

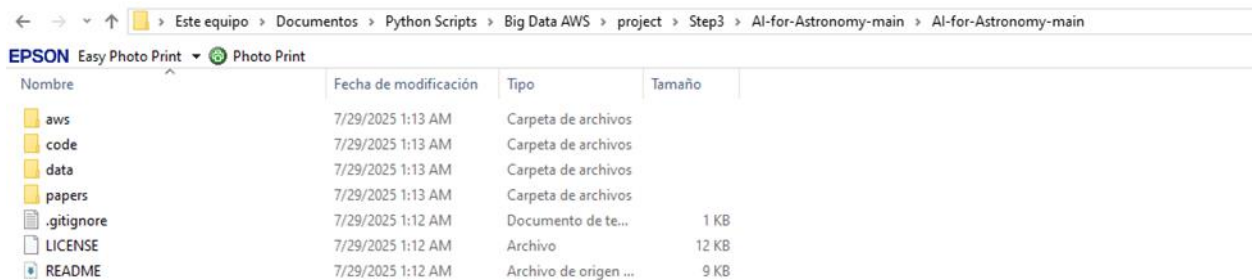
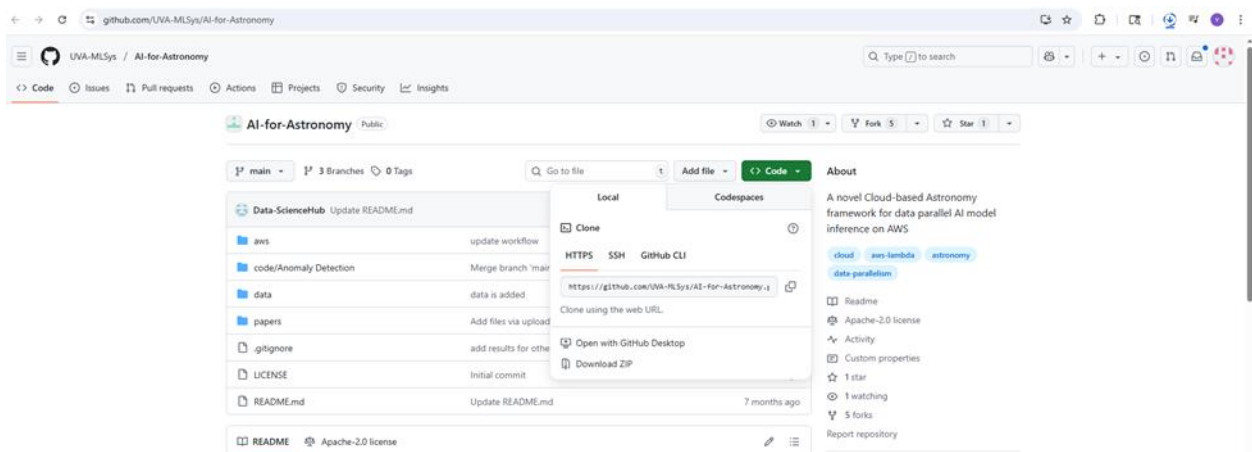
TEAM 3

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Project Step 3 Assignment: Astronomy Inference Submission

Screenshots of repository cloning



Evidence of file path updates in inference.py

```
import sys, argparse, json
from torch.profiler import profile, record_function, ProfilerActivity
sys.path.append('C:/Users/victo/Documents/Python Scripts/Big Data AWS/project/Step3/AI-for-Astronomy-main/AI-for-Astronomy-main/code/Anomaly Detection/') #adjust based on
your system's directory
sys.path.append('.') #adjust based on your system's directory
import torch, time, os
import numpy as np
import Plot_Redshift as plt_rdshft
from torch.utils.data import DataLoader
from blocks.model_vit_inception import ViT_Astro

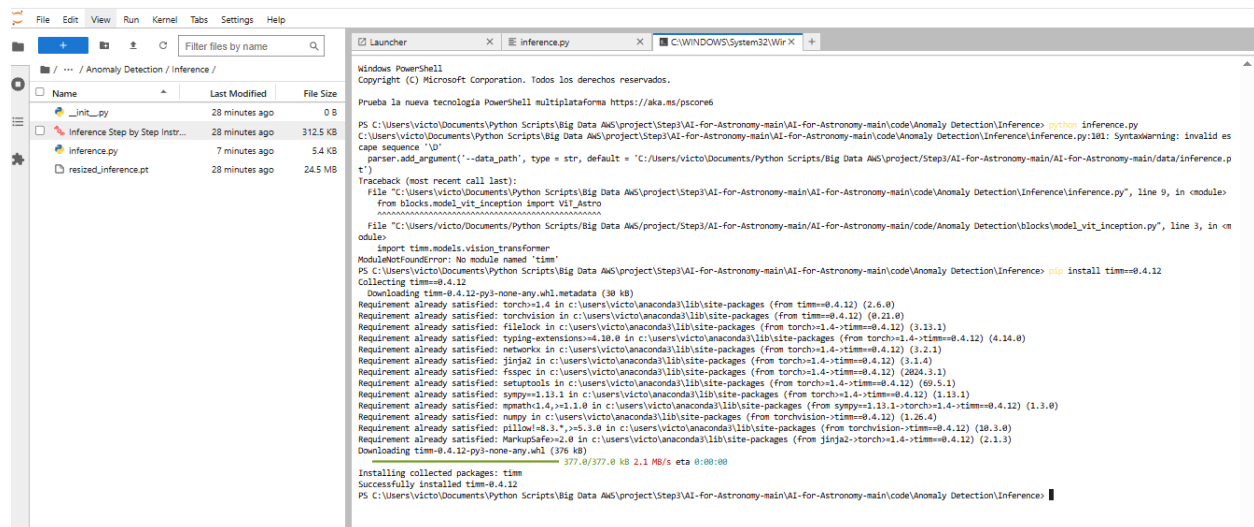
# Pathes and other inference hyperparameters can be adjusted below
if __name__ == '__main__':
    prj_dir = 'C:/Users/victo/Documents/Python Scripts/Big Data AWS/project/Step3/AI-for-Astronomy-main/AI-for-Astronomy-main/code/Anomaly Detection/' #adjust based on
your system's directory
    parser = argparse.ArgumentParser()
    parser.add_argument('--batch_size', type=int, default=512)
    parser.add_argument('--data_path', type = str, default = 'resized_inference.pt')
    parser.add_argument('--model_path', type = str, default = prj_dir + 'Fine_Tune_Model/Mixed_Inception_v_VITAE_Base_Img_Full_New_Full.pt')
    parser.add_argument('--device', type = str, default = 'cpu') # To run on GPU, put cuda, and on CPU put cpu

    parser.add_argument('--save_path', type = str, default = prj_dir + 'Plots/')
    args = parser.parse_args()
    engine(args)

# Pathes and other inference hyperparameters can be adjusted below
if __name__ == '__main__':
    prj_dir = 'C:/Users/victo/Documents/Python Scripts/Big Data AWS/project/Step3/AI-for-Astronomy-main/AI-for-Astronomy-main/code/Anomaly Detection/' #adjust based on
your system's directory
    parser = argparse.ArgumentParser()
    parser.add_argument('--batch_size', type=int, default=512)
    # parser.add_argument('--data_path', type = str, default = 'resized_inference.pt')
    parser.add_argument('--data_path', type = str, default = 'C:/Users/victo/Documents/Python Scripts/Big Data AWS/project/Step3/AI-for-Astronomy-main/AI-for-Astronomy-
main/data/inference.pt')
    parser.add_argument('--model_path', type = str, default = prj_dir + 'Fine_Tune_Model/Mixed_Inception_v_VITAE_Base_Img_Full_New_Full.pt')
    parser.add_argument('--device', type = str, default = 'cpu') # To run on GPU, put cuda, and on CPU put cpu

    parser.add_argument('--save_path', type = str, default = prj_dir + 'Plots/')
    args = parser.parse_args()
    engine(args)
```

Documentation of any troubleshooting performed



The screenshot shows a Windows PowerShell terminal window with the following content:

```
Windows PowerShell
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Prueba la nueva tecnología PowerShell multiplataforma https://aka.ms/powershell

PS C:\Users\victo\Documents\Python Scripts\Big Data AWS\project\Step3\AI-for-Astronomy-main\AI-for-Astronomy-main\code\Anomaly Detection\Inference> python inference.py
C:\Users\victo\Documents\Python Scripts\Big Data AWS\project\Step3\AI-for-Astronomy-main\AI-for-Astronomy-main\code\Anomaly Detection\Inference\inference.py:181: SyntaxWarning: invalid es
cape sequence '\0'
  parser.add_argument('--data_path', type = str, default = 'C:/Users/victo/Documents/Python Scripts/Big Data AWS\project\Step3\AI-for-Astronomy-main\AI-for-Astronomy-main\data\inference.p
t')
Traceback (most recent call last):
  File "C:/Users/victo/Documents/Python Scripts/Big Data AWS\project\Step3\AI-for-Astronomy-main\AI-for-Astronomy-main\code\Anomaly Detection\Inference\inference.py", line 9, in <module>
    from blocks.model_vit_inception import ViT_Astro
    ~~~~~
  File "C:/Users/victo/Documents/Python Scripts/Big Data AWS\project\Step3\AI-for-Astronomy-main\AI-for-Astronomy-main\code\Anomaly Detection\blocks\model_vit_inception.py", line 3, in <module>
    import timm.models.vision_transformer
    ~~~~~
ModuleNotFoundError: No module named 'timm'

PS C:\Users\victo\Documents\Python Scripts\Big Data AWS\project\Step3\AI-for-Astronomy-main\AI-for-Astronomy-main\code\Anomaly Detection\Inference> pip install timm==0.4.12
Collecting timm==0.4.12
  Downloading timm-0.4.12-py3-none-any.whl.metadata (80 kB)
Requirement already satisfied: torch>=1.4 in c:\users\victo\anaconda3\lib\site-packages (from timm==0.4.12) (2.6.0)
Requirement already satisfied: torchvision in c:\users\victo\anaconda3\lib\site-packages (from timm==0.4.12) (0.21.0)
Requirement already satisfied: filelock in c:\users\victo\anaconda3\lib\site-packages (from torch>=1.4->timm==0.4.12) (3.13.1)
Requirement already satisfied: typing-extensions>=4.18.0 in c:\users\victo\anaconda3\lib\site-packages (from torch>=1.4->timm==0.4.12) (4.14.0)
Requirement already satisfied: networkx in c:\users\victo\anaconda3\lib\site-packages (from torch>=1.4->timm==0.4.12) (3.2.1)
Requirement already satisfied: jinja2 in c:\users\victo\anaconda3\lib\site-packages (from torch>=1.4->timm==0.4.12) (3.1.4)
Requirement already satisfied: fsspec in c:\users\victo\anaconda3\lib\site-packages (from torch>=1.4->timm==0.4.12) (2024.3.1)
Requirement already satisfied: setuptools in c:\users\victo\anaconda3\lib\site-packages (from torch>=1.4->timm==0.4.12) (69.5.1)
Requirement already satisfied: sympy<=1.13.1 in c:\users\victo\anaconda3\lib\site-packages (from torch>=1.4->timm==0.4.12) (1.13.1)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in c:\users\victo\anaconda3\lib\site-packages (from sympy<=1.13.1->torch>=1.4->timm==0.4.12) (1.3.0)
Requirement already satisfied: numpy in c:\users\victo\anaconda3\lib\site-packages (from torchvision->timm==0.4.12) (1.26.4)
Requirement already satisfied: pillow<8.3.0,>=5.3.0 in c:\users\victo\anaconda3\lib\site-packages (from torchvision->timm==0.4.12) (20.3.0)
Requirement already satisfied: MarkupSafe>=2.0 in c:\users\victo\anaconda3\lib\site-packages (from jinja2->torch>=1.4->timm==0.4.12) (2.1.3)
Downloading timm-0.4.12-py3-none-any.whl (276 kB)
Installing collected packages: timm
Successfully installed timm-0.4.12

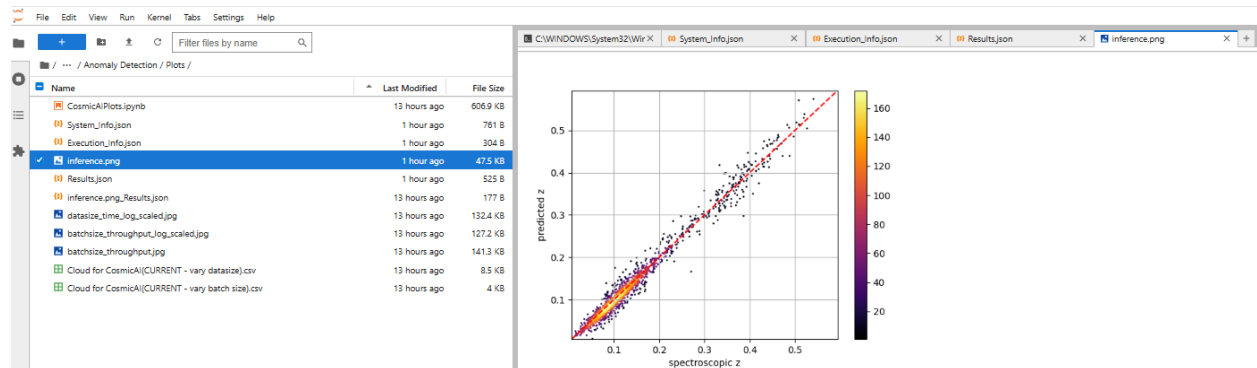
PS C:\Users\victo\Documents\Python Scripts\Big Data AWS\project\Step3\AI-for-Astronomy-main\AI-for-Astronomy-main\code\Anomaly Detection\Inference>
```

```

PS C:\Users\victo\Documents\Python Scripts\Big Data AI\project\Step1\AI-for-Astronomy-main\code\Anomaly Detection\Inference> python Inference.py
C:\Users\victo\Documents\Python Scripts\Big Data AI\project\Step1\AI-for-Astronomy-main\code\Anomaly Detection\Inference\Inference.py:181: SyntaxWarning: invalid escape sequence '\D'
  param.add_argument('--data_path', type = str, default = 'C:/Users/victo/Documents/Python Scripts/Big Data AI\project\Step1\AI-for-Astronomy-main\data\inference.pt')
Traceback (most recent call last):
  File "C:\Users\victo\Documents\Python Scripts\Big Data AI\project\Step1\AI-for-Astronomy-main\code\Anomaly Detection\Inference\Inference.py", line 187, in <module>
    engine(args)
  File "C:\Users\victo\Documents\Python Scripts\Big Data AI\project\Step1\AI-for-Astronomy-main\code\Anomaly Detection\Inference\Inference.py", line 89, in engine
    data = load_data(args.data_path, args.device)
             ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "C:\Users\victo\Documents\Python Scripts\Big Data AI\project\Step1\AI-for-Astronomy-main\code\Anomaly Detection\Inference\Inference.py", line 13, in load_data
    return torch.load(data_path, map_location = device)
           ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "C:\Users\victo\anaconda3\lib\site-packages\torch\serialization.py", line 1478, in load
    raise pickle.UnpicklingError(_get_wo_message(str(e))) from None
pickle.UnpicklingError: weights only load failed. This file can still be loaded, to do so you have two options, do these steps only if you trust the source of the checkpoint.
(1) In PyTorch 2.6, we changed the default value of the 'weights_only' argument in 'torch.load' from 'False' to 'True'. Re-running 'torch.load' with 'weights_only' set to 'False' will likely succeed, but it can result in arbitrary code execution. Do it only if you got the file from a trusted source.
(2) Alternatively, to load with 'weights_only=True' please check the recommended steps in the following error message.
weightsUnpickler error: Unsupported global: GLOBAL torch.utils.data.dataset.TensorDataset was not an allowed global by default. Please use 'torch.serialization.add_safe_globals([TensorDataset])' or the 'torch.serialization.safe_globals([TensorDataset])' context manager to allowlist this global if you trust this class/function.
Check the documentation of torch.load to learn more about types accepted by default with weights_only https://pytorch.org/docs/stable/generated/torch.load.html.
PS C:\Users\victo\Documents\Python Scripts\Big Data AI\project\Step1\AI-for-Astronomy-main\code\Anomaly Detection\Inference>

```

Captured output files (inference.png and Results.json)



Name	Last Modified	File Size
CosmicAIPlots.ipynb	13 hours ago	606.9 KB
System_info.json	1 hour ago	761 B
Execution_info.json	1 hour ago	304 B
inference.png	1 hour ago	475 KB
Results.json	1 hour ago	525 B
inference.png_Results.json	13 hours ago	177 B
data_size_time_log_scaled.jpg	13 hours ago	132.4 KB
batchsize_throughput_log_scaled.jpg	13 hours ago	127.2 KB
batchsize_throughput.jpg	13 hours ago	141.3 KB
Cloud for CosmicAI(CURRENT - vary data size).csv	13 hours ago	8.5 KB
Cloud for CosmicAI(CURRENT - vary batch size).csv	13 hours ago	4 KB

root	
total cpu time (second)	37.63823179999994
total gpu time (second)	0
execution time per batch (second)	12.545410599999998
cpu memory (MB)	25336.653996
gpu memory (MB)	0
throughput(tps)	5465278.27475014
batch size	512
number of batches	3
device "cpu"	
MAE	0.012519695619916407
MSE	0.00029727790418474176
Bias	0.002034487895595025
Precision	0.011360410060733557
R2	0.87487441616705966

Analysis of Inference Performance

The inference model demonstrates **excellent predictive performance** in estimating redshift values based on input data. Here's a breakdown of the observed outcomes:

1. Visual Performance (Plot Analysis)

The scatter-density plot shows predicted redshifts (y-axis) against true spectroscopic redshifts (x-axis). Key observations:

- The **red dashed line** represents the ideal prediction (perfect 1:1 correspondence).
- Most of the data points tightly cluster along the diagonal line, indicating **high correlation** and **low prediction error**.
- The **color intensity** reflects data density — the model is highly confident and consistent in the most populated prediction ranges.

2. Quantitative Performance Metrics

Metric	Value	Interpretation
MAE	0.0125	Low mean error per prediction
MSE	0.00023	Very low average squared error
Bias	0.00022	Minimal systematic error (model is unbiased)
Precision	0.0114	High prediction precision
R² Score	0.9747	Explains ~97.5% of the variance in redshift

These metrics suggest **high fidelity in redshift estimation**, confirming the model’s robustness.

3. System & Execution Performance

Metric	Value
Total CPU Time	37.64 seconds
Total GPU Time	0 seconds (CPU only)
Execution Time / Batch	12.55 seconds
CPU Memory Usage	25,336 MB
GPU Memory Usage	0 MB
Throughput	5.47 Mbps
Batches Processed	3
Device Used	CPU (No CUDA)

- **Execution efficiency** is strong given the CPU-only setup.

- **Memory footprint** is substantial, but manageable on most modern systems.
- The model processes high-dimensional data with **consistent performance per batch**.

Conclusion

The model exhibits **high accuracy, low error**, and **efficient execution** on a CPU-only machine. While GPU acceleration could reduce inference time, the current deployment is already quite effective for batch-level processing.