Defect Classifications of AOI

Group 5

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Outline

01 Introduction

02 Model Architecture

03 Tricks

04 Results

Introduction

We referred to Alexnet's model architecture and experimented with various techniques to enhance performance, ultimately achieving an accuracy of 98.91%

檔名	上傳時間	評估結果	排名
predicted_labels.csv yuzhong	2024-12-22 07:03:52	0.9891491	171/818

```
----------------------------------------------------------------
        Layer (type)               Output Shape         Param #
================================================================
            Conv2d-1           [-1, 64, 85, 85]           3,200
              ReLU-2           [-1, 64, 85, 85]               0
         MaxPool2d-3           [-1, 64, 42, 42]               0
            Conv2d-4          [-1, 128, 21, 21]         204,928
              ReLU-5          [-1, 128, 21, 21]               0
         MaxPool2d-6          [-1, 128, 10, 10]               0
            Conv2d-7          [-1, 256, 10, 10]         295,168
              ReLU-8          [-1, 256, 10, 10]               0
         MaxPool2d-9            [-1, 256, 4, 4]               0
AdaptiveAvgPool2d-10            [-1, 256, 4, 4]               0
          Dropout-11                 [-1, 4096]               0
           Linear-12                 [-1, 2048]       8,390,656
             ReLU-13                 [-1, 2048]               0
          Dropout-14                 [-1, 2048]               0
           Linear-15                 [-1, 2048]       4,196,352
             ReLU-16                 [-1, 2048]               0
           Linear-17                    [-1, 6]          12,294
================================================================
Total params: 13,102,598
Trainable params: 13,102,598
Non-trainable params: 0
----------------------------------------------------------------
Input size (MB): 0.25
Forward/backward pass size (MB): 9.44
Params size (MB): 49.98
Estimated Total Size (MB): 59.67
----------------------------------------------------------------
```

Snapshot from the torch-summary

Model Architecture

Refer to Alexnet.

(CNN + MaxPool) * 3
(Linear + Dropout) * 3

Env Setup

aoi-classification-basic-12-22-06-53

Description	What makes this run special?
Tags	+
Author	yuzhong1214
State	Finished
Start time	December 22nd, 2024 6:53:48 AM
Duration	8m 6s
Run path	yu-zhong/aoi-classification/jha71zai
Hostname	yuzhong-ubuntu
OS	Linux-6.8.0-49-generic-x86_64-with-glibc2.35
Python version	CPython 3.10.12
Python executable	/usr/bin/python3
Git repository	`git clone git@github.com:YuZhong-Chen/Defect-Classifications-of-AOI.git`
Git state	`git checkout -b "aoi-classification-basic-12-22-06-53" 75eac063b607cd0bf0a5edfd32c0eb55ca7c9b9e`
Command	`/home/user/Defect-Classifications-of-AOI/src/train.py`
System Hardware	CPU count 14
	Logical CPU count 20
	GPU count 1
	GPU type NVIDIA GeForce RTX 3070 Ti Laptop GPU
W&B CLI Version	0.19.0

Memory

40G

8G

Tricks

Weights & Biases

Tracing the training result.

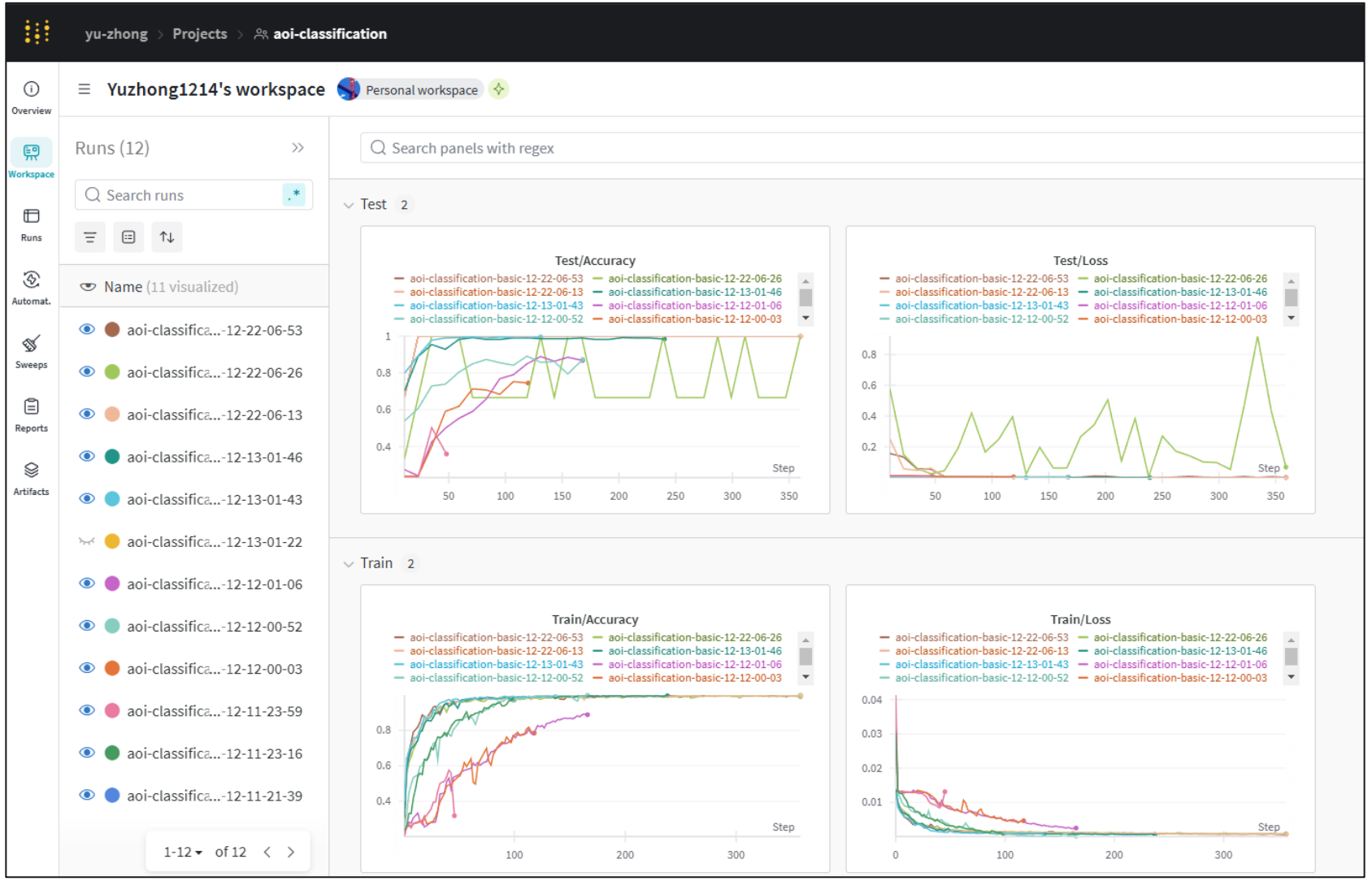
NVIDIA Nsight Systems

Profiling the system,
finding the bottlenecks,
and then optimizing it.

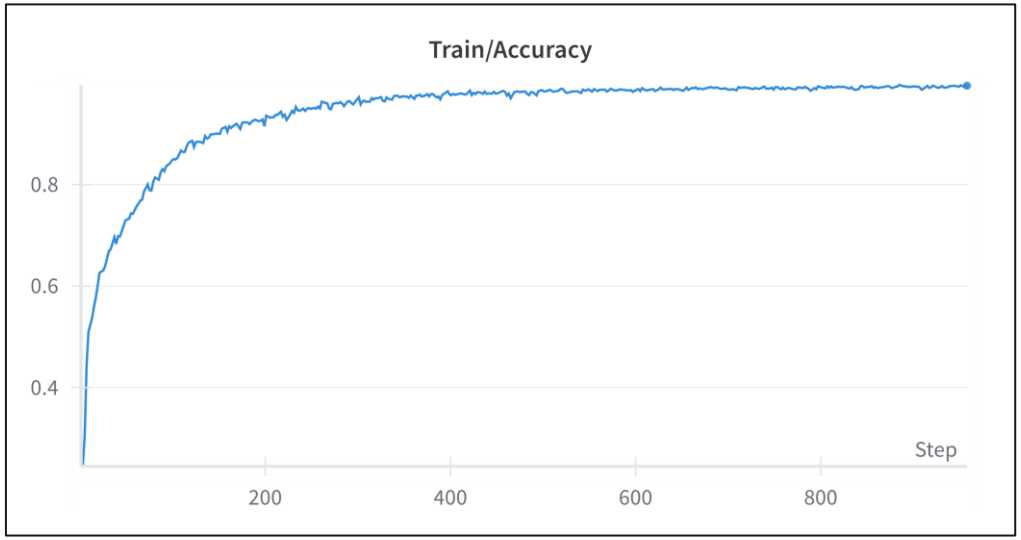
Torchvision

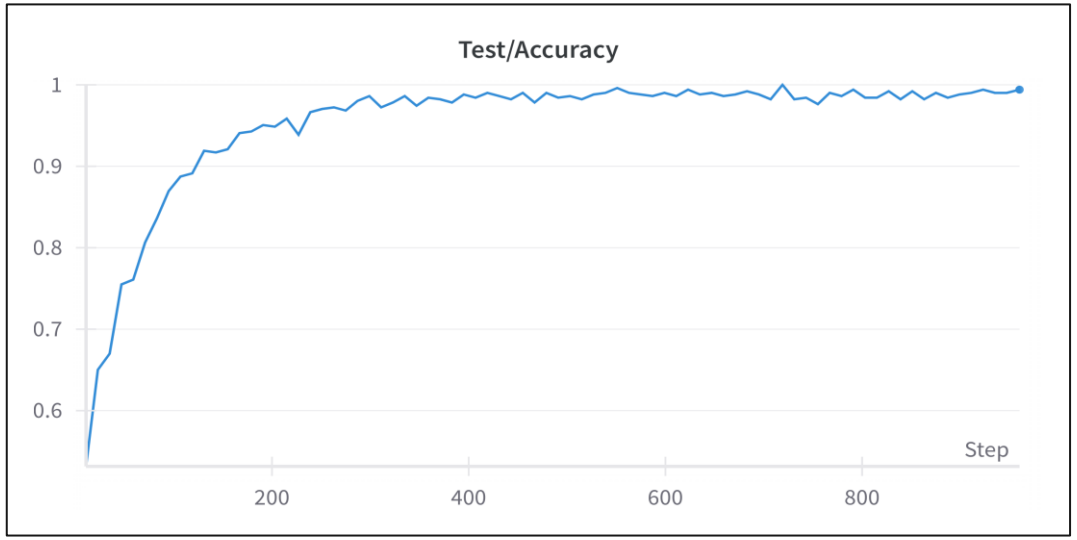
Transforming and
augmenting images.

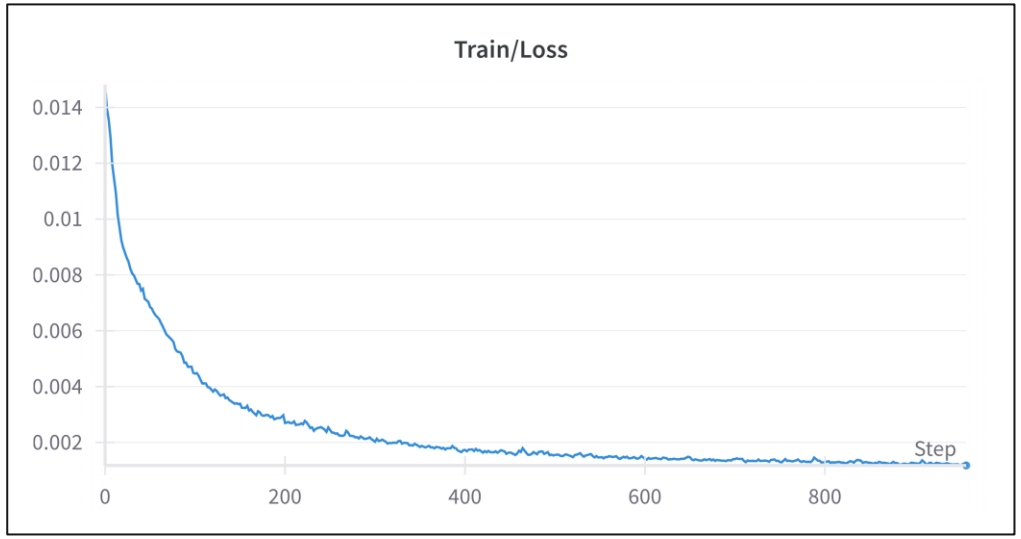
Weights & Biases



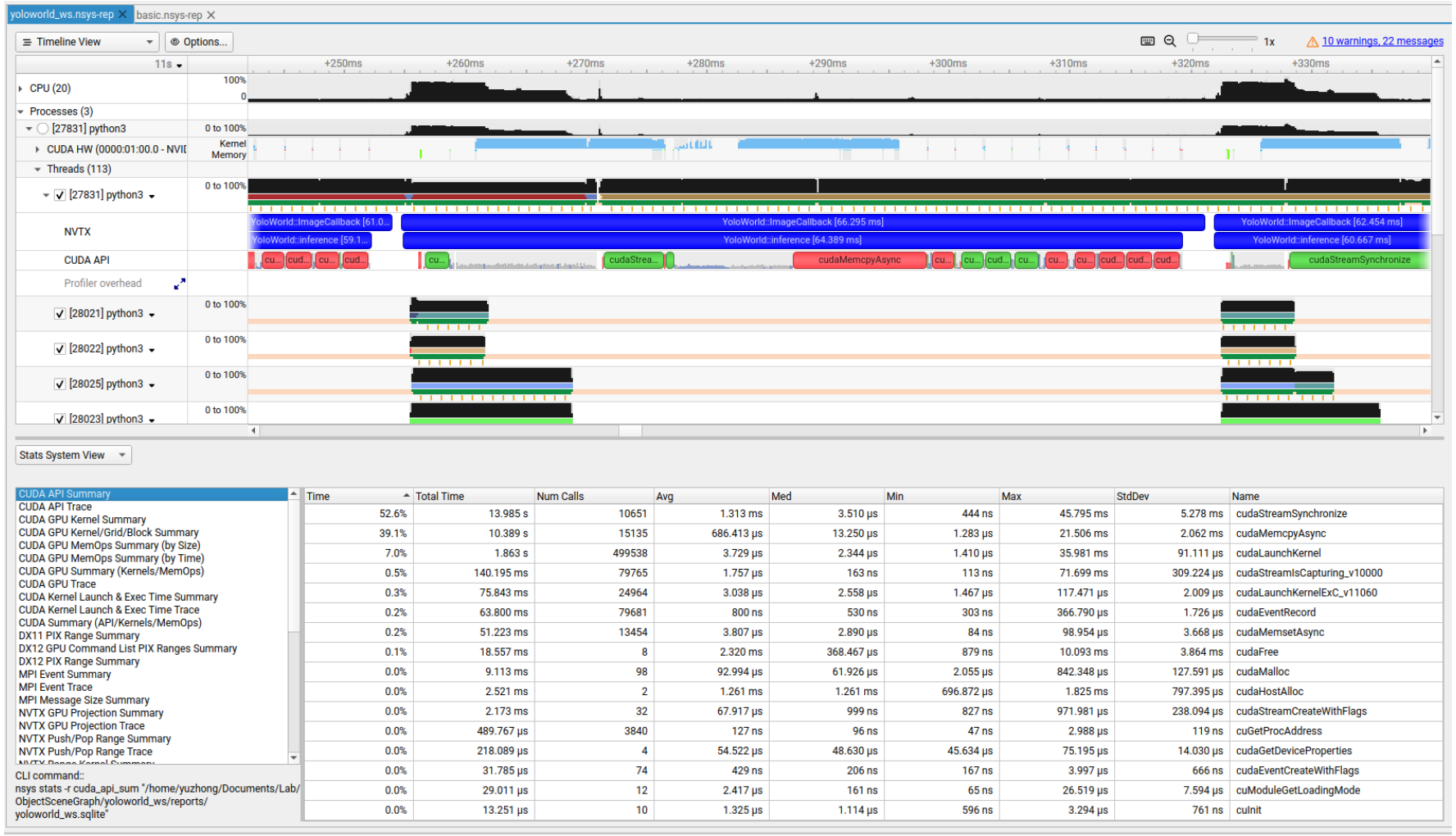
Weights & Biases







NVIDIA Nsight Systems + NVTX

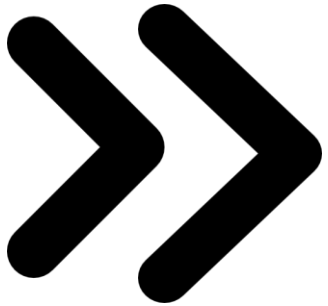


Time	Total Time	Num Calls	Avg	Med	Min	Max	StdDev	Name
52.6%	13.985 s	10651	1.313 ms	3.510 µs	444 ns	45.795 ms	5.278 ms	cudaStreamSynchronize
39.1%	10.389 s	15135	686.413 µs	13.250 µs	1.283 µs	21.506 ms	2.062 ms	cudaMemcpyAsync
7.0%	1.863 s	499538	3.729 µs	2.344 µs	1.410 µs	35.981 ms	91.111 µs	cudaLaunchKernel
0.5%	140.195 ms	79765	1.757 µs	163 ns	113 ns	71.699 ms	309.224 µs	cudaStreamIsCapturing_v10000
0.3%	75.843 ms	24964	3.038 µs	2.558 µs	1.467 µs	117.471 µs	2.009 µs	cudaLaunchKernelExC_v11060
0.2%	63.800 ms	79681	800 ns	530 ns	303 ns	366.790 µs	1.726 µs	cudaEventRecord
0.2%	51.223 ms	13454	3.807 µs	2.890 µs	84 ns	98.954 µs	3.668 µs	cudaMemsetAsync
0.1%	18.557 ms	8	2.320 ms	368.467 µs	879 ns	10.093 ms	3.864 ms	cudaFree
0.0%	9.113 ms	98	92.994 µs	61.926 µs	2.055 µs	842.348 µs	127.591 µs	cudaMalloc
0.0%	2.521 ms	2	1.261 ms	1.261 ms	696.872 µs	1.825 ms	797.395 µs	cudaHostAlloc
0.0%	2.173 ms	32	67.917 µs	999 ns	827 ns	971.981 µs	238.094 µs	cudaStreamCreateWithFlags
0.0%	489.767 µs	3840	127 ns	96 ns	47 ns	2.988 µs	119 ns	cuGetProcAddress
0.0%	218.089 µs	4	54.522 µs	48.630 µs	45.634 µs	75.195 µs	14.030 µs	cudaGetDeviceProperties
0.0%	31.785 µs	74	429 ns	206 ns	167 ns	3.997 µs	666 ns	cudaEventCreateWithFlags
0.0%	29.011 µs	12	2.417 µs	161 ns	65 ns	26.519 µs	7.594 µs	cuModuleGetLoadingMode
0.0%	13.251 µs	10	1.325 µs	1.114 µs	596 ns	3.294 µs	761 ns	cuInit

NVIDIA Nsight Systems + NVTX

$$(Height \times Width) \times Data\ type \times Total\ Image\ Size$$

$$512 \times 512 \times 1 \times 2528 = 662{,}700{,}032\ \mathrm{B}ytes \cong 0.6\ GB$$

20 ~ 30 minutes  8 minutes

Torchvision

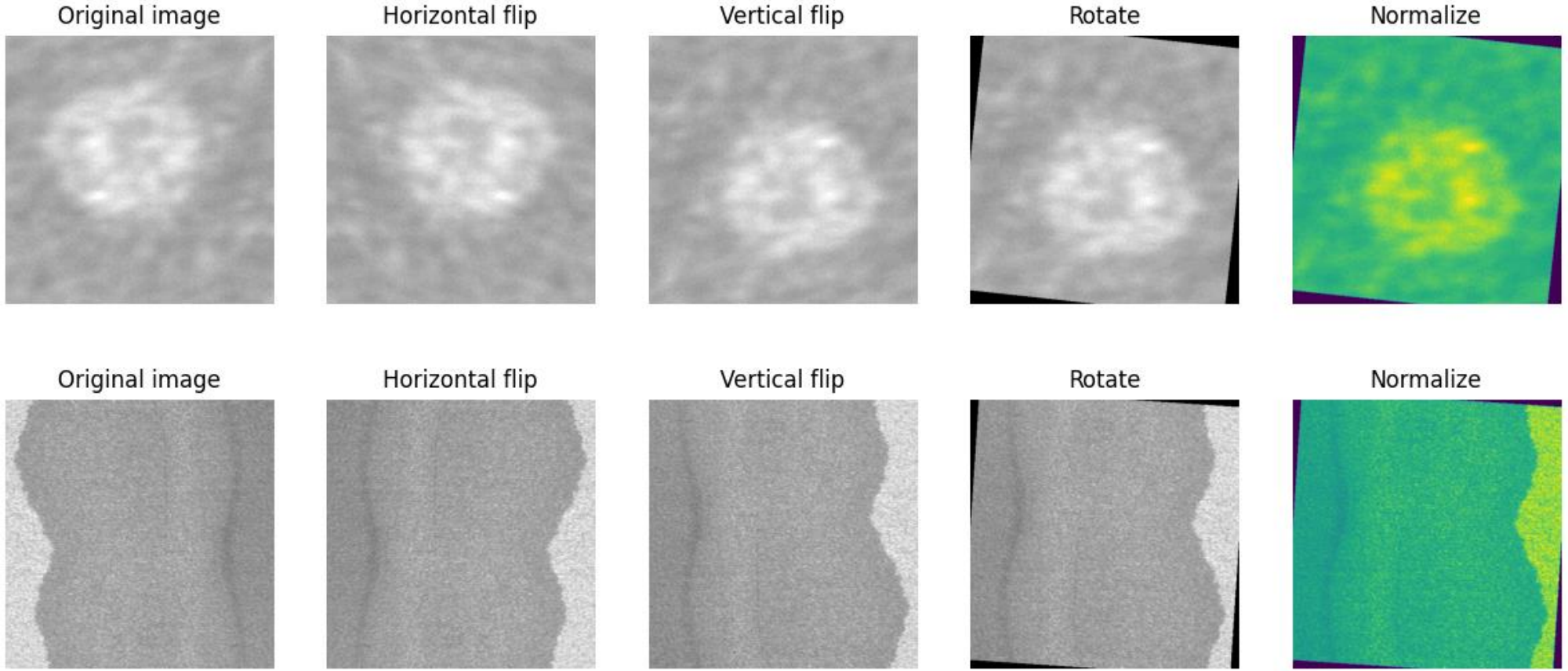
```python
import pandas as pd
from pathlib import Path

# Load the dataset
dataset_path = Path(__file__).parent / "data" / "train.csv"
df = pd.read_csv(dataset_path)
label_counts = df["Label"].value_counts()

# Print the dataset information
print(f"Total data: {len(df)}")
print(f"Total labels: {len(label_counts)}")
print(label_counts)
```

```
┌─[yuzhong-ubuntu] as user in ~/Defect-Classifications-of-AOI on (main)✗✗✗
└─(/°Д°)/ python3 test.py
Total data: 2528
Total labels: 6
0    674
5    644
1    492
3    378
4    240
2    100
Name: Label, dtype: int64
```

Torchvision



Results

Public Leaderboard | Private Leaderboard

檔名	上傳時間	評估結果	排名
predicted_labels.csv yuzhong	2024-12-15 13:32:23	0.9889025	177/818
predicted_labels.csv yuzhong	2024-12-15 12:58:33	0.9893958	
predicted_labels.csv yuzhong	2024-12-15 12:40:18	0.9876695	
predicted_labels.csv yuzhong	2024-12-14 00:43:58	0.9871763	
predicted_labels.csv yuzhong	2024-12-13 01:12:26	0.9442663	
predicted_labels.csv yuzhong	2024-12-13 00:57:26	0.9390875	
predicted_labels.csv yuzhong	2024-12-13 00:24:43	0.9242909	
predicted_labels.csv yuzhong	2024-12-12 01:16:11	0.8673242	
predicted_labels.csv yuzhong	2024-12-12 01:00:59	0.8769420	

檔名	上傳時間	評估結果	排名
predicted_labels.csv yuzhong	2024-12-22 07:03:52	0.9891491	171/818

Thanks.