
# MindSpore Challenge - Pathology Diagnosis

In the competition, participants are invited to use **MindSpore** as the AI training and inference framework, for developing trustworthy AI pathology diagnosis models that ensures ***privacy***, ***explainable*** and ***high accuracy***.

| | |
|---|---|
| **Quota** | 30 Teams |
| **Team size** | 1 - 3 Members |
| **Events** | Workshops, Pitching, Award Ceremony |
| **Competition Stage** | Model Evaluation and Pitching Stage |

# Co-organizers

HUAWEI CLOUD

**Huawei Cloud Hong Kong**

- A leading cloud service provider, committed to bringing affordable, effective, and reliable cloud and AI services through technological innovation.

**Huawei Hong Kong Research Center**

- Conducting researches in AI, fundamental theory, chips microarchitecture, software engineering, trustworthy software and so on.
- 250+ researchers, >48% PhD

**Guangzhou LBP Medicine Science & Tech. Co., Ltd**

- Founded in 2005. The first listed company on the Science and Technology Board of the Shanghai Stock Exchange in the field of pathology diagnosis in China. (Securities Code: 688393)
- More than 500 registered/recorded products.
- Covering nearly 1,800 medical institutions in China.

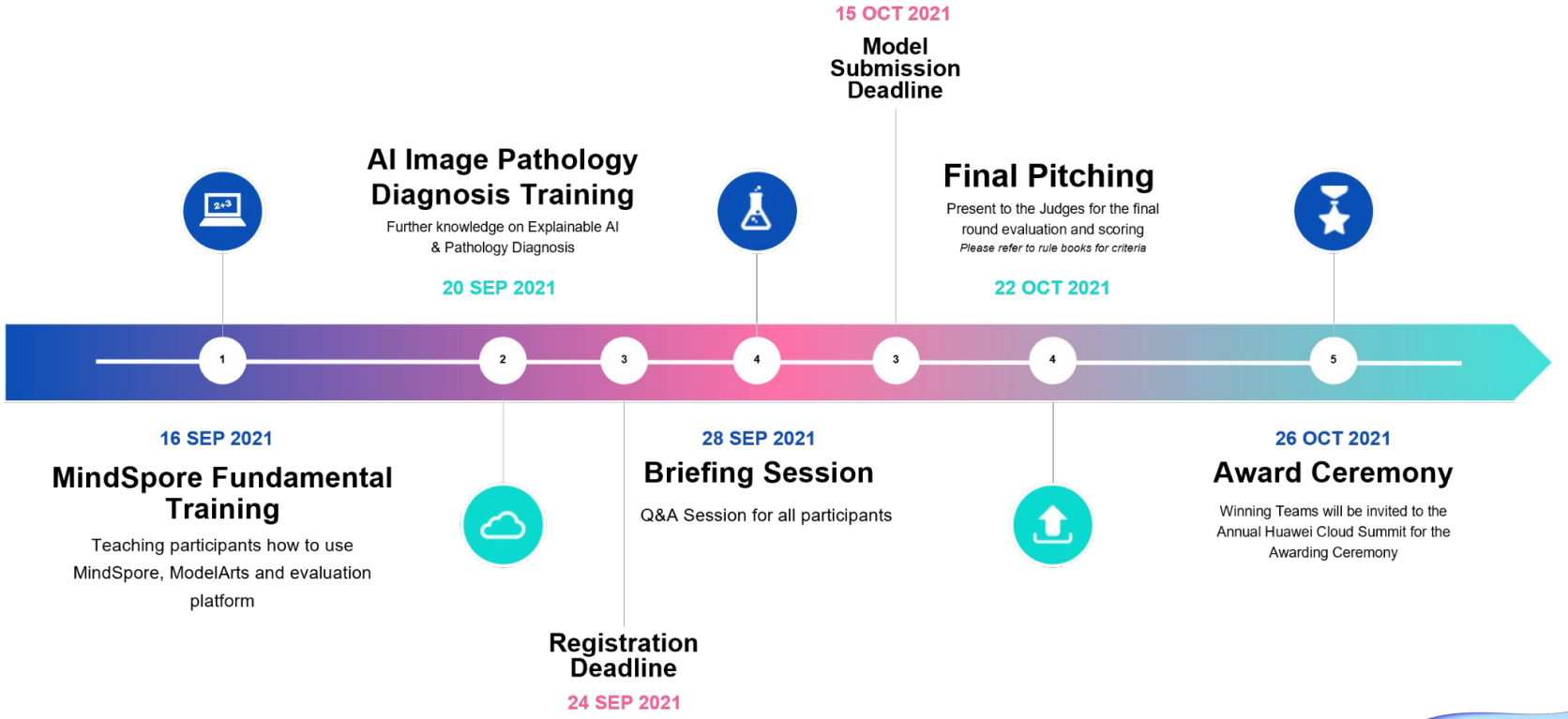
**Hong Kong Science and Technology Parks Corporation**

- A public corporation set up by the Hong Kong Government in 2001 to foster the development of innovation and technology in Hong Kong.
- Cultivated successful Innovation and Technology (I&T) companies, formed strong local and international partnership networks and created a thriving community

**Guangzhou Bingli Technology Co., Ltd.**

- A subsidiary of LBP Medicine, founded in 2017.
- The real-time visual field sharing system and pathology medical image analysis and processing system are widely used in intelligent diagnosis, data management, and data quality control.

# Competition Timeline



# Final Pitching & Award Ceremony

## Final Pitching

Date **22 October 2021 (Friday)**

Venue **Inno2, 17W, Hong Kong Science Park**

Time **2:30pm**

Agenda

- Welcoming Speech
- Solution Pitching
- On-site Evaluation

## Award Ceremony

Event **Huawei Cloud Summit 2021**

Date **26 October 2021 (Tuesday)**

Venue **Grand Hyatt Hong Kong**

Time Afternoon

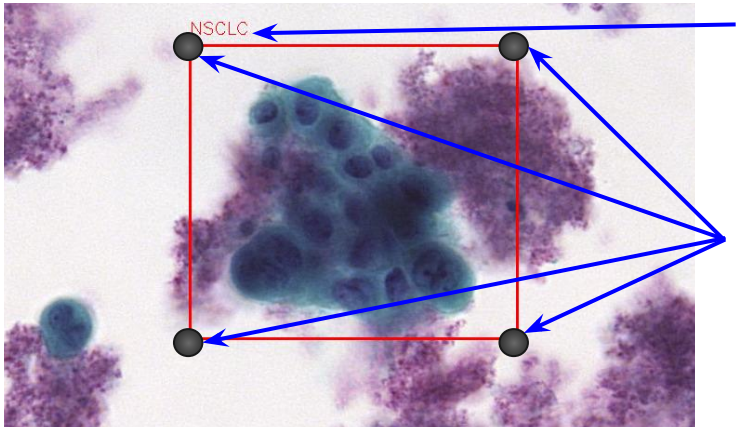
# *Prizes!*

| Winning Teams Award | Prizes per Team |
|---|---|
| *Model Score Winner* | **HKD 60,000 Cash + HKD 12,000 Huawei Cloud Credit** |
| *Model Score Runner-up* | **HKD 45,000 Cash + HKD 6,000 Huawei Cloud Credit** |
| *Pitching Score Winner* | **HKD 45,000 Cash + HKD 6,000 Huawei Cloud Credit** |
| *Pitching Score Runner-up* | **HKD 30,000 Cash + HKD 6,000 Huawei Cloud Credit** |
| *Special Prize for Explainability* | **Souvenirs up to HKD 900 + HKD 1,500 Huawei Cloud Credit (max: 30 winners)** |

# Problem Statement

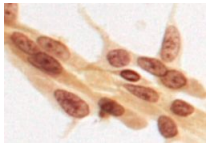
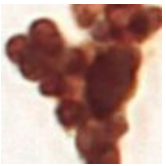
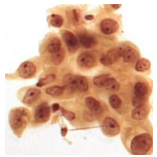
Train a **MindSpore** AI model to **identify locations and classifications** of cancer cells in pathological images. The AI Models will **assist pathologists** in the diagnosis of **peripheral pulmonary diseases**.

This is a form of **multi-label object detection**.




***Classification:***
- Class of diagnosed cell

***Location:***
- Bounding Boxes

| Class | English Name | Subclass | Example |
|---|---|---|---|
| **SCC** | *Squamous Cell Carcinoma* | *NSCLC* |  |
| **AC** | *Adenocarcinoma* | *NSCLC* |  |
| **SCLC** | *Small Cell Lung Cancer* | - |  |
| **NSCLC** | *Non-Small Cell Lung Cancer* | - |  |

# Model Evaluation - Evaluation Criteria

$$\text{Classification Score} = \frac{1}{|M|}\sum_{i \in M} \text{FROC}_i$$

$$\text{AUC} = \frac{1}{M \times N} \sum_{i \in \text{positive class}} rank_i - \frac{M(1+M)}{2}$$

Accuracy - FROC

- The trained MindSpore AI models should ***accurately locate*** and ***classify*** cancer cells.

Explainability (Bonus) - AUC

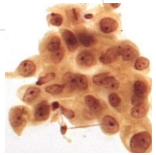
- The trained MindSpore AI models should provides ***pixel level feature attribution*** as an explanation for the task!

$$\text{Model Score} = \text{Accuracy Score} * 0.8 + \text{Explainable Score} * 0.2$$

The *top 6 highest model score* teams are invited to enter the **FINAL PITCHING**

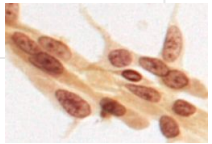
# Brief Introduction of Lung Cancer

Non-small cell lung cancer (NSCLC)



Small cell lung cancer (SCLC)

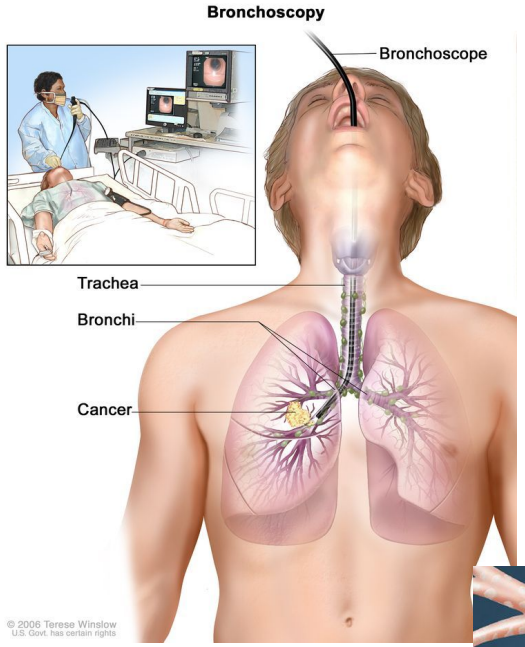
Squamous Cell Carcinoma (SCC)

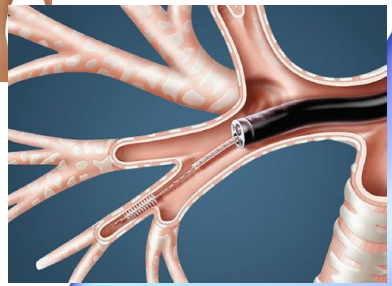


Adenocarcinoma (AC)

Their treatment and prognoses (outlook) are often similar.

# Brief Introduction of Bronchi Brushing



https://www.youtube.com/watch?v=V4Y5U7UU27Y

# *Learn more about Pathology Diagnosis and Explainable AI*

Join the 2nd training workshop at 2:30pm on 20 SEP

Dr. Lawrence Chan
Associate Professor
Department of Health Technology and Informatics
The Hong Kong Polytechnic University

Dr. Yongxiang Huang
AI Researcher
Huawei Hong Kong Research Center

# *Register Now!*

OFFICIAL WEBSITE

**Sign Up!**

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**Get Connected**

GITHUB

**Get Resources**

RULE BOOK & GUIDELINES

**Get Informed**

# Huawei Cloud

Elastic Cloud Server

## ELASTIC CLOUD SERVICE (ECS)

A powerful compute engine for you to deploy any application

Object Storage Service

## OBJECT STORAGE SERVICE (OBS)

A **cloud storage service** optimized for storing massive amounts of data

HUAWEI

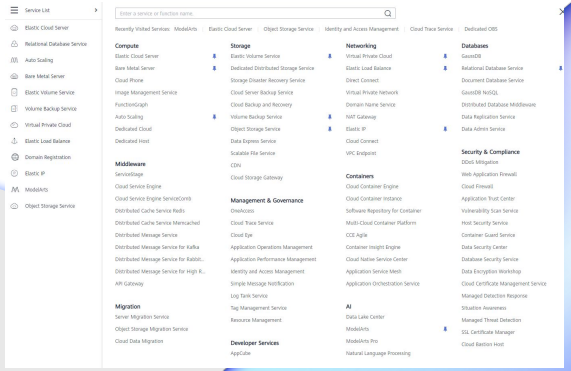
## HUAWEI CLOUD

ModelArts

## MODELARTS

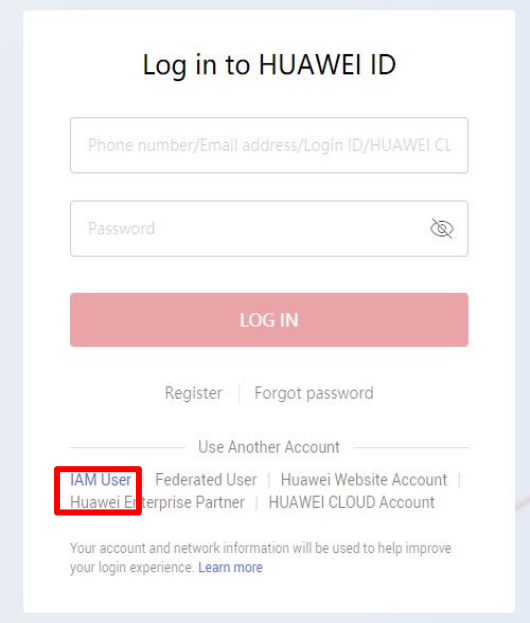
A one-stop **development platform** for AI developers

## AND MANY MORE...

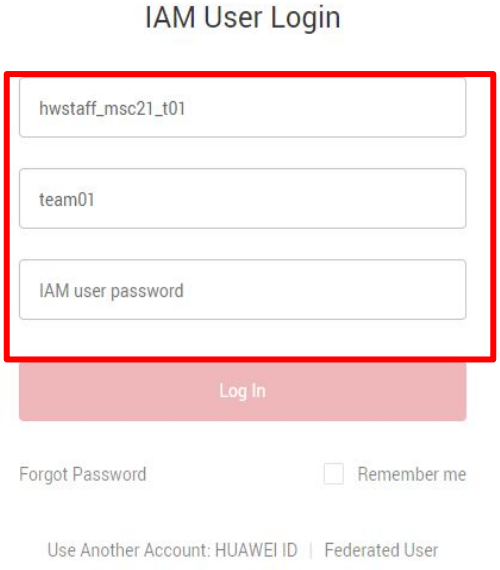


# Hands on time!

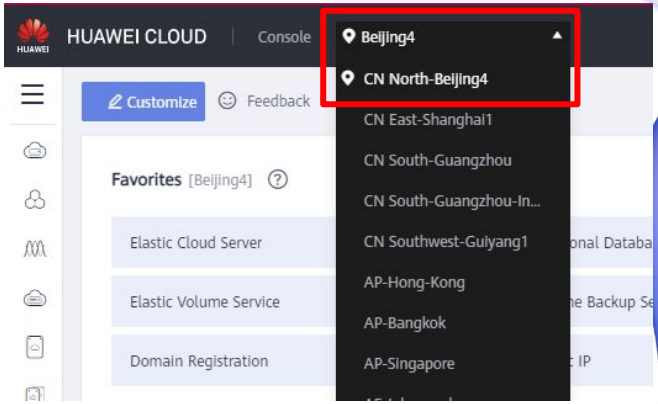
**Get your user_id from Discord !**




**Press IAM User in Login Page**



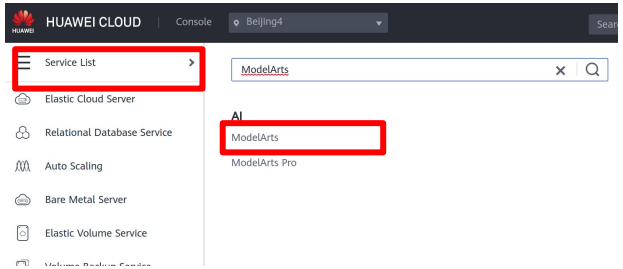

**Login with Credentials!**
Username: hwstaff_msc21_tutor
Iam: user_XX
Password: ***msc2021!***



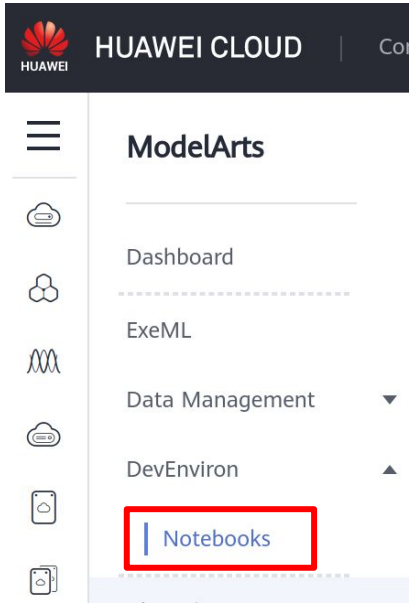

**Change the Region to CN-North-Beijing4**

https://auth.huaweicloud.com/authui/login?id=hwstaff_msc21_tutor

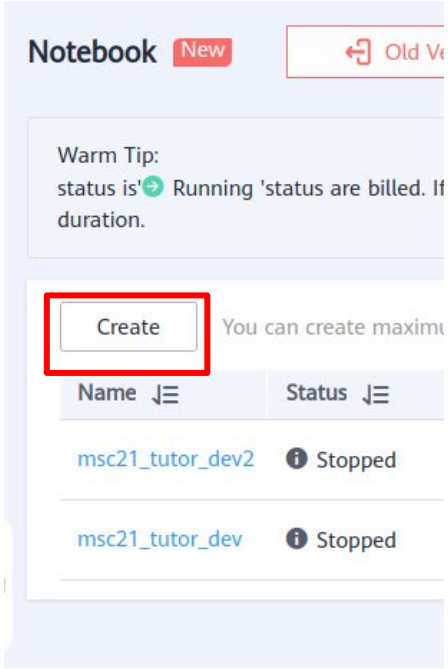
# Hands on time!




**Go to Service List, Search ModelArts**

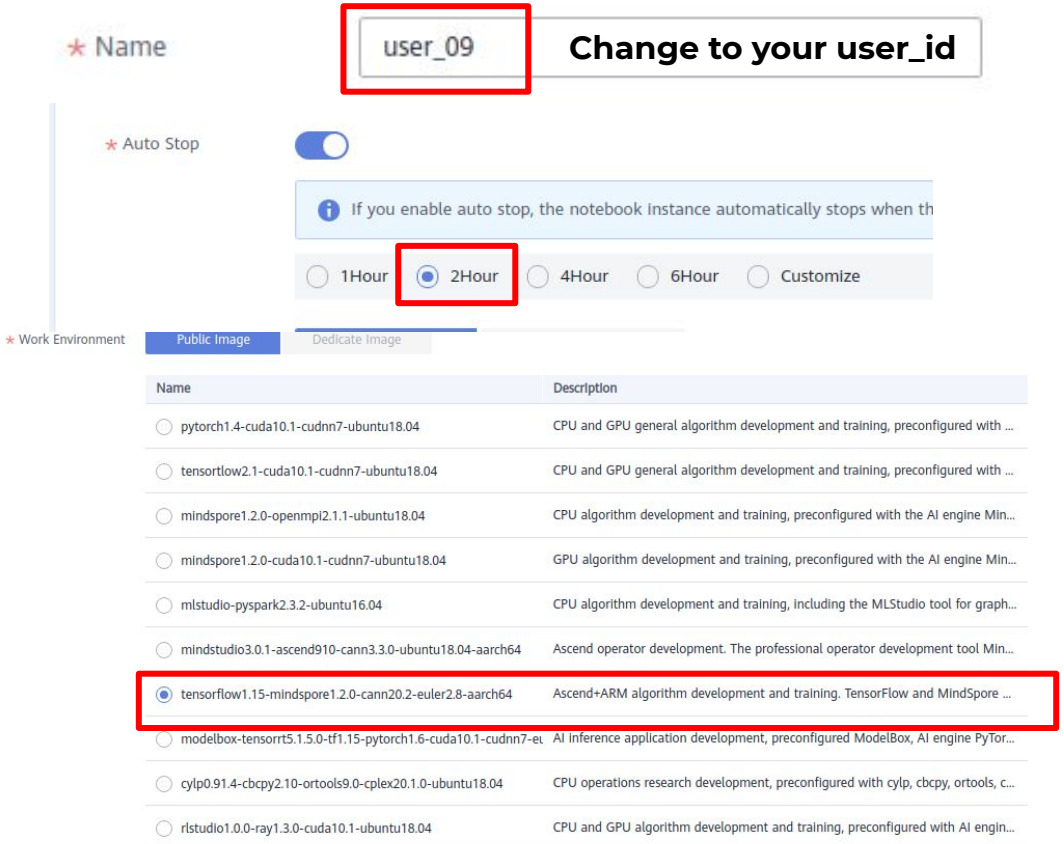



**Click DevEnviron > Notebooks**




**Create your own notebook**

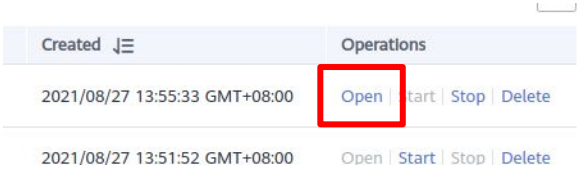
# Hands on time!




**Name : user_XX**

**Work Environment:**
**Choose, Ascend + ARM ....**

**Flavour:**
**Ascend: 1*Ascend 910|CPU: 24vCPUs 96GB**

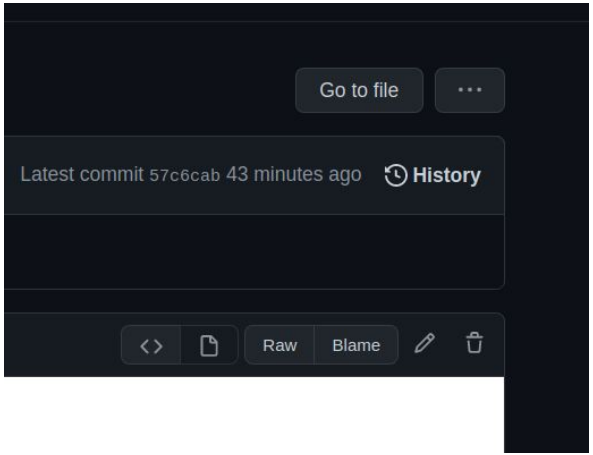




**Wait for the creation to finish and you can click Open**

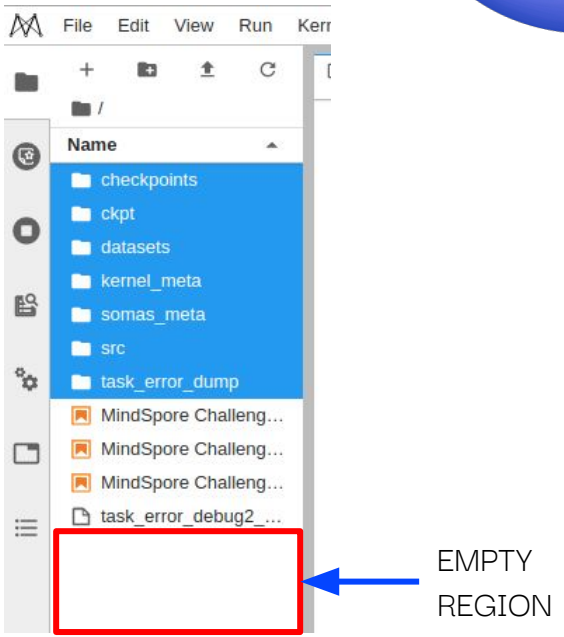
# Hands on time!

https://github.com/MindSporeChallenge21/resources

**Download required notebooks**
**In `notebooks` folder.**




**Right Click RAW > save link as ....**




**Drag and drop the file into the empty region to upload!**

# MindSpore

Introduction and Examples

# What is MindSpore?

MindSpore

An **Open AI-framework** that supports the multi-processor architectures developed by Huawei.

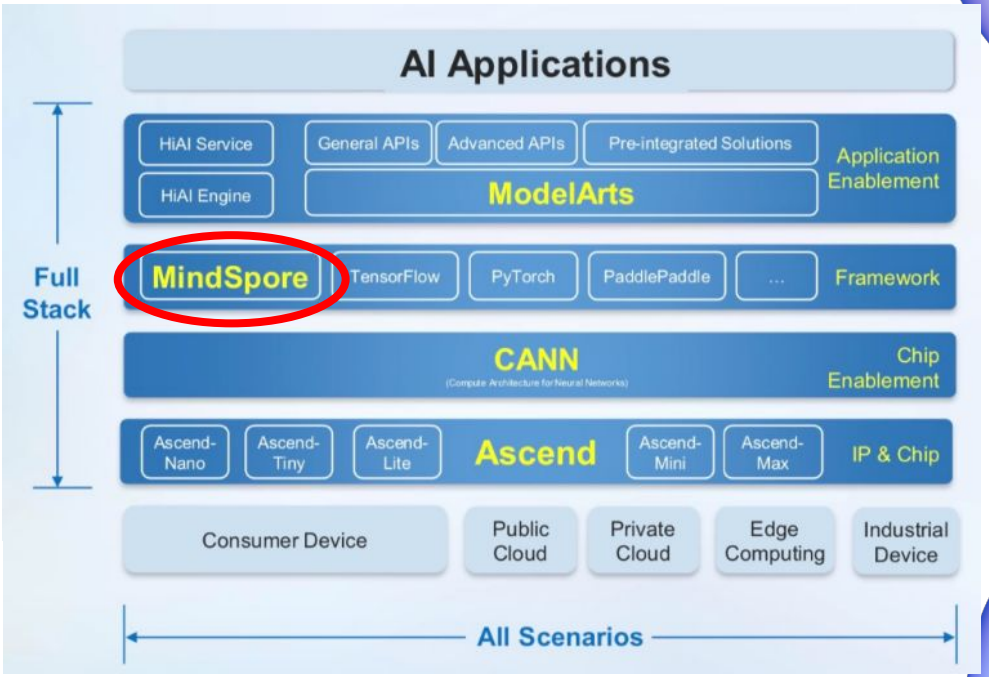
It provides a unified APIs and end-to-end AI capabilities for AI model development, execution and deployment in all scenarios, including cloud, edge and devices.

Friendly Development Experience

Flexible Debugging

Fully Unleashing Hardware Performance

Quick Deployment in All Scenarios



# DL Python Modules

| | Dataset Preparation and Preprocessing | Network Construction and Training | Explainable XAI |
|---|---|---|---|
| MindSpore Modules   | `mindspore.dataset:` Complete solution equipped with vision and text operators. | `mindspore.nn:` network constructions<br>`mindspore.ops:` common operators in neural networks<br>`mindspore.model:` defining model, optimizers and loss function<br>`mindspore.train:` provides common training utilities | **`mindspore .explainer:`** Provides methods to evaluate generate saliency maps/other explainable figures from inputs. |
| Tensorflow Pytorch Modules  | `tf.data` `torch.utils.data` | `tf.keras.Model` `torch.nn` | - |

# MindSpore Model Design and Training

```
import mindspore as ms
```

## Dataset

```
dataset = ms.dataset.MnistDataset()

dataset.batch # batching data
dataset.map # preprocessing data
```

## Network

```
class Net(ms.nn.Cell):
    def __init__(self):
        super(Net, self).__init__()
        self.flatten = ms.nn.Flatten()
        self.dense = ms.nn.Dense(1024, 10)

    def construct(self, x):
        x = self.flatten(x)
        x = self.dense(x)
        return x
net = Net()
```

## Model

```
loss = ms.nn.SoftmaxCrossEntropyWithLogits()
optimizers = ms.nn.Adam(
  net.trainable_params(),
  learning_rate=0.01
)

model = ms.Model(
    net,
    loss,
    optimizers,
    metrics={"Accuracy": ms.nn.Accuracy()}
)

model.train(epoch=10, dataset)
```

AI APPS

# Agenda

## Part I - Beginner Tutorial

- MindSpore Dataset
- MindSpore Neural Network Design
- MindSpore Model Training

Download Jupyter Notebook
https://downgit.github.io/#/home?url=https://github.com/MindSporeChallenge21/resources/blob/main/notebook/MindSpore%20Challenge%20Tutorial%20Beginner.ipynb

## Part II - Intermediate Tutorial

- Training a YoloV3 model
- Using ModelArts, OBS and Moxing Framework
- Submission to Portal

Download Jupyter Notebook
https://downgit.github.io/#/home?url=https://github.com/MindSporeChallenge21/resources/blob/main/notebook/MindSpore%20Challenge%20Tutorial%20Intermediate.ipynb