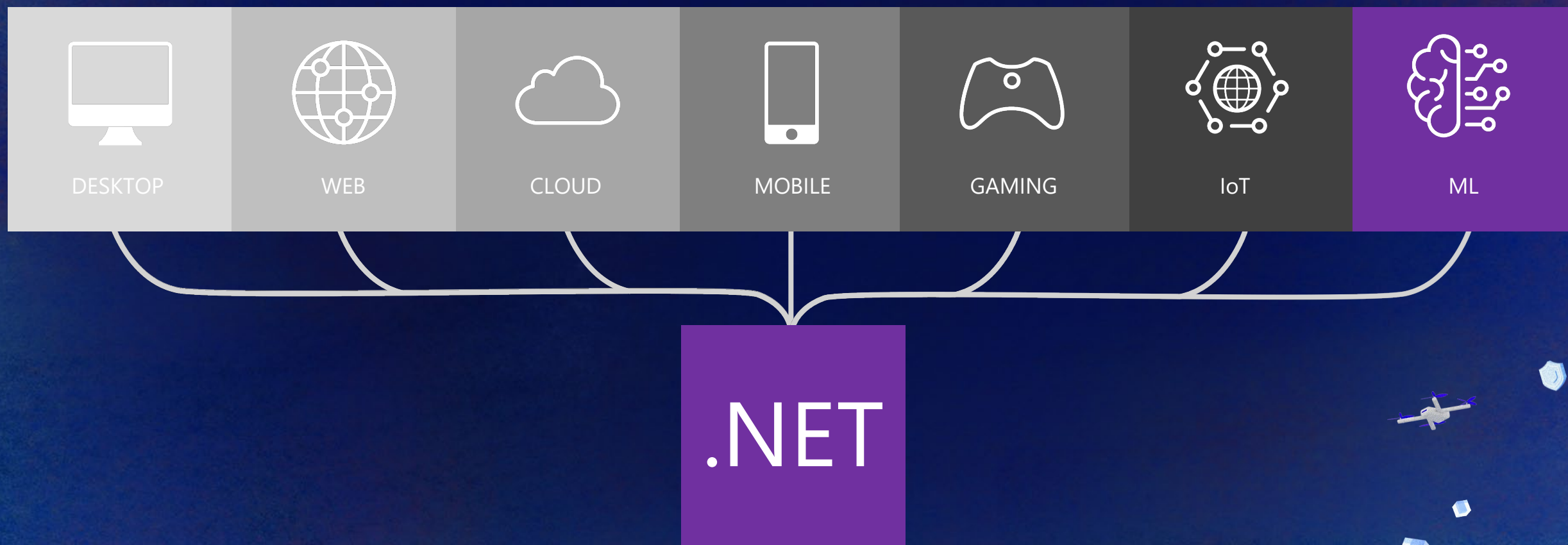
Kinfey Lo



**Since 2021.08**  
**Microsoft Cloud Advocate**



# .NET 能做什么



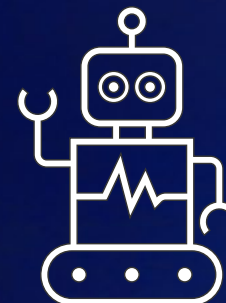


# .NET 如何做全场景开发





# 从一台无人机说起






# 原型咋做



## Polyglot Notebooks

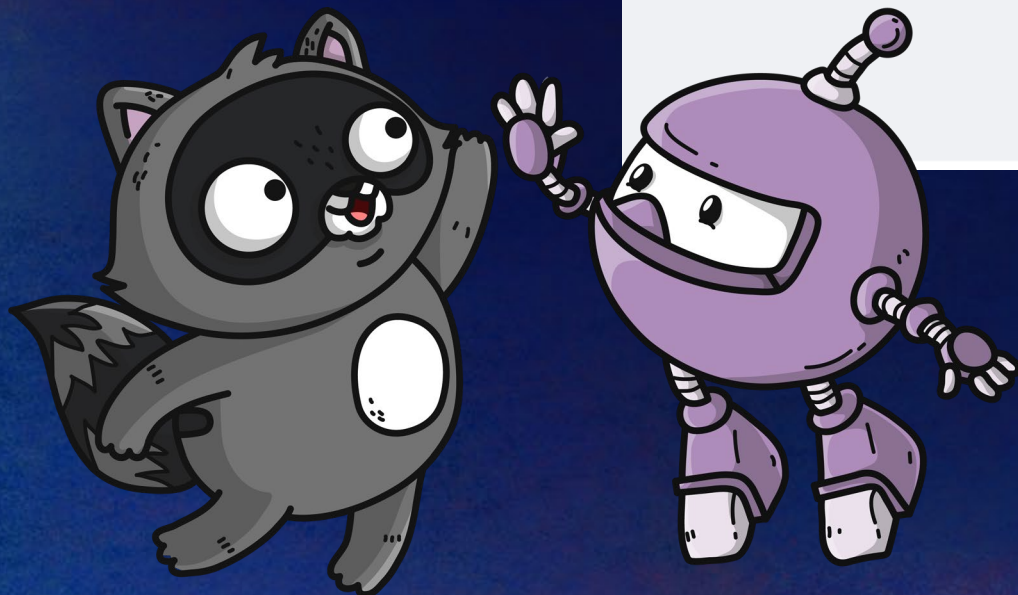
Preview

Microsoft  |  424,401 installs |  (29) | Free

Polyglot Notebooks for VS Code. Use multiple languages in one notebook with full language server support for each language and share variables between them.

Install

[Trouble Installing?](#) 





# 我们就从 Notebook 写原型



```
EXPLORER
└─ CSHARP
  └─ .ipynb_checkpoints
    └─ lib
      └─ 01.OpenCVSharp_Notebook.ipynb
      └─ 02.TelloSDK_Notebook.ipynb
      └─ demo.png
      └─ libOpenCvSharpExtern.dylib

02.TelloSDK_Notebook.ipynb > Byte[] sendCmdBytes1 = null;
+ Code + Markdown | ▶ Run All | Clear Outputs of All Cells | Restart | Values | Outline ...

[ ] using System.Text;
    using System.Threading;
    using System.Threading.Tasks;
    using OpenCvSharp;
    using OpenCvSharp.Extensions;
    using System.IO;
    using Microsoft.AspNetCore.Html;

[ ]

[ ] string telloIP = "192.168.10.1";
    int telloPort = 8889;
    // 11111

[ ]

[ ] UdpClient udpClient = new UdpClient();

[ ]

[ ] ▶ udpClient.Connect(telloIP, telloPort);

[ ]

[ ] ▶ Byte[] sendCmdBytes1 = null;
    Byte[] sendCmdBytes2 = null;
    Byte[] sendCmdBytes3 = null;

    sendCmdBytes1 = Encoding.UTF8.GetBytes("command");

    sendCmdBytes2 = Encoding.UTF8.GetBytes("streamon");

    udpClient.Send(sendCmdBytes1, sendCmdBytes1.Length);

    System.Threading.Thread.Sleep(5000);

    udpClient.Send(sendCmdBytes2, sendCmdBytes2.Length);

[ ]
```



# 我们需要 App

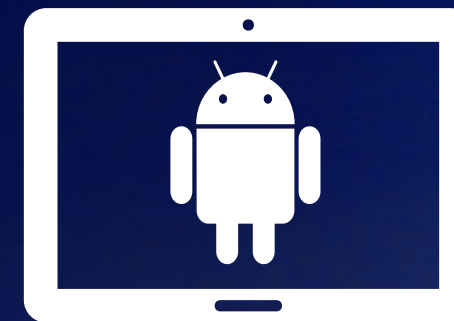
## .NET MAUI

any platforms  
any devices





# 面向前端应用的终端



# 全平台支持

iOS



mac  
OS



C#

C#

C#

C#

## Shared Code

UI, Resources, Platform Features, & Business Logic

- ✓ 40+ Pages, layouts, and controls  
(Build from C# or XAML)
- ✓ Two-way data binding
- ✓ Navigation
- ✓ Visual State Manager
- ✓ Animation API
- ✓ Dependency Service
- ✓ Messaging Center
- ✓ CI/CD Support
- ✓ Hybrid Development with Blazor
- ✓ Platform API Access
- ✓ Images, Icons, Fonts, Splash Screens
- ✓ Custom & Default Themes





# 我喜欢在 Visual Studio Code 下写 MAUI



```
ControlView.cs — Tello.Apps

EXPLORER
Tello.Apps
  .vscode
  {} launch.json
  {} settings.json
  > bin
  > Helpers
  > obj
  > Platforms
  > Android
  > iOS
  > Resources
  AppDelegate.cs
  Info.plist
  Program.cs
  > MacCatalyst
  > Windows
  > Properties
  Resources
  > Fonts
  > Images
  > Raw
  appicon.svg
  appiconfg.svg
  > Utils
  Views
  ControlView.cs
  App.cs
  GlobalUsings.cs
  MainPage.cs
  Tello.Apps.csproj

Views > ControlView.cs
1 using System.Collections.ObjectModel;
2
3 namespace Tello.Apps;
4
5 public class ControlView : View{
6
7     readonly DJITelloSDK tello = new();
8
9     [State]
10     readonly TelloStatus telloStatus = new();
11
12     public ControlView()
13     {
14         tello.Connect();
15         tello.Command("command");
16         tello.Command("streamon");
17     }
18
19     [Body]
20     View body()
21     => new Grid{
22         new VStack(){
23             new HStack(){
24                 new ImageButton("up.png" , ()=>{
25                     tello.FlyCMD("up 10");
26                 }).Frame(width:50,height:50).Alignment(Alignment.Center),
27             },
28             new HStack(){
29                 new ImageButton("left.png" , ()=>{
30                     tello.FlyCMD("left 10");
31                 }).Frame(width:50,height:50).Alignment(Alignment.Leading),
32                 new ImageButton(telloStatus.DroneStatus , ()=>{
33                     telloStatus.TakeOff = !telloStatus.TakeOff;
34                     if(!telloStatus.TakeOff){
35
```



# 我更喜欢描述式的语言


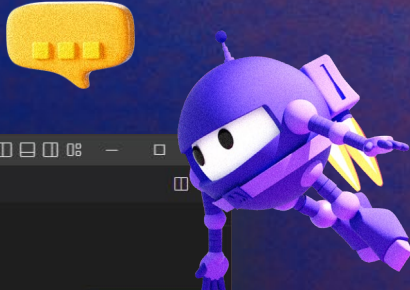


```
public class MyPage : View {  
  
    readonly State<int> clickCount = new State<int> (1);  
  
    public MyPage() {  
        Body = () => new VStack {  
            new Text (() => $"Click Count: {clickCount}"),  
            new Button("Update Text", () => {  
                clickCount.Value++;  
            })  
        };  
    }  
}
```





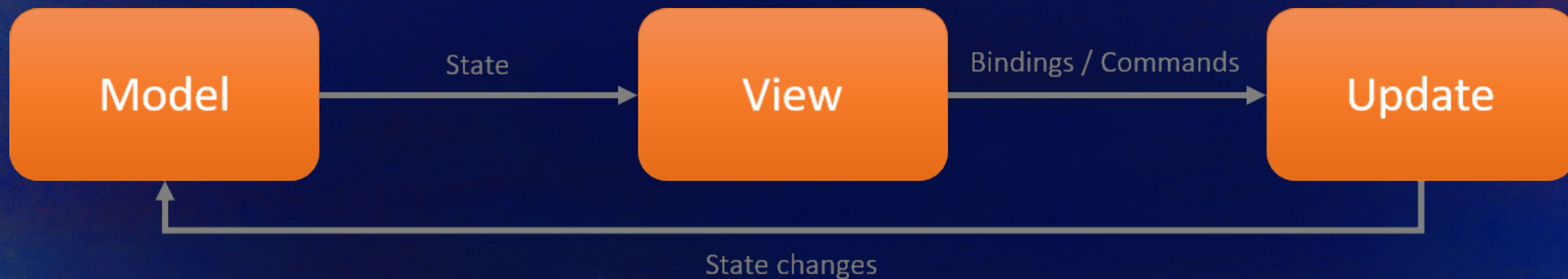
# 代码示例



```
code sample.cs x
D:\> LiveEvents > dotNetConf > 2022 > code sample.cs
1 namespace MVCCodeFirst.Migrations
2 {
3     using System;
4     using System.Data.Entity;
5     using System.Data.Entity.Migrations;
6     using System.Linq;
7
8     internal sealed class Configuration : DbMigrationsConfiguration<MVCCodeFirst.Entity.MyModel>
9     {
10         public Configuration()
11         {
12             AutomaticMigrationsEnabled = false;
13         }
14
15         protected override void Seed(MVCCodeFirst.Entity.MyModel context)
16         {
17             //初始化数据
18         }
19
20         protected override void Seed(MVCCodeFirst.Entity.MyModel context)
21         {
22             //初始化数据
23         }
24
25         protected override void Seed(MVCCodeFirst.Entity.MyModel context)
26         {
27             //初始化数据
28         }
29
30         protected override void Seed(MVCCodeFirst.Entity.MyModel context)
31         {
32             //初始化数据
33         }
34     }
35 }
```

Ln 33, Col 1 Spaces: 4 UTF-8 CRLF C# Go Live

# MVU



MVU (Model View Update) 是一种功能响应式编程、架构设计模式。在 MVU 中 UI 是不可变的。所以每次你想更新一个属性时，你都必须重建你的 UI。不变性 (Immutable) 是函数式编程的特性。C# 9.0 后支援函数式编程样式。UI 和业务登录使用相同的语言 (例如 C#) 编写。资料流是单向的。它非常适合应用程序的热重载。您不需要学习 XAML 来开发 UI，而是用一种语言开发完整的应用程序。MVU 的 MAUI 实现 <https://github.com/dotnet/Comet>



我们需要绑定  
通过 MAUI 可以绑定任意的库



AMapFoundationKit.framework

Headers

AMapFoundationConst.h

AMapFoundationKit.h

AMapFoundationVersion.h

AMapServices.h

AMapURLSearch.h

AMapURLSearchConfig.h

AMapURLSearchType.h

AMapUtility.h

Modules

module.modulemap

AMapFoundationKit



# iOS Library

Dynamic Libraries

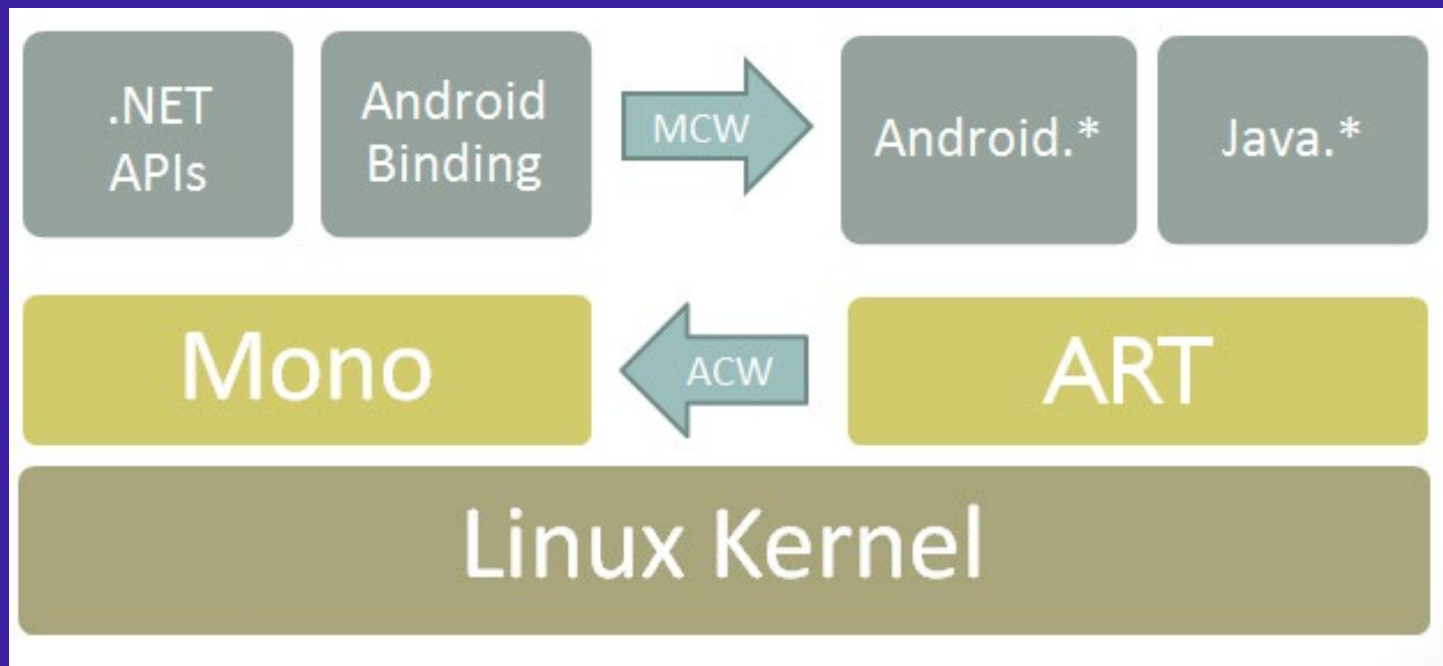
vs

Static Libraries



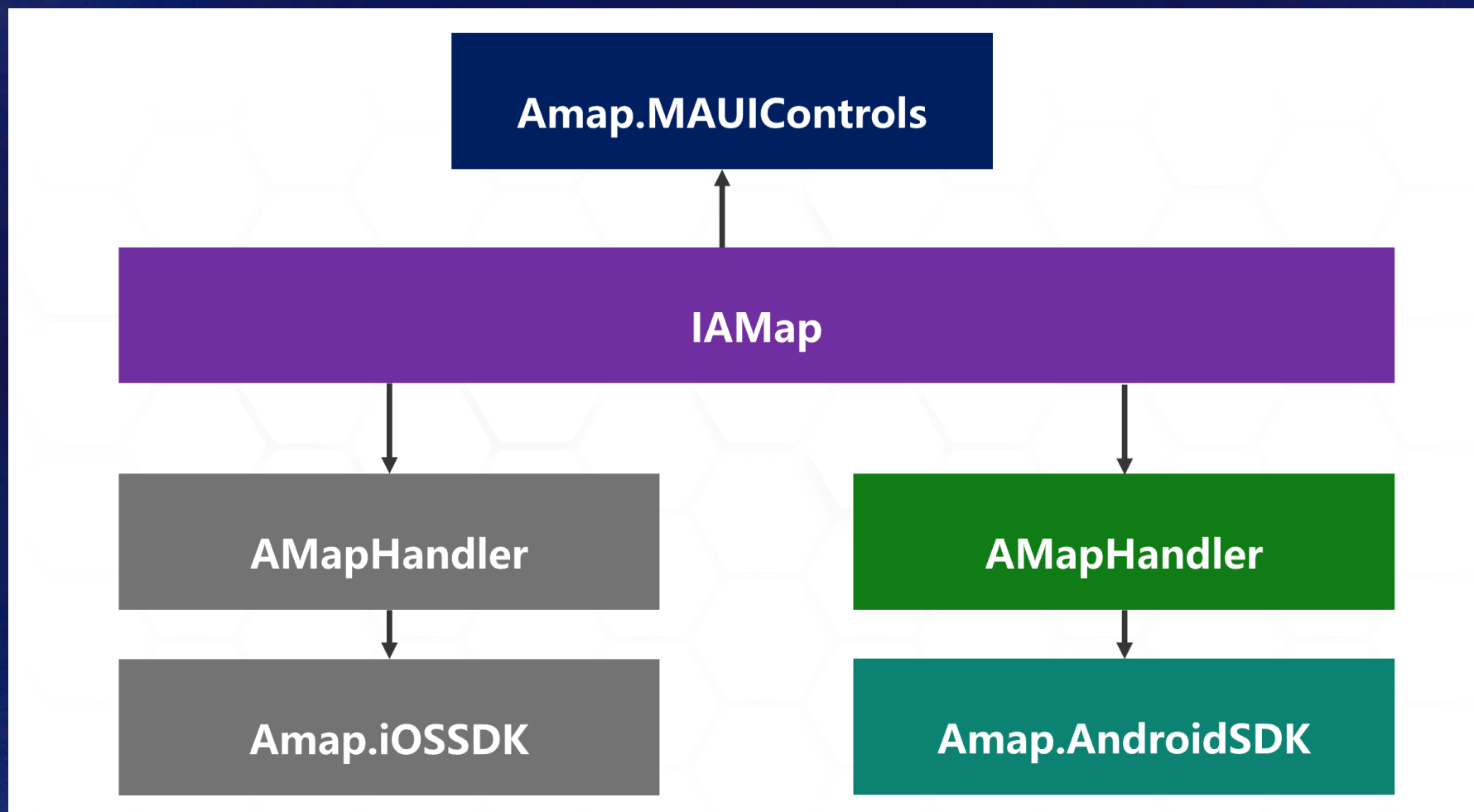
# Droid Lib

Android - .jar / aar



从上图中可以看出，Xamarin.Android / .NET for Android 通过使用托管可调用包装器 (MCW) 实现绑定。MCW 是一个 JNI 桥，当托管代码需要调用 Java 代码时使用。托管可调用包装器还支持子类化 Java 类型和覆盖 Java 类型的虚拟方法。同样，每当 Android 运行时 (ART) 代码需要调用托管代码时，它都会通过另一个称为 Android Callable Wrapper (ACW) 的 JNI 桥来实现。

# 或者不只是界面







**What about  
Deep Learning in .NET ?**

# Deep Learning in .NET



TensorFlow.NET

<https://github.com/SciSharp/TensorFlow.NET>

TensorFlow.NET (TF.NET) 为 TensorFlow 提供 .NET 标准绑定。它旨在用 C# 实现完整的 Tensorflow API，允许 .NET 开发人员使用跨平台的 .NET Standard 框架开发、训练和部署机器学习模型。

TensorFlow.NET 内置 Keras 高层接口，并作为独立包 TensorFlow.Keras 发布。



```
### install tensorflow C#/F# binding
PM> Install-Package TensorFlow.NET
### install keras for tensorflow
PM> Install-Package TensorFlow.Keras

### Install tensorflow binary
### For CPU version
PM> Install-Package SciSharp.TensorFlow.Redist

### For GPU version (CUDA and cuDNN are required)
PM> Install-Package SciSharp.TensorFlow.Redist-Windows-GPU
```



# Deep Learning in .NET



TorchSharp 是一个 .NET 库，可以访问为 PyTorch 提供支持的库。它是 .NET 基金会的一部分。

<https://github.com/dotnet/TorchSharp>

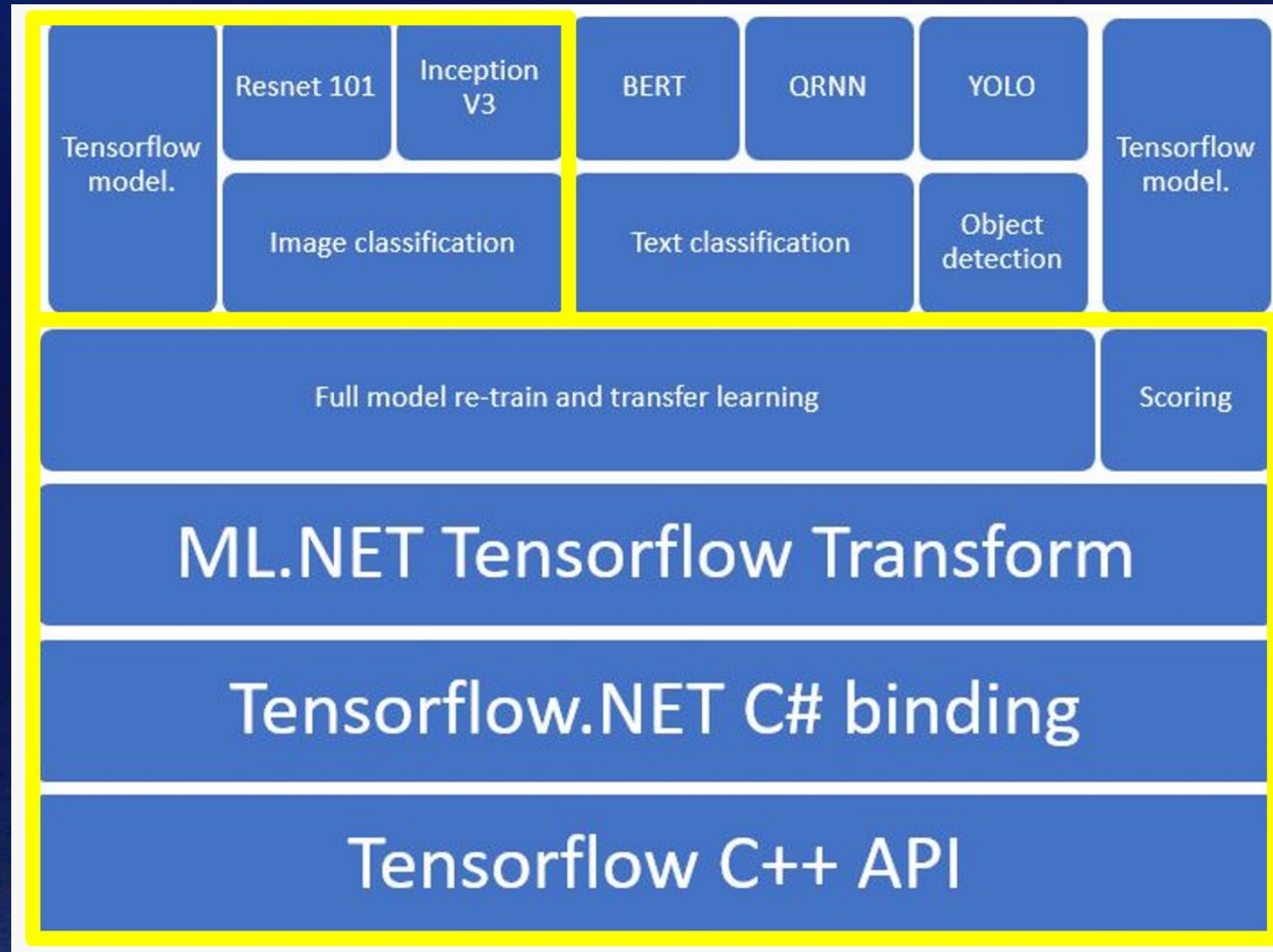
- `libtorch-cpu-linux-x64` (CPU, Linux)
- `libtorch-cpu-win-x64` (CPU, Windows)
- `libtorch-cpu-osx-x64` (CPU, OSX)
- `libtorch-cpu` (CPU, references all three, larger download but simpler)
- `libtorch-cuda-11.7-linux-x64` (CPU/CUDA 11.3, Linux)

NOTE: Due to the presence of very large native binaries, using the `libtorch-cuda-11.7-linux-x64` package requires .NET 6, e.g. .NET SDK version `6.0.100-preview.5.21302.13` or greater.

- `libtorch-cuda-11.7-win-x64` (CPU/CUDA 11.3, Windows)



# ML.NET Image Classification





# Azure ML

1. Snapshot folder and send to experiment



Experiment

2. Create docker image



Docker Image

3. Deploy docker and snapshot to compute

5. Launch script

6. Stream stdout, logs, metrics

7. Copy over outputs



Compute Target

4. Mount datastore to compute



Data Store

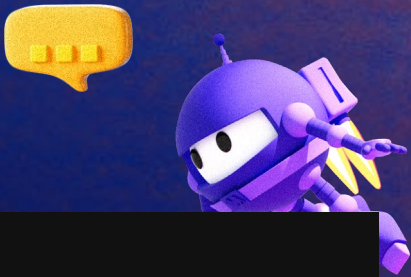
Azure ML  
Workspace



My Computer



# 准备工作 – 数据上传



## Data

Data assets    Dastores    Dataset monitors (preview)

Data assets are references to your data. You can create data assets from dastores, local files, public URLs, or Open Datasets. Data assets can be versioned and easily referenced and reused for machine learning tasks. [Learn more about data assets](#)

[+](#) Create    [↺](#) Refresh    [📁](#) Archive    [📊](#) Edit columns    [↺](#) Reset view

[🔍](#) All filters    [✕](#) Clear all

Showing 1-4 of 4 data assets

Page size:

Name	☆	Version	Data source	Created on ↓	Modified on	Type	Properties	Created by
starwar_data		1	workspaceblobstore	Nov 8, 2022 10:19 AM	Nov 8, 2022 10:19 AM	Folder		Lo Kinfe
flower_data		1	workspaceblobstore	Nov 2, 2022 5:55 PM	Nov 2, 2022 5:55 PM	Folder		Lo Kinfe
news_data		1	workspaceblobstore	Oct 31, 2022 5:38 PM	Oct 31, 2022 5:38 PM	Folder		Lo Kinfe
song_popularity		1	workspaceblobstore	Oct 28, 2022 3:32 PM	Oct 28, 2022 3:32 PM	File		Lo Kinfe





# Prepare : Set Azure ML Compute



## Compute

Compute instances

Compute clusters

Inference clusters

Attached computes

+ New

↺ Refresh

🗑 Delete

📄 Edit columns

↺ Reset view

📄 View quota

State ▾ Location ▾ ⚙ All filters ✕ Clear all

Name	☆	State	Size	Location	Created on ↓	Active runs	Idle nodes	Busy nodes	Un
GPUCluster		✔ Succeeded (0 nodes)	STANDARD_NC6	westus2	Nov 3, 2022 8:16 PM	0	0	0	



# Prepare : Create a docker and yml



```
FROM mcr.microsoft.com/dotnet/sdk:6.0
RUN dotnet tool install --global mlnet-linux-x64
ENV PATH="$PATH:/root/.dotnet/tools"
```

Dockerfile	
1	FROM mcr.microsoft.com/dotnet/sdk:6.0
2	RUN apt install wget





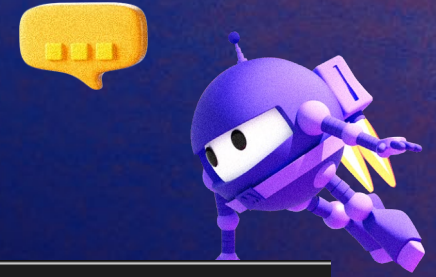
# Prepare : Create a docker and yml



```
$schema: https://azuremlschemas.azureedge.net/latest/commandJob.schema.json
command: |
  FILENAME=libtensorflow-gpu-linux-x86_64-2.5.0.tar.gz
  wget -q --no-check-certificate https://storage.googleapis.com/tensorflow/libtensorflow/\${FILENAME}
  tar -C /usr/local -xzf ${FILENAME}
  ldconfig /usr/local/lib
  export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/cuda-11.3/targets/x86_64-linux/lib
  cd code
  dotnet restore
  dotnet build
  dotnet run --dataPath=${{inputs.data_dir}} --outputPath="outputs"
code: .
inputs:
  data_dir:
    type: uri_folder
    path: azureml:flower_data:1
experiment_name: tf-image-training
environment:
  build:
    path: .
    dockerfile_path: Dockerfile
compute: azureml:GPUCluster
```



# Prepare : Create a docker and yml



```
$schema: https://azuremlschemas.azureedge.net/latest/commandJob.schema.json
command: mlnet image-classification --dataset ${inputs.data_dir} --output outputs --name "StarWarML"
code: .
inputs:
  data_dir:
    type: uri_folder
    path: azureml:starwar_data:1
experiment_name: mlnet-imageclassification-training
environment:
  build:
    path: .
    dockerfile_path: Dockerfile
compute: azureml:GPUCluster
```



# 1 : Snapshot folder and send to experiment



The ml extension to the Azure CLI is the enhanced interface for Azure Machine Learning. It enables you to train and deploy models from the command line, with features that accelerate scaling data science up and out while tracking the model lifecycle.

<https://learn.microsoft.com/en-us/azure/machine-learning/how-to-configure-cli>

```
az configure --defaults group=Your Resource Group workspace=Azure ML Workspace  
Name
```

```
az ml job create --file Your.yml
```

```
~/L/CloudStorage/OneDrive-Microsoft/Microsoft/FY23/GitHubRepo/dotNETMLinAzureML on main
```

```
az configure --defaults group=CUDAWSGroup workspace=CUDAWS
```

```
~/L/CloudStorage/OneDrive-Microsoft/Microsoft/FY23/GitHubRepo/dotNETMLinAzureML on main
```

```
az ml job create --file AzureTrain.yml
```

# 2 : Experiment



happy\_box\_6rpsq5nf1d Completed

Overview Metrics Images Child jobs **Outputs + logs** Code Explanations (preview) Fairness (preview) Monitoring (preview)

Refresh Connect to compute Edit and submit Register model Cancel Delete | Download all ☒ Enable log streaming ☐ Word wrap

azureml-logs

20\_image\_build\_log.txt

system\_logs

user\_logs

std\_log.txt

std\_log.txt

20\_image\_build\_log.txt

```
128 2022/11/03 05:41:19 Populating digests for step ID: acb_step_0...
129 2022/11/03 05:41:21 Successfully populated digests for step ID: acb_step_0
130 2022/11/03 05:41:21 Step ID: acb_step_1 marked as successful (elapsed time in seconds: 28.011481)
131 2022/11/03 05:41:21 Step ID: acb_step_2 marked as successful (elapsed time in seconds: 2.055775)
132 2022/11/03 05:41:21 The following dependencies were found:
133 2022/11/03 05:41:21
134 - image:
135 | registry: cde4c13a8285455380d8260c9975c937.azurecr.io
136 | repository: azureml/azureml_bc7358ba4e6b7e0cffd51cf5c7d34fab
137 | tag: latest
138 | digest: sha256:615c99cb033d002a5598e15ef50124711e5453867eda0d901ab2979b6595c51c
139 runtime-dependency:
140 | registry: mcr.microsoft.com
141 | repository: dotnet/sdk
142 | tag: "6.0"
143 | digest: sha256:ce977e0ce71ce4aeeecde3917f3abf0dcffcf952e9ca138704b63e1a838b4700c
144 git: {}
145 - image:
146 | registry: cde4c13a8285455380d8260c9975c937.azurecr.io
147 | repository: azureml/azureml_bc7358ba4e6b7e0cffd51cf5c7d34fab
148 | tag: "1"
149 | digest: sha256:615c99cb033d002a5598e15ef50124711e5453867eda0d901ab2979b6595c51c
150 runtime-dependency:
151 | registry: mcr.microsoft.com
152 | repository: dotnet/sdk
153 | tag: "6.0"
154 | digest: sha256:ce977e0ce71ce4aeeecde3917f3abf0dcffcf952e9ca138704b63e1a838b4700c
155 git: {}
156
157 Run ID: cc17 was successful after 51s
```





## 2 : Experiment



🔍

⏪

📄 std\_log.txt ×

▼ azureml-logs

📄 20\_image\_build\_log.txt

▼ outputs

📄 models.h5

▼ system\_logs

> cs\_capability

> data\_capability

> hosttools\_capability

> lifecycler

> metrics\_capability

> snapshot\_capability

▼ user\_logs

✔️ std\_log.txt

1555 Epoch: 010/010, Step: 0127/0147, loss: 1.648712, accuracy: 0.173244

1556 Epoch: 010/010, Step: 0128/0147, loss: 1.648889, accuracy: 0.172670

1557 Epoch: 010/010, Step: 0129/0147, loss: 1.648503, accuracy: 0.172494

1558 Epoch: 010/010, Step: 0130/0147, loss: 1.647967, accuracy: 0.173092

1559 Epoch: 010/010, Step: 0131/0147, loss: 1.647576, accuracy: 0.173298

1560 Epoch: 010/010, Step: 0132/0147, loss: 1.647555, accuracy: 0.172741

1561 Epoch: 010/010, Step: 0133/0147, loss: 1.647415, accuracy: 0.172570

1562 Epoch: 010/010, Step: 0134/0147, loss: 1.647400, accuracy: 0.172775

1563 Epoch: 010/010, Step: 0135/0147, loss: 1.647714, accuracy: 0.172606

1564 Epoch: 010/010, Step: 0136/0147, loss: 1.648350, accuracy: 0.171702

1565 Epoch: 010/010, Step: 0137/0147, loss: 1.648853, accuracy: 0.171178

1566 Epoch: 010/010, Step: 0138/0147, loss: 1.648233, accuracy: 0.171750

1567 Epoch: 010/010, Step: 0139/0147, loss: 1.648779, accuracy: 0.171233

1568 Epoch: 010/010, Step: 0140/0147, loss: 1.648586, accuracy: 0.172155

1569 Epoch: 010/010, Step: 0141/0147, loss: 1.648377, accuracy: 0.171997

1570 Epoch: 010/010, Step: 0142/0147, loss: 1.648831, accuracy: 0.171842

1571 Epoch: 010/010, Step: 0143/0147, loss: 1.648998, accuracy: 0.171689

1572 Epoch: 010/010, Step: 0144/0147, loss: 1.649805, accuracy: 0.170842

1573 Epoch: 010/010, Step: 0145/0147, loss: 1.649572, accuracy: 0.172080

1574 Epoch: 010/010, Step: 0146/0147, loss: 1.649600, accuracy: 0.171929

1575 Epoch: 010/010, Step: 0147/0147, loss: 1.649328, accuracy: 0.171438

1576 123:/mnt/azureml/cr/j/6767acdac1334190bc919637e7ad132a/exe/wd

1577 2022-11-03 06:45:37.149685: I tensorflow/core/common\_runtime/gpu/gpu\_device.cc:1733] Found device 0 with properties:

1578 pciBusID: 32f6:00:00.0 name: Tesla K80 computeCapability: 3.7

1579 coreClock: 0.8235GHz coreCount: 13 deviceMemorySize: 11.17GiB deviceMemoryBandwidth: 223.96GiB/s

1580 2022-11-03 06:45:37.149719: W tensorflow/core/common\_runtime/gpu/gpu\_device.cc:1766] Cannot dlopen some GPU libraries. Pl

1581 Skipping registering GPU devices...

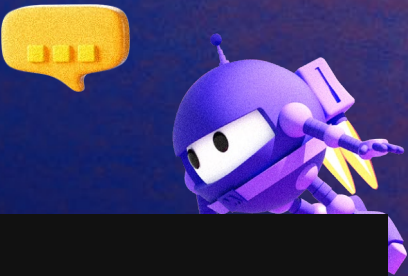
1582 2022-11-03 06:45:37.149736: I tensorflow/core/common\_runtime/gpu/gpu\_device.cc:1258] Device interconnect StreamExecutor w:

1583 2022-11-03 06:45:37.149744: I tensorflow/core/common\_runtime/gpu/gpu\_device.cc:1264] 0

1584 2022-11-03 06:45:37.149750: I tensorflow/core/common\_runtime/gpu/gpu\_device.cc:1277] 0: N

1585

# 2 : Experiment



## Jobs

All experiments All jobs

Refresh Archive experiment Edit columns Reset view

Search

☐ View archived experiments

Showing 1-5 experiments

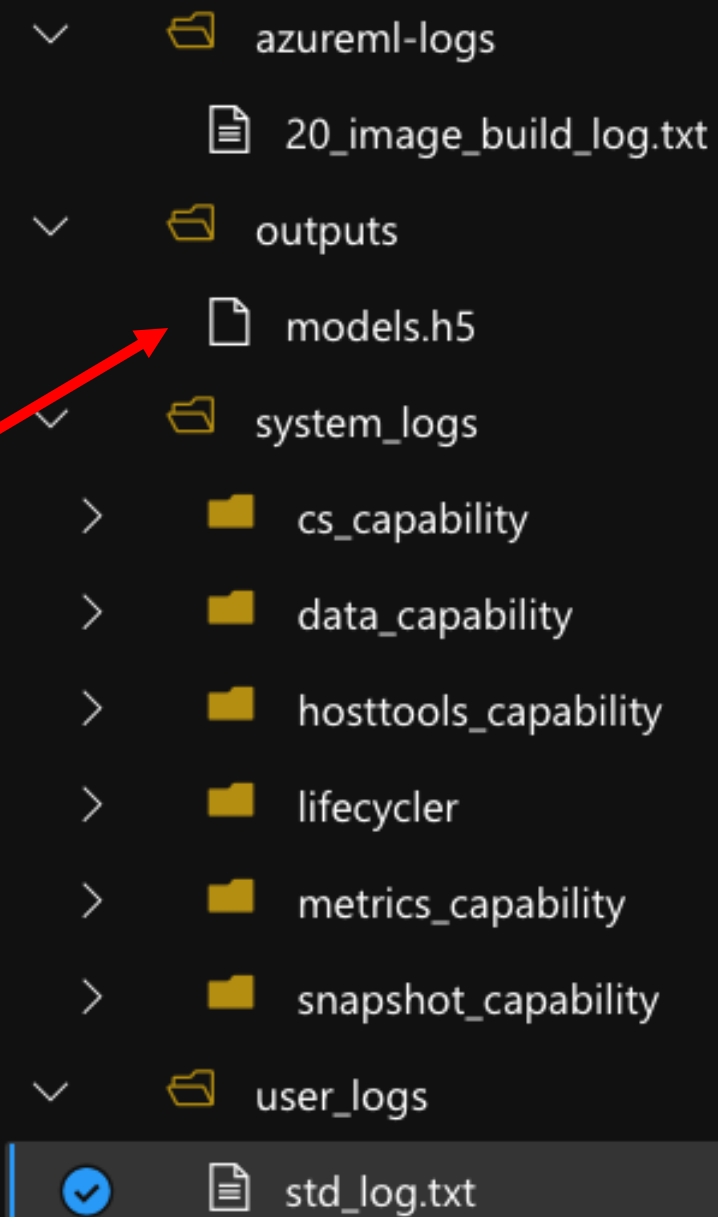
Experiment	☆	Latest job	Last submitted ↓	Created	Created by
tf-image-training		mango_cart_z3syldpp	Nov 10, 2022 10:16 AM	Nov 2, 2022 6:01 PM	Lo K...
mlnet-imageclassification-training		sincere_needle_gh2ptwv5	Nov 8, 2022 11:11 AM	Nov 8, 2022 10:46 AM	Lo K...
<input checked="" type="radio"/> torchsharp-training	★	funny_pear_wxkwfpr2	Nov 2, 2022 6:29 PM	Nov 1, 2022 7:36 AM	Lo K...
mldotnet-training		heroic_window_99jksv15	Nov 1, 2022 7:49 AM	Oct 28, 2022 4:13 PM	Lo K...
dotnet-training		mango_balloon_6wvt1xkwqr	Oct 28, 2022 7:26 PM	Oct 28, 2022 7:26 PM	Lo K...





### 3 : Output Model

You can see the model



# 4 : Register Model

Model List

+

Register

↺

Refresh

🗑

Delete

📁

Archive

▶

Deploy

📄

Compare (preview)

📊

Edit columns

↺

Reset view

🔍

Search

Created on

Created by

Tags

All filters

Clear all

Showing 1-1 of 1 models

Page size: 25

Name	☆	Version	Experiment	Job (Run ID)	Created on ↓	Tags	Properties
demo		1		tough_shoe_2dvs7v6d53	Nov 3, 2022 5:29 PM		⋮ azureml.da

Create deployment

Endpoint

Model

Deployment

Environment

Compute

Traffic

Review

Create endpoint

An endpoint is used to deploy and score your models. [Learn more](#)

Endpoint name \*

Description

Compute type ⓘ

Managed

Kubernetes

Authentication type ⓘ

Token-based authentication

Key-based authentication

Public network access

Enable this option if you want to allow scoring requests to your endpoint from the internet. Disable this option if you want to allow scoring requests to your endpoint only from your resources in your virtual network. [Learn more](#)

Enabled



# Thank you!

Let's build amazing apps with .NET 7  
[get.dot.net/7](https://get.dot.net/7)

